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Use of the Computer in the Stock Selection Process.

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by

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ABSTRACT

Because computers are being used with increasing frequency in the stock selection process, this study was undertaken to examine how they are being utilized and their effects on this important endeavor. Such specific procedures as screening, correlation, simulation, and discounted cash flow were first examined. Next the computer-assisted stock selection systems of COMPUSTAT, an IBM program, LAFFF1, SCAN, and FFL, along with their advantages and disadvantages, were presented. The uses of computers in fundamental and technical approaches to stock selection were investigated, and it appears that some fundamentalists may have shifted to the technical viewpoint. However, some fundamentalists feel that the computer will be of greater aid to them as they can now pursue in greater depth the relationships between the economy and earnings of specific companies and industries.

Because the majority of data which analysts use is secured from accounting records, some of the problem areas of accounting and their impact on investing were discussed. These areas were the reporting of extraordinary items, allocation of income taxes, the investment tax credit,

convertible securities, pooling of interests versus purchase combinations, and divergent accounting procedures for reporting and for taxes.

Because millions of dollars are being spent on computer usage and research, discussion was presented as to effects which the computer might have on the market and investors such as the possibilities of increased speculation and advantage of large investors with computers over smaller investors without them.

The first part of this study also served the purpose of gathering information to set the stage for the mail survey by questionnaire of sixty of the larger funds, bank trust departments, and management groups. These institutional investors were selected due to their tremendous size and resulting huge impact on the market and their use of the computer for stock selection purposes.

Based on the responses from those institutions using the computer, the major findings from the survey were as follows:

- (1) fundamental criteria are employed far more than technical,
- (2) there is a large amount of diversity in institutional investment procedures as more than seventy different financial facts and processes employed

were reported; however, most respondents use only six to ten factors at one time,

- (3) only slightly more than half have adopted the efficient technique of screening, but it appears that this procedure will be more prevalent in the future,
- (4) most companies purchase their information but prepare their own stock selection programs,
- (5) the most respected financial data are earnings, especially estimated future earnings; price-earnings ratio was the second most common relationship,
- (6) some institutions utilize (a) regression analyses to project future sales, the overall market movement, future interest rates, and price-earnings ratios, and (b) model building in order to estimate earnings with probable risk patterns,
- (7) the large majority of firms adjust earnings-per-share figures as reported before using them in their stock selection procedures, which implies that financial reporting may require some reform, and
- (8) although there are drawbacks to computer usage in the selection process, its abilities to rapidly examine thousands of stocks and to perform complex regression analysis operations and simulation studies appear to far outweigh the disadvantages.

The future will likely witness a rise in the number of investors employing computers in stock selection as well as an increase in the quantity and sophistication of computer-assisted stock selection techniques.

CHAPTER I

IMPORTANCE OF THE STUDY

Introduction

Computers have received much attention in recent years in business and educational circles. Their capacity for processing large quantities of data rapidly and economically has made them an increasingly important element when complex business decisions are weighed and research projects are undertaken. Computers have been used by stockbrokers for many years to perform back office operations--recording transactions, billing, preparing monthly statements, and similar bookkeeping duties. Now the computer is being increasingly employed in security analysis and portfolio management. This relatively new and very promising use is the subject of this study.

A few years ago the use of computers for stock selection was in its infancy and was referred to as a speculative endeavor. By 1967, \$5 million a year was being spent by the investment community in areas of computer-based investment research. In the hands of competent security analysts, it has become an instrument to search for stock market truths; it is

a medium by which beliefs about the market are quickly substantiated or dispelled.¹

Initially only the largest and wealthiest of investors were able to utilize the computer for stock selection because of the tremendous cost of computer systems. However, the utilization of computers for security analysis and portfolio management on a larger scale will allow the cost of computer use to be reduced, thus making the service economically feasible to smaller investors.

One method of lowering the cost is the purchase of time on computers on an hourly basis. Thus the user does not have to buy or lease the equipment and is freed from chores of operations. Generally all he needs is one person with sufficient knowledge of the computer to recognize its possibilities and to obtain programming assistance. This person then becomes the connecting link between the analyst and the computer programmer. Fees for time sharing on a moderately efficient computer can be obtained for approximately \$50 an hour. Other more advanced computers can be rented at prices up to \$400 an hour. Perhaps the cost of

¹A. E. Feuerstein, "Investment Decision by Computers," Bankers Monthly, September, 1967, p. 68.

renting computer time appears to be expensive, but since these advanced machines can perform complicated tasks at great speeds, the cost is not unreasonable. For example, it is estimated that one of the more advanced machines can process in an hour the more routine paperwork (i.e., ratio analysis of income statements and balance sheets) on which a staff of six or more junior and senior security analysts and portfolio managers would spend 25 per cent or more of their time during a week.²

Another technique for making the computer available to less wealthy investors is the use of the on-line or time-sharing system. With this arrangement, there is only one computer complex, but many different users have access to it. Because there are numerous clients for one computer system, the cost is lowered. Although many use one computer, there is rarely a waiting problem since it is extremely fast. Some machines can process directives at millionths of a second of time.

A third factor that has lowered the cost and made computers available for more security analysts and investors

²Jerome B. Cohen and Edward D. Zinbarg, Investment Analysis and Portfolio Management (Homewood, Illinois: Richard D. Irwin, Inc., 1967), p. 732.

is the use of FORTRAN (Formula Translator) or some other programming language. Such usage allows one with practically no programming knowledge to learn within a few weeks to utilize the computer for most routine assignments such as preparation of financial statement ratios. Several languages are presently available, and more will likely follow to make the task even simpler for the non-professional programmer.

The analyst and the computer, with their combined attributes, form an excellent team. The computer can perform complex calculations, recall vast amounts of data, and work for long periods of time without error or exhaustion. However, it lacks the ability of intuitive judgements and sudden insight. The analyst has opposite traits. Through intuition he can suddenly perceive answers to problems, but he becomes exhausted and makes errors.

The computer and the availability of financial data on magnetic tape have revolutionized the field of security analysis and portfolio management. Some analysts feel that the placing of financial data on magnetic tape is probably the most significant event that has happened to the field of finance since the invention of money. The availability of financial data on magnetic tape has taken much of the drudgery and clerical work out of security analysis and imparted to the field an

air of excitement unknown before.³

Goals and Methodology

This study has two main goals. The first is to determine how the computer is used in the stock selection process by analysts and investors. The types of investors considered include open-end and closed-end funds, brokerage firms, advisory services, bank administered trusts, and the individual investor. The methodology involves a study of the literature on the subject and written and oral inquiry of some of these users. The second goal is to determine from some of the larger funds, bank administered trust departments, and management groups their specific analyzation and investment procedures with the computer.

The findings of these endeavors are believed to be very important because the use of the computer in security analysis and portfolio management has become a very potent force in security markets. Accordingly, there are at least three important reasons for studying this phenomenon. First,

³Adolph E. Grunewald, "Using the Computer in Investment Analysis," Papers Presented at the First Investment Seminar (Gainesville, Florida: Department of Finance and Insurance, College of Business Administration, University of Florida), November 10, 1967, p. 13.

the pure research aspect is present since computer usage is forcing a substantial change in the investment procedures and policies of many investors. A development occurring in an area of such farreaching importance as the stock market should be thoroughly investigated. Second, shifting emphasis to computer usage presents one of the most classical situations of the need to keep up or perish. There are few areas which equal the stock market in competition. Failure to stay informed usually costs one dearly. The stock market approaches the situation mentioned in Alice In Wonderland--of having to run fast just to stay in the same place. Since investors will be using computers more and more, one must learn about them or fall behind others who do. Third, the study can be used to enhance the development of a series of computer programs and to aid in the teaching of investment courses. Several major universities have developed extensive research and teaching programs utilizing the computer for studying investments. Although years may be required for collecting data and testing programs, these experiences will be excellent learning devices for students enrolled in investment courses.

The term "portfolio management" is normally used to cover the whole realm of investing, which includes such aspects as (a) analyzation and selection of specific issues, (b) determination of portfolio mixes and (c) formulating diversification strategies. Although pertinent points

concerning portfolio management are included, this study primarily pertains to procedures and policies that affect the specific stock selection process itself and does not include a large amount of material concerning the total portfolio selection process (e.g., allocation between stocks and bonds). Investment analysis differs from investment management. The analyst's job is to describe an investment opportunity. Generally, the most important dimension of the endeavor is the earnings expectation or range of possible earnings outcomes. The manager on the other hand, confronted with a set of investment opportunities and with additional information and assumptions about economic variables (e.g., monetary and fiscal policy), must combine these investment alternatives into an efficient portfolio designed to achieve the objectives of the owners. This latter function is investment management, or as it is more commonly called, portfolio management.

Order of Presentation

Chapter II examines several specific procedures that are being utilized with the aid of the computer, such as correlation and regression analysis, models and simulation techniques, discounted cash flow and tax concepts, and screening, by which thousands of stocks can be measured against certain standards or limiting criteria such as earnings per share, yield, and price-earnings ratio. Chapter III provides an

insight into some of the systems, such as COMPUSTAT and IBM programs, that have been developed to capitalize on the speed of the computer. In addition, the benefits of the on-line feature, which reduces costs, and special languages, that expedite computer usage, are discussed with the programs of LAFFFl and FFL which employ these processes. The effects of the computer on fundamental and technical approaches to investing are discussed in Chapter IV. Technical procedures, which employ large quantities of data such as price movement and volume statistics and which can be placed on the computer with relative ease, appear to be causing some fundamentalists to shift to the technical approach. On the other hand, some analysts feel that in the near future, the fundamental approach will be by far the more profitable method since the computer will allow greater indepth study through relationships between the economy and earnings of specific industries and companies.

The impact of certain accounting procedures on investing, especially when using the computer, is set forth in Chapter V. Accounting information is very important because most data which investors use are secured from the companies' financial statements. Some areas of difficulty examined are the reporting of extraordinary items, allocation of income taxes, the investment tax credit, convertible securities, and

pooling of interests versus purchase acquisitions. Since millions of dollars are being expended annually on research with the computer, Chapter VI explores possible effects on investors and the stock market in general. Potentially undesirable effects, such as speculation, concentrated buying and selling because of similar buy and sell signals, and the conceivable disadvantages to those not having a computer, are examined. The basis for selecting types of institutions for the mail survey, some of their characteristics, and the effects of their trading on the market are shown in Chapter VII. The procedure of the survey and the rationale of the questionnaire are also discussed in the chapter. Chapters VIII and IX exhibit the findings of the questionnaires sent to sixty of the larger institutions. The distribution was: twenty to bank trust departments, twenty to management groups, ten to open-end funds, and ten to closed-end funds. As the findings for each question are presented, interpretative comments are also included. Summary and conclusions are made in Chapter X.

CHAPTER II

SPECIFIC PROCEDURES OF THE COMPUTER

Development of Procedures

In earlier years, both professional and amateur investors seeking financial information usually turned to thick volumes containing financial statements of thousands of firms. Except for a few computations such as those published in Moody's, price-earnings ratios and earnings per share, the analyst was required to make all necessary calculations. Inter-firm and inter-industry comparisons required huge efforts. Clerical detail alone was formidable, and time was a problem due to the high cost of human labor. More importantly, by the time the analysis was completed, the opportune time to act had frequently passed.

One answer to this problem of timeliness of analysis was Standard Statistics Corporation's (a subsidiary of Standard & Poor's) COMPUSTAT. The company originally placed data for approximately 1,000 firms on tape. Due to the fact that the information is in the computer, further use of the data for computing ratios, model building, and other procedures is greatly facilitated. Changes have been made in this system

since it was originally introduced, a topic covered in greater detail in Chapter III.

Computer applications range from simple to complicated as computers can print out selected company data or calculate a series of financial ratios. However, they can also process many items of financial data for a large number of companies according to prescribed directions or develop a security valuation model in an attempt to explain security prices.

Numerous approaches are now being used for computer analysis of data, but the two most common and earliest uses are (1) to have the computer report certain financial and price information, and (2) to process these financial and price data according to a particular format (i.e., growth in sales, earnings per share, and various ratios). With these applications analysts and investors can obviate the usual relationship of time consuming collection and computation steps and hastily done analysis and evaluations.

Each investor desires to account for the causes of stock price changes. Before the advent of computers, much untested logic had been set forth, but there was a constraint on one's ability to grasp and collate the huge volumes of data required to fulfill a true experimental approach to the problem. This constraint no longer exists with the computer

because of its analytical speed. Briefly, the following are some of the major steps in a computer-assisted investment analysis system. First, a process to retrieve and display information should be established. This will eliminate much of the clerical duties and permit more time for analysis. Second, a system must be developed that will evaluate, using historical information, and accept or reject proposed decision rules. Third, a program will have to be written that will search the data bank and print out those companies which meet the prescribed criteria. Fourth, a procedure should be designed which will compare the performance of the securities selected to the goals of price appreciation, yield, and diversification. The above operations should provide the analyst with a sound approach to successful investing.

One of the earlier tasks assigned to computers was to determine an estimated intrinsic value of a stock, but analysts today are attempting to go much further. One avenue of advancement is the endeavor to determine near-term future demand for a stock. Although one of the major uses of the computer is financial statement analysis and calculation of financial relationships such as price-earnings ratios, yields, returns on assets or book value, and capital structure proportions, many analysts use computers to provide more detailed breakdowns and cross comparisons. This may include such items as product

profit margins, turnover rates, and growth of earnings. The last factor alone can be subdivided into the growth rate of sales, changes in expenses, and pre-tax profit margins. After these ratios are computed for companies being considered, similar ratios can be computed for their industry. Such comparison among companies and industry standings can be performed with relative ease via the computer contrasted to time consuming and expensive analysis without its service.

It must be observed, however, that the above processes have two limitations. First, such a program does not furnish information about the underlying economic events that brought about the changes in the firm's position (i.e., it merely monitors past events). Second, financial statement analysis sometimes fails to supply an insight into the effect upon profits and prices brought about by a shift in an important variable (such as sales or operating margins). It treats each variable as if it were independent of all others rather than being functionally related to them. However, it does efficiently spotlight specific important relationships.

Screening

The first use of the computer in a stock selection process is generally the printout of certain data and the computation of certain basic ratios while the second step is the

employment of the screening or filter technique. Screening is thought to be the most efficient procedure of the computer, accomplishing the task in a small amount of time. Also, the screening procedure is far less complicated than simulation and model building. The problem of deciding which stocks to analyze is a major hurdle, though by use of the computer and financial data tapes, the field of inquiry can be reduced to the most promising issues. The screening technique is widely used by brokerage firms, advisory services, and investment companies in researching common stock investments.

The starting point of the selection process is usually a hypothesis regarding the various characteristics of a stock thought to make it a better-than-average market performer. With historical financial and price data of many stocks on magnetic tape, the computer can be programmed to search for the issues in prior time periods with the desired characteristics, print out their names, and indicate any additional data desired. It will also rank the stocks according to a prescribed criterion.

The second stage of the program is to compare the market price performance of the selected stocks in later time periods with the overall movement of the market. If the selected stocks outperform the averages, they are then subjected to further intensive analysis; if not, they are dropped from

further consideration. Generally, the procedure is to substitute, add, or delete various other characteristics to the applied theory until one particular combination is found that provides the most profitable results from an ex-post analysis.

A number of investment houses have performed substantial experimentation, searching for meaningful characteristics and hypotheses. A stock with an accelerating earnings growth, for example, normally performs well in the market. Another theory is that companies using their human and material resources with increasing efficiency are worthy of further analysis. Thus, a search is made for companies that are showing increasing sales and earnings relative to the number of employees, dollars invested in plant and equipment, financial resources, capital, and research and development expenditures.

The further evaluation of the stocks filtered out by a screening program generally consists of projections of growth rates and stability rates for sales, earnings, and dividends. A capitalization rate is then applied to earnings per share in order to obtain a measure of value for the stock. This determined value is then compared with its market price to determine whether it is over- or underpriced.

By shifting factors and cut off points, each portfolio manager can devise his own investment philosophy. Past accomplishments do not, of course, assure a similar future, and

just because a company has had a high growth rate, high yields, and relatively low price-earnings ratios in the past does not guarantee that such will be the case in the future. The analyst desires the growth to continue or accelerate and the price-earnings ratio to rise. He places little emphasis on the dividend yield as it is dependent upon the price. However, these benchmarks are valuable, and the filtering process does help to isolate and spotlight them.

Screening procedures have several refinements in addition to sifting features. One of these modifications is to print out changes in stock prices, earnings per share, or some other factor important to the financial analyst. The person desiring the information may be a client of a brokerage firm or the particular analyst who is in charge of a certain industrial group of stocks. The programmer instructs the computer to print out information any time the price, earnings per share, or some other factor reaches a certain point. Whenever a certain relationship, such as current earnings per share compared with previous years' earnings per share, occurs, he is informed immediately, and does not have to continuously observe the stock or make manual computations. Such an analysis requires constantly-updated systems, but these are becoming more common.

A slightly different approach to improving the screening process is the study of the attributes of stocks in order

to determine those which cause their prices to perform better than stocks in general. This step is usually accomplished by selecting numerous possible factors, sending the computer on a search for stocks which have these characteristics, and having the computer print out their price behavior. The results are then compared statistically with stocks that do not exhibit these characteristics. When certain factors are found to have a high correlation with certain ensuing price behavior patterns, these characteristics are then programmed into the computer as part of the filter process.¹

A related step to the screening procedure is ranking, and it has many variations. The simplest procedure is to instruct the computer to rank the stocks that pass the predetermined tests in a certain order. For example, the instruction may have the computer print the stocks in order of descending dividend yields. The ranking procedures occasionally incorporate directly into the screening instructions. For example, the instruction may read as follows: of all stocks that pass two or three predetermined hurdles, select only the ten that have the lowest price-earnings ratios. Other stocks, even though they meet the present criteria, are dropped because their ranking

¹Manown Kisor, Jr. "Quantitative Approaches to Common Stock Selection," Business Economics (Spring, 1966) quoted in Jerome B. Cohen and Edward D. Zinbarg, Investment Analysis and Portfolio Management, p. 742.

is not sufficient in the price-earnings category. The ranking concept frequently is applied to more than one limitation. After the ranking step has been completed, there generally are other screening hurdles which the surviving stocks will have to pass. Thus, a further refinement is achieved and an attempt is made to select only those issues which offer outstanding potentials for performance.

Correlation and Regression Analysis

Correlation and regression analysis is **widely** used in the stock selection process by computers. Obviously, if certain characteristics are found to have a high degree of correlation with a company's sales, earnings, and share price, the occurrence of the event with its known effect provides a tremendous help in locating profitable stocks.

Situations involving lead-lag relationships are thought to be very important because actual independent variables, rather than estimated independent variables, can be used. These actual variables normally give far more reliability to the estimated dependent variable than the use of only forecasted series. Thus, the search began utilizing regression analysis procedures. Literally thousands of different independent variables and combinations thereof have been run through the computer by various organizations. Capital

outlays, research and development expenditures, fixed assets to employees, changes in debt-equity relationships, retention rates, and economic indicators are some of the more popular independent variables. While the estimated price of the stock is the most desirable dependent variable, many analysts attempt to project estimated sales, earnings, earnings per share, price-earnings ratios, and a range of market prices. In accomplishing this step, they often use the regression analysis procedure.

After estimated per-share earnings and prices are computed, various selection options still exist. Some portfolio management groups use the estimated price changes as the sole determinant to buy or sell, and others use estimated earnings changes as the main guide. Generally, both of these factors are utilized. One of the combination approaches is to plot price-earnings ratios. Those below the regression line are considered as undervalued and potential purchase candidates while those above it are either sold or dropped from consideration. Security decisions made by using this mode are based on two assumptions that may not develop-- (1) the adjustment process that will bring the actual and theoretical price-earnings ratios together occurs through price rather than earnings changes, and (2) the stock will return to its regression line before the line itself shifts.

These possibilities should be considered when making buy or sell decisions.

The analyst should also determine how one series of data relates to another. For example, earnings projections utilizing past earnings are usually computed by comparing present earnings per quarter with the same quarter last year, which some analysts feel is an undesirable method. These analysts believe that a preferable device is to compare each quarter's earnings with the immediately preceding quarter's earnings. However, the problem of seasonable fluctuations arises making the latter comparison dangerous. Fortunately, the computer can play a very important role in analyzing normal seasonal oscillations in sales and profits. With it, data can be adjusted for seasonal variations at a small fraction of the time necessary to do it manually, thus making available a method of analysis heretofore out of the realm of efficient usage. The computer's speed allows it to calculate the percentage changes from quarter to quarter more rapidly and accurately than can be done manually.

Although correlation studies have been used for making worthwhile security selections, certain pitfalls are also present. One of these is the problem of using related independent variables called multicollinearity, which can lead to false interpretations of the results. However, statistical

adjustments exist which can be used to help guide the analyst in evaluating the reliability of his projections. These statistical tools should always be considered, and if the analyst is not trained in statistics, he should secure such advice before acceptance of regression analysis results.

Past trends do not continue uninterrupted forever, and just because sales have increased by 10 to 12 per cent per year for the last five years, obviously, does not guarantee such continuation. One study showed that in 69 per cent of the cases studied, no correlation existed between a firm's growth rate in one period and in the one immediately following.² Since the study found four cases to one where past earnings were not a key to future earnings, one could conclude that the time to buy is when earnings have collapsed and to sell when the company is in the midst of an earnings rebound. Similarly, Graham and Dodd admonishes against projecting profit levels beyond the highest total earnings ever actually realized by a company.³

²D. L. Thomas, "Where The Action Is; Computers Have Increased Volatility and Risk in Stock Market," Barrons, August 28, 1967, p. 3.

³Grunewald, "Using the Computer in Investment Analysis," p. 15.

Models and Simulation Techniques

Probably the most advanced and complex usage of the computer is found in the area of model building and simulation studies. Although these techniques are some of the more recent applications of the computer, they have gained a large following. Some have become so complicated that only those with a knowledge of higher mathematics and statistics can understand the concepts.

A model is frequently defined as a statement about relationships between certain variables; simulation is a technique that enables the analyst to experiment with the information he has about the companies he studies. Model building and simulation together allow analysts to work through the implications of a complex series of events. The problem might be stated as, "What is likely to happen to the price of a company's stock if its industry's sales increase 3 - 4 per cent a year, the company maintains 18 to 20 per cent of the market, the firm's profit margin fluctuates between 12 and 15 per cent, it continues its dividend policy of 60 to 70 per cent payout, and the market continues to capitalize dividends to yield 3.5 to 4.0 per cent?" This model and simulation should give the most likely price and price distribution. Simulation studies can also help the analyst understand present and past phenomena, such as G.P.L. Clarkson's model of

trust officers' behavior.⁴

The advantages of such a system are the following:

(1) it can improve the research efforts of an analyst by directing him to the most sensitive parts of the model, (2) it can demonstrate the way changes in one part of the model influence changes in other parts, and (3) it enables the analyst to deal successfully with questions that begin with the phrase "What would happen if . . .?"

A variation in model building is a system called "stock valuation," which is a mathematical approach. The formula contains factors with their assumed relationships which the model builder deems determinative of stock values. Each criterion is also accorded its proper weight. Normally such factors as sales, earnings, dividends, growth rates, debt-to-equity ratios, payout ratios, and historical price-earnings ratios are included. After the model has been tested and found to yield satisfactory results, the data for selected stocks are inserted, and the output is an indicated market price. If the indicated market price is substantially above the actual market price, the stock is a "buy" prospect; if below, the stock is unattractive.

⁴G.P.E. Clarkson, Portfolio Selection: A Simulation of Trust Investment (Englewood Cliff: Prentice-Hall, Inc., 1963).

Another approach considers the future income stream. It is based on the premise that the value of an asset is the value of the future income stream (accruing to the owners of the asset) discounted at some market rate of interest. Under conditions of uncertainty no one can know exactly what the real value is. It is the market's function to keep the price of the asset as close to the expected value of the asset as uncertainty will allow. The better the estimates, the better the ability to determine present value. By comparing present value to the market price and by assuming that the market price will move towards the intrinsic value of the security, it can be determined whether one should take a long or a short position in the stock. By comparing the size of the discrepancy between the market price and value of alternate investment opportunities, the best probable investments can be ascertained. A broader approach to investing with the help of model building is to consider that the market is directly related to the economy. Models that encompass economic data are frequently referred to as econometric models. For investment purposes, these include investment behavioral patterns and economic data in statistical structures that hopefully represent cross sections of the stock market and economic climate. These models are then tested under different economic changes in much the same way that an aircraft

manufacturer simulates test flights of airframes with a computer instead of testing model airplanes in a wind tunnel. The objective is to determine what factors influence stock prices and price-earnings ratios and then construct formulae. By juggling variables in the formulae, operations researchers attempt to determine values which should be assigned to stocks in the future and whether or not present prices are undervalued.

An alternative approach, originally propounded by Standard Statistics Corporation, concerns leading indicators and is somewhat simpler than model building. The objective is to find company characteristics, or patterns of information flow, that regularly precede stock movements. A simple criterion might be a five-year earnings growth which is greater than the market as a whole but coupled with a price-earnings ratio that is less than the market. Then the computer is sent searching for all companies that meet this requirement.

An ideal arrangement is to take a talented portfolio manager with an instinct for successful stock selection, thoroughly dissect his decision-making process, and then program a computer to duplicate his technique. Of course, one of the big obstacles to this approach is that intangibles such as intuition are unassailable. A very sophisticated model was

designed by Haden, Stone & Company, where an economic model for sixty different industries using computer figures of all major companies was established. Each industry is a standard against which to measure the performance of each individual company, like an individual golfer measuring himself against par. The performance of a company is then evaluated by means of an index of management's ability at which the computer has arrived by testing the statistical performance of its four main components--marketing, production, engineering, and finance. On the basis of these measurements, the computer ferrets out undervalued industries and companies.⁵

A considerable amount of information influences the recommendations of an investment counselor while such a computer simulation model is difficult to design and update. Knowledge about the personality of a future company president and Defense Department considerations of a company's products are important in setting market prices but impossible to program into the computer. Accordingly, this mathematical analysis of portfolio selection, regardless of how successful it may become, does not threaten the investment analyst with technological unemployment. However, routine patterns of portfolio selection can be simulated by computers. For

⁵D. L. Thomas, "Electronic Investing," Barrons, August 14, 1967, p. 18.

example, Dr. Geoffrey Clarkson achieved a remarkable degree of success in programming a computer to predict the investment recommendations of an investment trust officer. He spent some time studying the investment officer's decisions, programmed into the computer the criteria used by the officer in choosing his portfolios, and finished with a good description of the actual selection process which, given the requirements of the investor, often succeeded in picking the same companies as those selected by the investment manager and frequently in recommending the same number of shares.⁶

However, attempting to program the actions of hundreds of portfolio managers would be a monumental task.

Portfolio selection decisions must remain an art, employing at its best a fine balance of experience, judgement, and intuition, all of which only a good analyst can supply. Nevertheless, a successful mathematical analysis can offer him invaluable assistance. Because of the sheer magnitude of the problem and the multitude of data which must be examined, the analyst must adopt questionable shortcuts in his decision making process. The role of mathematical analysis via the computer is to reduce this problem and to present the alternatives to the analyst in a way that readily permits him to

⁶William J. Baumol, "Mathematical Analysis of Portfolio Selection: Principles and Application," Financial Analysts Journal (September-October, 1966), p. 75.

exercise his judgement most effectively.

A major area where the computer and mathematical processes can be of great use is when its effect can be combined with the judgement of analysts. When the analyst wishes to select a portfolio of two securities out of three possible stocks, neglecting the proportion of investment in each, there are only three possible combinations. If the objective is to select two stocks from among five candidates, the number of possible portfolios has increased from three to ten. When an even larger set of numbers is considered, for example, ten out of one hundred (which is closer to the usual situation for large institutional investors), the number of alternative combinations exceeds 17 billion! Hence, it is necessary to establish some system of issue elimination that will diminish this formidable obstacle. In actual practice, the large number of possible investments are reduced by a combination of judgement, intuition, and observance of certain data such as yield, price-earnings ratio, and estimated earnings. The computer can help not only in the limiting or screening step but also in the final selection process.

One type of simulation investigates risk patterns and distribution of possible returns one might expect on securities of given grades. The most popular work involving risk was

completed by Dr. Markowitz.⁷ His approach considers (a) the expected return, (b) the variance of each stock's return (i.e., its possible range of returns), and (c) the co-variance of each pair of securities (Co-variance occurs where two or more independent variables are related to each other). The co-variance is necessary in determining the true value of diversification present in a portfolio. That is, two stocks do not contribute much more to safety via diversification than only one stock if their co-variance is high, because if one of the stocks drops the other one will probably likewise decline in value. Therefore, the loss of one will not be offset by the independent price behavior of the other stock. Markowitz's work has been well acclaimed, and other writers have begun to adopt his basic framework with some modifications. One of the latest studies using the risk and return concept for portfolio management is a recently completed dissertation by Dr. Kahl.⁸ The Kahl study contrasts actual with simulated portfolios selected from 665 sample stocks in order to research the effectiveness of such a simulation and model procedure.

⁷H. M. Markowitz, "Portfolio Selection," Journal of Finance (March, 1952), pp. 77-91.

⁸Alfred L. Kahl, Jr., Investment Management and the Computer: Limitations and Prospects, (University of Florida, 1969).

Attempting to predict the future price and yield of a stock based on extrapolation of its past performance is felt to be questionable and even dangerous by some analysts, particularly random-walk subscribers.⁹ Another possible drawback to mathematical models such as the Markowitz technique is that the expected price changes and dividends have to be estimated by a non-mathematical process utilizing a considerable amount of subjective judgement and intuition. Thus, this procedure results in a complex and sophisticated calculation based on a set of admittedly subjective and possibly inaccurate figures. Nevertheless, there are advantages to such an approach. For instance, the second and third sets of data that are needed--the variances and co-variances--can usually be computed from historical data with a satisfactory degree of confidence. Lastly, the extrapolation method provided surprisingly generous returns over ten-year simulated holding periods.¹⁰

Discounted Cash Flow and Tax Procedures

The computer has influenced decision making in another

⁹Baumol, "Mathematical Analysis of Portfolio Selection," p. 99.

¹⁰Kahl, Investment Management and the Computer: Limitations and Prospects.

area--that of using discounted cash flow techniques. Although the technique itself is not new, the speed of the computer makes this procedure far more feasible. Discounted cash flow calculations, carried to three or four decimal places, are very time consuming by hand but rapid for the computer once the necessary information has been placed into the computer.

Discounted flow analysis has several variations, but the following is a simplified illustration. Suppose Stock A is expected to increase in price by 50 per cent over a five-year period but pays no dividends. Further assume that Stock B is expected to increase in value, counting both dividends and increase in price, by slightly less than 50 per cent. If Stock B has a large dividend yield and if it is assumed that both stocks will be sold at the end of five years, it would probably be advisable to purchase Stock B even though its final total increase in value is slightly less than Stock A. This preference is due to dividends from Stock B increasing the present value of expected returns from Stock B over the present value of expected returns from Stock A. Anytime two or more competing modes of investment are being compared and inflows are received at different times, discounted cash flow techniques should be used to inject the time value of money so that both options will be judged on the

same basis.

Investment decisions in the field of taxation are also being affected by the computer, because it can be programmed with numerous tax brackets and situations of an investor. The facts of each stock, including the estimated changes in price and dividends, are programmed into the computer. Then the program which contains the tax status of a particular investor is matched against the various stocks' characteristics of expected dividends and price changes. The computer then selects the stock that provides the greatest after-tax yield.

After-tax consideration is not new, but the computer allows extremely rapid computations of many stocks and numerous tax situations. When the tax consideration is linked with a discounted cash flow technique, the task becomes extremely time consuming if performed by manual means. Analysis of after-tax cash flows for a number of issues with wide ranges of tax situations is very tedious, but with the computer, time requirements are greatly diminished.

Testing Possible Misconceptions

The previous material has extolled the virtues of the computer by describing the many and varied ways in which the computer can aid the investor. These positive approaches are

worthwhile, but a negative approach exists that has also been of significant value for both academic and practical reasons. One such process is for the computer to test the validity of long-held beliefs about the stock market. Only the computer with its ability to rapidly scan and analyze millions of pieces of data could efficiently accomplish such a task.

In the process of studying the many facets of the stock market, research has frequently revealed cases that conflict with long-held beliefs about stock market behavior. One of these pertains to the very important factor of estimated future earnings. There are many investors and advisors who feel that earnings prospects are possibly the most important criteria in stock price behavior. The results of the questionnaires sent to sixty large institutions for the basis of this study, for example, indicate heavy emphasis on estimated future earnings. (This finding will be discussed in more detail in Chapters VIII and IX.) However, one firm discovered that although the Dow Jones Industrial Average rose only 4 per cent during 1968, an examination of 3,000 stocks indicated that half the issues ranged as much as 50 per cent or more in price from low to high. In addition, half of those with large price fluctuations increased in price on flat earnings.¹¹

¹¹D. L. Thomas, "Computerized Gunslingers: Electronic Brains Increasingly are Calling the Shots on Wall Street," Barrons, March 24, 1969, p. 32.

Hence, any investor who bought stocks on earnings prospects alone missed many profitable situations.

Another possible misconception is that asset-rich companies, where per share book value exceeds market value, normally do much better than when the reverse is true. Utilizing multiple regression techniques, one firm surveyed 900 stocks from 1948 to 1967. The computer reported that the asset rich stocks over the 19 years had done only slightly better than any random selection of stocks and that even this slightly better performance might have been due to chance.¹²

Due to extensive research with the computer, another myth was broken regarding dividend cuts and omissions. A cut or omission is usually a very bearish sign. The firm of Philip, Appel and Walden observed the sixteen companies on the New York Stock Exchange which reduced or omitted dividends in 1967. The computer followed their price movements from January 2, 1967, to November 1, 1968, and found that over a twenty-week period, beginning with the week of the dividend action, each stock rose in price, the average gain amounting to 78%.¹³ If an investor had bought only the Big Board stocks which had omitted their dividends that year, he would have

¹²ibid., p. 32.

¹³ibid., p. 32.

realized, on average, a 100% appreciation in price over the next twenty months. What apparently happens in many cases is that the informed minority will accumulate a stock forced down to a bargain level by a dividend cut in the knowledge that coming conditions will cause a rise in company fortunes. It is possible that this particular observation may not be highly significant for two reasons. First, the overall market movement during the period studied--January 1967, to November 1968--was one of overall rising prices. That is, although the Dow Jones Industrial Average had its usual ups and downs, it moved from approximately 780 in January 1967, to the 980 range by November 1968. Thus it could be argued that some (or perhaps all) of the increase shown by the sixteen companies was due to the overall upward pressure of the entire market or readjustment from oversold levels.

Another consideration is that price is often affected several months before actual dividend action is seen. Thus, a legitimate counter-claim to the above reported findings is that price action is adversely affected by dividend cuts or reductions and the reason for this seeming contradiction is that the price drops in advance of the dividend action. Then after the dividend action actually takes place and because the stock has already been driven down, the only logical direction the stock can move is up.

Many analysts believe that an increase in the short interest is bullish over the short term because the short interest represents potential buying and upward pressure as the bears cover their position. The firm of Philip, Appel and Walden conducted an extensive survey to determine the validity of this commonly held belief. It examined sixty-five stocks on the New York Stock Exchange which in 1967 had short positions of 100,000 shares or more at any time during the year. Eleven of these stocks fluctuated too widely to show any definite conclusion. Of the fifty-four remaining stocks, 72% suffered a price decline within an average of four months after their short interest position increased over the 100,000 shares level.¹⁴ An investor who had bought these stocks in the hope of a price rebound would have been disappointed.

Another belief that has been tested recently concerns the popular conception that stocks that hold up relatively well when the overall market is dropping are excellent stocks and should not be sold. It is further prophesied that because of their basic strength these particular shares will far outdistance other stocks at the time of the market's next rebound

¹⁴Ibid., p. 32.

movement. Paine, Webber, Jackson & Curtis gave their computers the job of examining the validity of this belief. The computer analyzed the market performance of approximately 800 stocks in the major bear markets of 1962 and 1966. It computed the performances of these issues in the three months before the low periods of each of the market breaks. It also checked their price patterns for the six months following the bottom. The 800 issues were divided into five groups of 160 each. Significantly, the stocks that turned in the poorest performances during the three months preceding the bottoms of the bearish markets far outstripped the issues during the rally that held up best in the decline. For example, in 1962, the stocks that had skidded the most, on the average, were the best rebounders in the subsequent six months of the market recovery--jumping 17 per cent in price. In the same period, the stocks that had held up best during the slump managed to achieve only a 7.8 per cent rise. In 1966, it was the same story again, as the poorest performers in the decline outpaced the better ones by a price advantage of 40.5 per cent to 25 per cent in the following advance.¹⁵

Operating on essentially the same theory, the firm had

¹⁵Dan Dorfman, "Heard on the Street," Wall Street Journal, August 29, 1969, p. 15.

its computer select 160 of the poorest stock performers during the decline of 1969, which began in April of that year. (It sent more than 800 stocks through the computer.) The 160 were then turned over to their analysts for further study. Subsequently, they chose thirteen which they believed were good buys and which should have substantial price increases in the future. They expect these selections to run 10 per cent to 15 per cent above any market advance. The company listed these thirteen stocks as Conrac, General Portland Cement, Gray Drug, Hammermill Paper, Kaiser Cement and Gypsum, Kinney National Service, Litton Industries, Mead Corporation, Sanders Associates, Super Valu Stores, Victor Comptometer, Westvaco, and Whittaker. It will be interesting to watch the fortunes of these stocks in the future to determine if the phenomenon which Paine-Webber claims to have discovered occurs again. In short, Paine-Webber states that the market folklore of stocks holding up best during a decline are the best buys for the following upswing "is just not so."¹⁶

Numerous other Wall Street legends have been and are being tested now that the computer allows extensive research at an affordable cost. Such findings as these may have a profound

¹⁶Ibid.

effect on the actions of stock analysts, brokers, and investors. If, for example, large numbers of account executives had strongly recommended the purchase of holding-action stocks, their clients may have been disappointed with subsequent performances.

Other Procedures

The procedures previously described are common uses of the computer in the selection process. Other somewhat less popular methods preferred by certain portfolio managers who have had success with them are described briefly, however. The speed of the computer has been used to determine relationships and ramifications of certain company, stock market, and economic manifestations. Dependable relationships could then be used as a guide to formulate buy or sell decisions.

One such investigation deals with companies which have suffered deficits, and an examination was made of 900 stocks with annual reported losses from 1948 through 1967. The results revealed that a two to three-year investment in such issues would have performed better than a diversified holding of other stocks. If one had invested \$100 in the companies on the Big Board that had a deficit in 1948, his holding would have been worth \$3,032 by 1967.¹⁷

¹⁷Thomas, "Computerized Gunslingers," p. 31.

Another example of computer research correlated the size of the company and the returns from dividends and price increases. Simulated purchases of shares of 900 companies from 1948 to 1967 revealed that investments in the smaller companies provided more generous returns.¹⁸

Some analysts require that the computer scan available data on all stocks in order to locate companies with reasonable price-earnings ratios which have declined from the previous year. This procedure frequently identifies companies which have growing earnings and for which the stock prices have not yet risen by a relative rate. This identification spotlights companies that are apparently currently undervalued.

An endeavor that is becoming more common is to have computers print graphic output. Also, tables may be secured in any one of the three possible dimensional forms, for instance, years and companies for a fact, companies and facts for a year, or years and facts for a company. The list of possible investigations and projects is practically endless, but a few of the more common ones are as follows:

- (a) A study of the effects on price for changes in the capital structure of companies,

¹⁸Ibid., p. 32.

- (b) the development of a measure of stability of earnings for individual companies and/or an industry,
- (c) the development of theoretical price-earnings ratios for various rates of earnings growth,
- (d) the determination of probabilities of risk involved in the prediction of a company's future earnings,
- (e) a programming of the computer to adjust the price-earnings ratio to growth in earnings and historical change in the average price-earnings ratio itself,
- (f) the grouping of all companies according to a growth rate measure and recent price-earnings ratio. This program permits identification of companies with (1) high growth rates which are selling at low price-earnings ratios, medium price-earnings ratios, and high price-earnings ratios; and (2) medium growth rates and low price-earnings ratios,
- (g) the continuance of investigative work that has already progressed to a considerable degree in determining how much effect the overall movement of the market and the forces that cause this overall market movement affect individual issues. There are various estimates as to the degree of influence. One estimation is that 90 per cent of the stocks move

with the market averages.¹⁹

(h) the development of a more comprehensive method of comparing profitability of various portfolios and portfolio managers. The overall yield can be computed much faster and accurately with the computer. This is due to the fact that several items besides dividends and capital gains should be considered, for example, interest earned on funds invested in government securities and other short term instruments while awaiting investment in the stock market. Also, the cost of commissions and the time value of money via discounted cash flow techniques should be considered now that the computer makes these analyses procedures manageable.

Risk can be incorporated into an evaluation program to determine overall effectiveness and desirability of each alternative and/or manager. For example, trust officer A may have earned a 20 per cent rate of return while trust officer B earned only 16 per cent on investments entrusted to their care, respectively, using all of the factors described

¹⁹D. L. Thomas, "Electronic Investing," Barrons, August 14, 1967, p. 18.

in the above paragraph. But if officer A had extremely riskier investments in his portfolio than officer B, the 4 per cent improvement may not have justified the higher risk assumption. In short, such a program of evaluation can help guide the allocation of resources, whether it is between trust officers within a bank, between banks, between investment companies, or any other situation where proper allocation is one of the decisions that must be made.

Areas of Difficulty

The discussion thus far has given a glowing picture of the ability of the computer. However, the use of computer selection techniques is not without its problems. One of the most difficult tasks in storing large amounts of data on companies is the need to keep it updated correctly. Updating with the latest information for items such as earnings per share and sales is an issue of some magnitude as analysts demand the latest data. Thus, measures must be installed so that the most current information is available. This constant updating becomes quite expensive. An additional problem, especially as far as accuracy and dependability are concerned, is that of adjustment of past data for stock splits, stock dividends, and mergers. These events must be continually monitored if a usable historical research file is to be compiled. Also, computations involving prices and volume must

allow for the occurrence of weekends and holidays in order to permit linear time projections.

The solution to the problem caused by changes, such as stock splits or adjustments in reported earnings, is difficult. First, this process of adjustment is not only time consuming but offers the chances for errors. Such computations and restatement of data should be closely monitored. Second, even when there are no errors in the adjustment process, there is the question of mode of adjustment. Because of the differences of opinion as to how certain transactions should be handled accounting-wise, divergent corrections are possible depending on who makes the adjustment. For example, transactions such as stock dividends and mergers have alternate generally acceptable methods by which they can be recorded.

A source of trouble, even if the data are purchased, is errors in the input information, and there have been instances where this situation occurred. Certainly output is worthless if the input has errors, and reliance upon the results may lead to costly buy and sell recommendations. One way of checking for input error is to have the computer scan all data and print out items that vary widely from a selected midpoint. Other computer assignments for locating possible input errors involve instances where:

- (a) there is a price change on zero volume,

- (b) the same volume is recorded for three consecutive days,
- (c) the same volume is recorded for two consecutive days, and it exceeds 10,000 shares,
- (d) the same price is recorded for four consecutive days,
- (e) there is a day-to-day price change of greater than 10 per cent,
- (f) there is a price adjustment (split, stock dividend, etc.) of greater than 2 per cent,
- (g) there is a reverse split of any size,
- (h) the volume is greater than 300,000 shares,
- (i) the current volume is greater than 30,000 shares and greater than five times the previous day's volume, or
- (j) the previous day's volume is greater than 30,000 shares and greater than fifteen times current volume.²⁰

The above are situations that occur very rarely. Hence, when one of these phenomena takes place, there is an excellent possibility that an error has been made, which should precipitate an investigation.

²⁰R. A. Levy, "Technical, Fundamental and Random Walk Selection," Commercial and Financial Chronicle, April 4, 1968, p. 1372.

CHAPTER JII

SYSTEMS UTILIZING THE COMPUTER

Introduction

The previous chapter discussed specific procedures and techniques now being used in the stock selection process. This chapter examines some of the systems which have been developed to assist many of the previously discussed procedures. In addition to the large and complicated systems that are discussed, there are numerous smaller and less involved ones. In view of their size, possibly a better term for them would be services, of which a very wide range is offered. For example, there are several sources which offer daily price and volume information on magnetic tape shortly after the market closes each day. These data are very useful to investors, particularly to those who utilize the technical approach in their stock selection processes.

COMPUSTAT

One of the pioneers in utilizing the computer in stock selection and currently one of the leading data supplying companies is Standard & Poor's Corporation. A subsidiary of Standard and Poor's Corporation, called Standard

Statistics Company, Inc., accumulated and placed in the computer a huge collection of financial and other data about many of the largest corporations. This collection of data is named COMPUSTAT.¹ COMPUSTAT contains, in machine readable form, numerous income statement and balance sheet statistics and other financial data for thousands of companies. Historical data are available for periods beginning in 1946, and in 1969, the data were heavily utilized in the areas of computerized investment research, pension fund management, industry studies, and merger and acquisition analysis. The COMPUSTAT information can be retrieved by any of three modes:

1. By bringing the data base in-house and running it internally on the company's own computers. The analyst can either write his own software packages or purchase Standard Statistics's program, PANCA, which is written in Fortran IV for operation on a 360 system,
2. By purchasing Standard & Poor's Comparative Analysis Service which is available on either a per-study or annual contract basis, or

¹A considerable amount of information for this section is based upon written and oral communication with Standard Statistics Corporation and on some of their printed materials.

3. By joining time-sharing organizations which offer the data base through their networks.

COMPUSTAT consists of magnetic tapes containing pertinent financial and statistical information on an annual basis for 1,800 leading industrial, 100 utility and 200 insurance companies in the United States as well as 350 industrial companies located in Canada. Quarterly information on the 1,800 United States industrials is also available for the most recent twenty quarters. At the time of this writing COMPUSTAT is in the process of adding additional companies to its collection. The number of pieces of information COMPUSTAT has available also varies, since the company is frequently making changes to improve the system. Recently the number of statistical items stood at sixty. These are all primary data, that is, they are not derived from provided facts. These items can then be manipulated in various ways in order to compute other data such as price-earnings ratios and yields. In other instances the bits of data are used to judge stocks such as in the screening process.

The basic service consists of annual data recorded on magnetic tape in Fortran and other languages. The service is prepared basically for IBM equipment, but with slight modifications any computer system currently on the market

can be used. Companies are grouped by industry, listed alphabetically within each industry, and coded according to the Standard Industrial Classification Code. The classification of information for industrial companies is as follows:

Balance Sheet Information

Cash and Equivalent Items
 Receivables
 Inventories
 Current Assets
 Investments & Advances to Subsidiaries
 Investments and Advances - Other
 Gross Plant
 Net Plant
 Intangibles
 Total Assets/Liabilities
 Debt in Current Liabilities
 Current Liabilities
 Long-Term Debt
 Deferred Taxes and Investment Credit
 Minority Interest & Subsidiary Preferred Stock
 Preferred Stock
 Preferred Stock at Redemption Value
 Common Equity
 Total Invested Capital

Income Statement Information

Net Sales
 Unconsolidated Subsidiaries-Remitted Earnings
 Cost of Goods Sold
 Labor and Related Expenses
 Pension & Retirement Expenses
 Incentive Compensation Expenses
 Selling & Advertising Expenses
 Research & Development Expenses
 Rental Expenses
 Operating Income
 Depreciation & Amortization
 Fixed Charges

Minority Interest
 Deferred Taxes
 Investment Credit
 Income Taxes
 Non-recurring Income or Expenses (Not Net of Taxes)
 Net Income
 Preferred Dividends
 Available for Common
 Common Dividends
 Non-recurring Income or Expenses

Other Items

Stock Price - High
 Stock Price - Low
 Stock Price - Close
 Number of Shares Outstanding
 Dividends Per Share
 Number of Shares Traded
 Amount of Convertible Debt & Preferred Stock
 Number of Shares Reserved for Conversion
 Number of Common Shares Purchased or Sold Net
 Carryforward Tax Loss
 Unconsolidated Subsidiaries-Unremitted
 Market Value of Stock Rights
 Earnings Per Share as Reported
 Capital Expenditures
 Inventory Valuation
 Inventory Cost
 Number of Employees

Similar data are available for utilities; however, where certain items are more important for utility company analysis, they are substituted for less pertinent information listed above. Selected data, called FINANCIAL COMPUSTAT, have recently been made available for financial institutions such as banks, bank holding companies, savings and loan companies, finance and small loan companies, and mortgage investment

trusts. A separate information bank for insurance companies called INSURANCE COMPUSTAT is now available. This separation is a result of different data having more importance for these types of companies than is the case with industrial companies. Also, the accounting procedures are considerably different for this industry; this fact is especially significant for insurance companies because the accounting procedures dealing with "reserve" accounts vary considerably from related procedures in non-insurance companies.

All COMPUSTAT master tapes are updated weekly. Under the usual COMPUSTAT contract, subscribers are entitled to ten tapes per year. Tapes are reproduced on Fridays and are delivered to the subscriber only at his request, up to the ten provided for in the basic contract. Additional tapes can be provided on any Friday at extra cost.

Of particular importance is the fact that all information is comparable and has been collected using a fixed set of definitions. These definitions have been reviewed by a number of leading accounting firms. Collecting the data in accordance with these definitions provides almost complete comparability of figures between companies and industries. This is a very important feature, because without it comparison is not only severely hampered but serious mistakes are possible when examining companies where accounting procedures

differ materially.

Standard Statistics Corporation provides a thirty-five page booklet to all subscribers which describes how dozens of financial statement accounts are classified by COMPUSTAT. For example, Cash and Equivalent includes:

- A. All cash, government, marketable and other securities listed in the current asset section
- B. Letters of credit
- C. Margin deposits on commodity future contracts
- D. U. S. Government securities, regardless of whether stated by the company as a current asset or netted against tax liability in the current section on the liability side of the balance sheet.

Items specifically excluded are:

- A. Money due from sale of debentures (treated as receivable)
- B. Bullion, bullion in transit, uranium in transit, etc. (treated as an inventory item)
- C. Commercial paper issued by subsidiaries to parent company
- D. Cash surrender value of life insurance (treated as current asset).

In some cases this classifying procedure overcomes certain controversial situations such as pension costs and extraordinary items. On the other hand areas such as changing depreciation methods and pooling of interests still pose difficulty. For the latter areas, COMPUSTAT uses company reported figures. Notwithstanding the above drawbacks, the

system of standard definitions seems to be a valuable device for making worthwhile comparisons between companies. One of the key figures which analysts scrutinize is earnings per share. COMPUSTAT does not adjust earnings per share in prior years for changes due to mergers and consolidations. However, prior year figures are adjusted for any changes resulting from an accounting restatement.

The contract form for the service is a lease agreement. The price of COMPUSTAT is divided into two parts, the initial cost for the back library and the annual updating fee. The library fee is a one-time charge, and it entitles the user to lease the tape and use it in any manner not specifically restricted by the lease agreement. The charges vary depending on the number of companies desired. For example, a recent pricing list ran from approximately \$3,000 for 100 utility companies to approximately \$15,500 for 1,900 industrial and utility companies. This is the basic fee referred to as the library fee. The corresponding annual updating fees ran from approximately \$1,400 to \$8,600. Quarterly data have no library fee, and a recent charge for 1,800 companies was approximately \$7,000. Standard & Poor's Corporation has donated this system to several universities for research and instructional purposes. Hence, the system is creating a following of students who have used it in college. Standard &

Poor's believes that students will request the system at their future employer's place of business, thus making the loan worthwhile.

If a company does not desire to construct its own program, it can purchase (for approximately \$7,500) Standard Statistics' program called PANCA. This program is quite complicated and has many features and options. The entire details will not be presented here because of the program's complexity but can be secured from Standard Statistics Corporation if desired. The company is constantly making changes to improve all of its services, and though this program is subject to change, some of the main points are presented below in order to illustrate the program's basic capabilities.

PANCA will compute any criteria devised by the user such as sales to cash, return on two-year average capital, and the debt-equity ratio for any company and/or composite. PANCA will also compute moving averages, indexes, rankings, and growth rates. It will screen for companies which meet any list of criteria, or any number of a subgroup of criteria (say, two out of five). The data are printed in several formats. For example, one format has the years across the page from left to right starting with the latest year, and the criteria name is printed across the top of the page with the companies listed down the left side. Another format has the

company's name printed across the top of the page with the criteria listed down the left side, and so on. The updated material appearing in PANCA may be acquired under seven different arrangements, but due to space limitation and periodic price changes, it will not be discussed in detail.

An IBM Program

In order to promote the use of their hardware, IBM turned to the development of programs designed to meet the needs of stock portfolio managers. One such endeavor is the 1401 Portfolio Selection Program.² It has been designed to assist the portfolio manager in the development of an investment strategy. This program selects sets of optimal portfolios from a given list of securities, balancing risk and return according to criteria developed by H. M. Markowitz.³

The Program can accommodate 750 securities, and restrictions can be imposed upon the relative percentages to be invested in each issue. It prints out the various combinations of risk and return. The combinations are in a series beginning with the portfolio distribution which gives

²Much of the information in this section is based upon materials acquired from the International Business Machines Corporation.

³Although this program is based on the Markowitz technique and encompasses most of its features, it is not

the highest rate of return and the highest risk. At the opposite end of the list is the portfolio that provides the lowest rate of return and lowest level of risk. In between, the other most efficient portfolios are listed in increments of return of 2 per cent or whatever levels requested. The term efficient means that given a choice of alternate portfolios with equal expected rates of return, the procedure will select the portfolio that has the smallest associated overall variance or risk; or given a choice of several portfolios with equal risk, the procedure will select that portfolio with the greatest expected rate of return. The composition of each efficient portfolio is shown for each level of return. Thus, an entire set of efficient portfolios is presented. The final selection is left to the portfolio manager.

Basically, the three parameters in this approach to security analysis are (1) the return of each individual security, (2) the risk of each individual security, and (3) the degree to which the price behavior of the securities is correlated. Many possible portfolios can be drawn from any one given list of securities. Each possible portfolio has an expected return that is based upon the proportion that is

exactly the same. Nevertheless, the results from this system should be similar to those obtained from the entire Markowitz procedure.

invested in each security and upon the return of each security. In addition, the overall fluctuation, or risk, is dependent upon the proportion that is invested in each security, the risk of each issue, and the degree of correlation between security price changes. The goal in portfolio selection is to choose the combination that minimizes risk for each possible return. The IBM 1401 Portfolio Selection Program minimizes risk by the principle of diversification.

The input to the program consists of estimates about the behavior of individual securities (the return, the risk, and the degree of correlation); the output from the program is a set of diversified portfolios. Each of these portfolios provides minimum risk for its level of return. Various restrictions can be imposed upon the portfolio by the user of the program, such as a maximum amount to be invested in each security. This analysis can be summarized as follows: Investors predict the future performance of individual securities in terms of probability beliefs. These beliefs concern the expected return of each security, the risk associated with the achievement of this return, and the correlation of return between pairs of securities. For instance, the expected price of a security can be predicted together with the probable deviation from this price. This prediction then can be translated into an expected return and risk of return,

based upon the price spread.

The program allows for ordinary income and capital gains taxes (two rates); also, it allows for cash presently not invested in stocks to be invested at a minimal annual rate of 4 per cent as might be the case with government securities. The system can accommodate a large number of stocks, but whenever a large amount of items exist, the number of correlation values becomes prodigious. For instance, with 100 securities, 4,950 correlation values are required. Because of this, a simpler, yet effective, mathematical model has been developed for the system. The same criterion (balance of risk and return) is used, but the large number of correlations are not required as direct input. This simpler model is called the index or linear model.

A recent dissertation has been written testing the Markowitz technique.⁴ In addition to coming to the conclusion that the technique should be quite profitable if it were placed into service by institutional investors, the author also made the observation that institutions presently trade too often and diversify excessively. He recommended that both practices be reduced. This type of system not only

⁴Alfred L. Kahl, Jr., Investment Management and the Computer.

provides the direct benefit of helping to select a more profitable portfolio, but it often gives indirect benefits such as the instance stated above. Further research with this system, and the computer which makes it possible, will continue, and it will likely provide additional benefits. Though the computer is able to handle complex systems, there remains the problem of training analysts to more fully understand its abilities.

LAFFFl

Another computer-assisted stock selection system was designed at the Amos Tuck School of Business Administration at Dartmouth College.⁵ It is used in the study of investments and encompasses a simplified language and the use of the on-line feature. The language is named LAFFFl--an abbreviation for Language for the Aid of Financial Fact Finders--which is said to be very easy to learn. The system allows the analyst to have the computer perform whatever tasks he desires--whether it is simple information retrieval or a series of complicated manipulations with the data--without having to explain his needs to a computer expert.

⁵R. S. Bower, et al., "A Language for the Aid of Financial Fact Finders," Financial Analyst Journal, (January-February, 1967), p. 121.

The on-line feature of LAFFF1 allows many users to be brought into the system, thus considerably decreasing the cost by utilizing only one central computer for calculations and a smaller monitoring computer for receiving instructions and sending out results. It can serve as many as forty teletype stations at a time, which can be located at any telephone connection. The analyst communicates with the computer by way of a teletype machine; types in his problems or information needs; and the teletype types back the answers. The central computer actually serves only one teletype at a time, but it moves so rapidly from one to another and the communications with different teletypes are so well controlled by the monitoring computer that the user is normally under the illusion that he has the entire computer to himself. All one needs to become a computer user is a teletype installed by the telephone company, an arrangement to use time on the "utility" computer, and a few hours with a computer language manual. The administrators of this system believe that under these circumstances no company is too small to consider its own direct access to the speed, power, and memory of a computer.

LAFFF1 uses a data bank drawn from Standard Statistics' COMPUSTAT tapes. Each piece of information in this bank is identified by three characteristics: company, year, and financial fact. For example, the financial fact, Accounts

Receivable for the year 1960 for the Bendix Corporation, is available and can be retrieved and printed out in only a few seconds. Symbols are used to identify each characteristic of the information. For example, REC refers to the financial fact Accounts Receivable, 60 indicates the year 1960, and BX, the stock ticker symbol, identifies Bendix. A list of the facts, years, and companies available with LAFFF1 and their identifiers can be called from the system by the user at any time.

There are twelve operating instructions which may be used in working with the data bank. Eight of these manipulate the data and four are associated with retrieving information and printing out results. The manipulative operating instructions are addition, subtraction, multiplication, division, averaging, natural logarithms, correlation, and growth rate computations. The four non-manipulative operating instructions are equating, data retrieving, screening, and printing. This system may be used for several purposes. Some of these are simple data retrieval, numerous basic manipulations such as yield and price-earnings computations, screening procedures, correlation studies, and comparative print-outs.

There are two modes of operation available to the user. One is the conventional method such as screening and

comparative print-outs, and the other is the conversational approach. In the conventional mode the instructions in a program are numbered, and the program is written in its entirety before it is run. Programs so written can be retained by the user and altered or run at some later time. In the conversational approach the system executes each instruction as it is received and indicates completion of an instruction and readiness to receive a new instruction by responding with a typed question mark. In this method, the user is involved in a continuing exchange with the computer. The analyst has data retrieved and asks for certain manipulations. The computer then types out the results, which the user examines, and then he makes his next request. Again the system responds. This give and take procedure continues until the analyst has completed his task.

Once a program has been devised, it can be used again and again. For example, the analyst may desire to use a particular program periodically as his screening program, or different analysts within the same company may use it. These programs can be written in the conventional manner and stored in the company's library or the user's personal library. For example, this particular system has a program labeled LAFFF 20 which is a 31-instruction program. Some of the items contained are growth rates, closing stock prices, dividends per

share, and earnings per share.

Another use to which LAFFF1 can be assigned besides the usual screening, ratio, and comparative procedures is basic research such as stock price behavior relative to determinable factors. For example, this system was used to investigate the theory advanced by some that an investment program would be more successful by purchasing low price-earnings ratio stocks than one that purchased stocks with high price-earnings ratios. The results of the study provided little support for the view that a low price-earnings ratio is a good statistical indication of a future high return.

Another use of this system can be simulation studies. For example, one might project his yield estimates on a certain stock considering capital gains and dividends and certain other financial and economic data. This projection can be programmed to give estimated results after one, two, three, or X number of years. This approach will give the potential investor some idea as to how long he should retain the investment, if purchased, and will allow him to compare a particular investment with an alternate selection for a like number of years.

The developers of LAFFF1 believe that its cost is reasonable. Besides the time sharing aspect, they feel that the system itself is programmed for efficiency. One illustration

they gave was for a program that computes and prints out changes in closing stock prices, earnings per share, and dividends per share for eighteen companies for ten years. The calculations required eleven seconds of computer time, and at commercial rates then in effect, the charge for the time was about sixty cents.

FFL

Like LAFFFL, First Financial Language--FFL--was designed to allow the direct use of the computer by those who are not experienced programmers.⁶ The system utilizes the on-line feature. White, Weld and Company offers to lease the entire system to stockbrokers, advisory services, investment companies, and others. The system obtains a majority of its data from COMPUSTAT. The language required fifteen man-years to develop and program, and it supposedly allows considerable programming flexibility with a variety of commands designed specifically for the financial analyst and portfolio manager.

In addition to common uses, such as retrieval of certain data, computation of desired ratios, and screening procedures, FFL has plans for facilities which will allow

⁶Thomas, "Electronic Investing," p. 3.

subscribers to input their own estimates by way of a code. These estimates can be used in any way desired such as computing ratios for the future and in making simulation studies. The system is designed so that even though there are many users, the estimates remain known only to the one who put them into the computer. FFL also plans to install TV display units in customers' offices which will give their clients easy access to the data. The plans appear intriguing, however, knowledge about actual progress by FFL has been withheld.

SCAN

English analysts also have a computer-assisted investment system, which is Intinco Limited's SCAN--Stockmarket Computer Answering Network. One of SCAN's main advertised attractions is an easy-to-learn language, and it makes financial information available on British, Continental, and American companies.⁷

SCAN offers the user less programming power than LAFFF1, thus making it simpler to use. As the programming power

⁷"Computers: Dial an Electronic Investment Analyst," Statist, July 8, 1966, p. 119.

decreases, however, the number of computer uses decline. Nevertheless, if the analyst does not desire a complicated program, he may employ it easily. For example, a London stockbroker can dial a phone number, press certain buttons on a Westrex printer on his desk, and instantly obtain a list of stocks in a certain industry with certain qualifications such as price-earnings ratios and yields.

SCAN has an agreement with Standard & Poor's for securing information on 1,000 United States stocks. Like its American counterpart, the company does not expect SCAN to replace the analyst; rather it is expected to release him from time consuming and tedious calculations and provide him more time for thinking and research.

CHAPTER IV

APPROACHES TO INVESTING WITH THE COMPUTER

Introduction

There have always been differences of opinion among those who invest as to how it should be performed. There are many facets to these arguments, but the most common area of disagreement is whether investing in the stock market should be based on fundamental or technical procedures. The fundamentalists feel that as a whole stocks are priced according to value as indicated by assets, yields, and earnings. On the other hand, technicians are concerned with market psychology, supply, and demand for securities. As the computer was developed, it was immediately drawn into this controversy. The computer is now used by both groups, and some analysts in each camp believe that the computer has made their approach even better. Accordingly, this chapter examines the ways in which the computer has been employed by each group.

Actually, there are few pure fundamentalists or technicians, as most investors and advisors use both procedures. Generally a person is called a fundamentalist or technician

because he leans to that particular approach, not because he uses that means exclusively. A common position on this subject is held by Bill Parkhurst at Hayden, Stone & Company, who believes that the price of a stock at any time is a function of two factors: the psychological and fundamental. He employs the computer to develop a record for each issue under study by analyzing both its earnings power and its technical position and has the computer report by exception. In other words, only when a stock emerges from its usual status does the computer call it to the attention of the analyst. He looks for those issues that do not correlate with the market, which may indicate that the market has over- or under-appraised them.¹

Another authority on investing feels that both the fundamental and technical concepts can be used to gain maximum results. He states that the fundamental approach is good for locating potentially profitable stocks, and the technical analysis is very helpful in the timing step.² Many authorities feel that the timing aspect is not only one of the most

¹D. L. Thomas, "Electronic Investing," p. 27.

²Donald E. Vaughn, Survey of Investments (New York: Holt, Rinehart, and Winston, 1967), p. 321.

important considerations in stock selection, but determination of buy and sell points is where the computer can serve in a most valuable manner. The timing aspect is discussed in the third section of this chapter.

Fundamental Approach

The first recorded analytical work to which the computer was assigned was along fundamental lines. For example, the screening technique is usually assigned to the task of locating stocks which meet certain fundamental qualifications such as earnings per share, yield, and price-earnings ratio. Model building also encompasses fundamental criteria such as earnings, balance sheet and income statement amounts, ratios, and aggregate economic data. The fundamental approach lends itself very well to the computer as vast amounts of quantitative data for each company can be stored and quickly retrieved. Also, the rapid ability of the computer can provide ratios needed by the analyst, such as earnings as a percentage of sales, earnings as a percentage of assets, current ratio, acid ratio, inventory turnover, accounts receivable turnover and many others.

The screening process can be carried out with fundamental information exceedingly well. For example, if an investor is primarily interested in stable income rather than

quick capital gains, he can have the computer scan the available stocks and select those that have desired characteristics; that is, he may establish qualifications for the screening step with such fundamental factors as a relatively high yield, a long and consistent history of dividend payments with little or no decreases, and a low price-earnings ratio. Conversely, if a person were less interested in current and steady income but were more interested in making a large trading profit, even though the risk of a price decrease was greater, then he would instruct the computer to locate stocks with high growth rates in sales and earnings, relatively low price-earnings ratios in respect to other companies in the same industry or in respect to previous price-earnings ratios of that particular company.

Fundamental security selection may be handled manually as was the case before the computer; but with it, the search is far less time consuming. Another advantage is that some of the qualifications which the computer might be asked to use may not be available in the printed material at hand, for instance prospecti and advisory service brochures. With the computer, qualifications can be computed in fractions of a second, making possible greater thoroughness at heretofore impossible speeds. The fundamentalist can certainly use the computer to compute his data, thus

replacing his slide rule and desk calculator.

Some financial analysts feel that the shift of emphasis from the fundamental to the technical soon may begin to reverse itself, and the computer may be part of the reason for this turnaround. One example of this possible reversal relates to the fundamental factor of yield. In the go-go market atmosphere of the mid-1960's, dividend yield generally assumed lesser importance than in previous years as high-quality bonds were yielding 7 to 8 per cent and stocks only about 4 per cent. Notwithstanding this condition, at least one firm has become interested in dividend yields. This renewal of interest is not taking the traditional course of buying for safe income, however. Dividend analysis has taken a different avenue, one that helps explain the greater mileage some analysts expect to receive from a more sophisticated approach in selection techniques via computers.

In 1969, Investment Quality Trends, a San Diego investment advisory and counseling firm, began studying dividend payouts in relation to stock-price levels of blue-chip companies in order to time stock purchases and sales.³ The ability of the computer to examine many years and quarters of

³Charles J. Elia, "Heard on the Street," Wall Street Journal, May 9, 1969, p. 29.

data on thousands of stocks makes this type of investigation feasible. Before employing the computer, a full staff working almost constantly on this project would have been needed. Investment Quality Trends scans 250 top-ranked blue chips to determine whether stocks are undervalued or overvalued on its scale of dividend payout and price level. The firm reports a high degree of success for stocks with a history of paid dividends. In a recent advisory, the service found 80 of its 250 issues "undervalued" and 63 "overvalued." Some 33 blue chips were singled out with a potential of advancing 80 per cent to 233 per cent on the basis of their historical price-to-dividend relationships.

Investment Quality Trends believes that a stock's price-yield history tends to be repetitive. When a stock's price falls, the yield rises if the dividend is not lowered (which frequently occurs). When the price climbs and dividends remain unchanged, yield declines. In these cases, yield is measured as the percentage of the stock's price represented by the dividend payout. A recent example of the firm's rationale dealt with Libbey-Owens-Ford.⁴ By their measure it was "undervalued." Paying a \$2.80 dividend, the

⁴Ibid.

stock was yielding 5.8 per cent in 1969 at a price of 48 which is a historically high yield level. By the same token, the stock has retreated in the past whenever it approached the 4 per cent yield level, or a price near 70, which would indicate it would be in an "overvalued" area at that point.

It is not suggested that buyers should base their decisions solely on dividend yield. Other factors are often of more direct importance, and dividend yields may not even be a conscious motivation. But one reason the timing of purchases often coincides with dividend levels may indicate that trusts and big block money managers recognize good price levels and come into the market.

A similar approach is seeking out situations where a low yielding stock at time of purchase can become a high-yielder over a period of time as dividends are increased. Stock prices tend to move up as dividend payments are boosted, with the result that the increased payments usually result in substantial price appreciation. Thus, one company, Standard and Poor's Advisory Service, is isolating on its computers issues that have had a doubling of dividends in the past ten years. However, Standard & Poor's and other market observers caution that most investment decisions based on dividends require a long-term outlook. Its current list of fifty long-term recommended issues includes many stocks that have

little appeal for current return or the hope of current appreciation.⁵

Studies correlating prices and returns should continue to point out worthwhile investments primarily in larger and more stable stocks. Although this classification would include the so-called blue chips, it should also embrace other stocks. Many of the larger and more stable companies seem to operate in cycles, even though these may not be identical in magnitude or duration. This cyclical effect seems to emerge more in the stock's price than in the company's earnings.

One of the more popular Wall Street statements frequently made is that the stock's price always accentuates the company's earnings. That is, the price movement generally overreacts to changes in earnings or other events in the company's history. Thus, it is proposed that if a company's record was one where prices mostly overreacted to some particular company act such as a change in earnings, then if an investor bought (or sold depending on the position in the cycle) the stock at the advent of this particular event, he would increase his chances of acquiring the investment near

⁵Ibid.

the lowest point in the swing. Conversely, determining the bottom of a move may be difficult as the optimum buy-time may precede a shift in earnings or follow it. Some insight may be gained by thorough investigation of the previous cycles. The investigation would be akin to the lead-lag indicators used by economists and the government to hopefully determine where the country is presently located economically in order to determine what remedial steps need to be taken and when to apply them.

In addition to the need of careful study to determine the appropriate timing and the reliability of the correlated events, an effort should be made to determine what events are highly correlated with price levels. Though earnings and yield are likely indicators of price, other factors are also conceivable, such as research and development expenditures, capital outlays, and even such less publicized events as personnel expansion or reduction, large borrowings, or equity increases. Once again the computer makes feasible an examination of the many possible factors and combinations of factors for many companies which may influence stock prices. Without the computer, such an exhaustive search would be more time consuming and expensive.

An illustrative cyclical situation occurred with General Motors. For the 1950-1965 period, an increase in

earnings and the stock's price occurred in four to six-year cycles. The question is raised as to what factor or influence has caused this repetition every four to six years. What this factor's identity is, possibly no one knows. Conceivably it could be that the number of cars abandoned or turned to scrap is highest every five years; that is, the average life of an automobile might be five years. Thus in the year that an unusual number of automobiles are taken out of service, there is a shortage. This shortage, in turn, causes increased sales and increased profits.

The 1965 increases in earnings and stock prices may be the end of such four to six-year repetitions, and there may be nothing to the above observations but coincidence. However, it seems that 1970 would be well worth watching to see if this phenomenon occurs again. Regardless of the outcome, this type of study--attempting to locate certain characteristics that accompany or precede stock price increases--is where the computer is expected to provide profitable benefits.

One must be aware that investing in the stock market remains an art and is not a science. Although it is recognized that the computer can be classified as a scientific instrument, the programmers who instruct the machine usually have mathematical backgrounds, and the computer is

being used with more complex and "scientific" procedures (i.e., regression analyses, econometric models and simulation techniques), investing will always be, in the final analysis, a subjective endeavor. Therefore, in reference to the example of General Motors, though the four to six-year phenomenon had taken place for the last thirty years and accepting the probable cause of these increases found by exhaustive regression analyses, these facts would not mean that the stock's price in 1970 must necessarily rise. The failure of an expected price increase could be due to numerous causes; for instance, one reason could be the fact that during 1969 this nation has supposedly been trying to cool the economy. Thus it could easily be that 1970 will be the year that these tactics actually take hold. If that is the case, it is very possible that this fifth year (1970) may result in General Motors having a drastic drop in its earnings and the price of its stock.

Technical Approach

It appears that in the last few years more attention has been devoted to the technical approach by investors. The computerized advisory services have followed this pattern also. Besides discussing some of the procedures used, some of the reasons for this trend will be presented. One reason

offered could possibly be considered an extension of a position that technicians have long proclaimed--that fundamental factors, such as yield and earnings, account for only a portion of a stock's price movements. One official of a large brokerage firm believes that so many of the large investors are now using computers that the acting and reacting on the strength of mere fundamental factors alone will no longer suffice as large movements occur too rapidly. He further believes that one can be 15 per cent behind the swings and still succeed, but only when the market obligingly keeps posting new highs. He adds, "Today, one's timing must be a good deal sharper."⁶

Timing seems to be the technician's major interest, and although this was true before computers were used in the stock selection process, many technicians feel one of the most useful roles that the computer can play is in the area of timing. The Sebag brokerage firm in England holds this view, and it utilizes a method which assists in determining when to buy and sell; it leaves to the analyst the decision of which stock to buy or sell. In fact, the firm has doubts as to the value of the computer's ability to select the right

⁶D. L. Thomas, "Computerized Gunslingers," p. 3.

stock. Like most technicians, the firm's system assumes that the market is always right and that the future of a share cannot be predicted from the past earnings and dividends performances of the company involved. Sebag takes the history of the share's price and works out by normal statistical methods the probability of the current price rising by a given amount in a short period of time. That is, it considers not only the trend line of the price, but its volatility as well. The resulting formula determines a price for a short period beyond which it is more likely to go up than down (a buy signal) or more likely to go down than up (a sell signal). These signals are not entirely reliable, but the firm states that if followed consistently "they are statistically bound to give a better investment result than hunches, state of one's liver, or an apparent shortage of stock in the market."⁷

It is argued that the computer provides a higher return via better timing because it not only allows one to invest in the stock earlier (via rapid examination of data and immediate signals), but it also permits remaining in the

⁷"Computer Investment: Timing, Gentlemen, Please," Economist, March 25, 1967, p. 1181.

stock longer than fundamentalists who advise selling when the price moves too high in relation to earnings. Technicians claim that fundamentalists fail to take advantage of the best part of many price swings. History, they claim, shows that the market frequently exaggerates a trend, and 50 per cent of a move will occur in the final 10 per cent of the time span during which it takes place. Hence, technicians counsel to hold a stock until the computer spots a technical change in direction, even if this means selling after the stock has reached its peak and started to slide. This theory is based on the assumption that computers can be used to determine when the change in direction is about to take place.

Although a substantial portion of this study deals with the selection process via screening, models, correlation, and other procedures, the selling function is just as important. A possible study on when to sell would be to examine thousands of stocks to determine the average price increase during a certain period of time. The speed of the computer will make such an undertaking practical because many stocks will have to be studied over an extended period of time in order to test it thoroughly. Although there are a few cases where stocks have increased in price by 100 per cent or more within a year's time, considerably more than half do not move that drastically. It appears that a selling guide might be

to sell when the price has increased approximately 20 per cent. Briefly, the a priori argument is as follows: (1) although some stocks increase in price far beyond 20 per cent, it is believed that for the vast majority of stocks, particularly those traded on the New York Stock Exchange, such advances are rare, (2) thus unless one has the knowledge and/or luck to determine with consistency which stocks will enjoy such an unusual rise, it appears that "playing the averages," as in baseball, would be a profitable route, particularly over a long period of time, (3) specifically this would result in an investment policy which would sell when the percentage in price increase was equal to the mode in an array consisting of percentage increases in prices of all, or nearly all, prices on an exchange, and (4) it is proposed that this mode figure might likely be close to 20 per cent.

Naturally, in some cases the price will continue to rise, and this will cause disappointment among some sellers who seemingly sold prematurely. However, for those who have held on to stocks after a 20 per cent rise hoping for an increase of 50 per cent or more and then watching dejectedly as the price drops back to, or below, its cost price, even a 10 per cent profit would be acceptable. If this investment philosophy were adopted and proved to be profitable, the 20

per cent figure would remain only a guideline, since items such as the length of time held (for the capital-gains tax advantages), the ex-dividend date, and national and international political and economical conditions should still be considered. In addition, it probably would be desirable to compute a separate average of cyclical or seasonal swings for different groups of issues. Since many technicians believe that future earnings cannot be predicted with sufficient accuracy, they shift emphasis from earnings to market action. They feel that the market action of day-to-day movements is the summation of what everybody knows or thinks about a company, which fits into their plan. Their premise is that prices tend to move with momentum in a given direction until a new element enters the picture to change the trend. Therefore, they keep charts showing daily or weekly quotations on a number of stocks, watching carefully for any breakouts or pronounced movements. The computer facilitates their work since it can keep track of more stocks and discern trends more quickly than any chart maker.

Mathematical analyses may also be applied to the technical vein, and a few procedures are fairly complex. These mathematical models usually deal with probability studies and examination of the degree of consistency of certain phenomena as price-volume relationship patterns. The use of

the computer in mathematical analysis has created a series of complex and creative equations influenced by forces which make the market. They are programmed to gauge the impact of news, the importance of forecasts of earnings, market and industry trends, and to print out the expected rate and direction of price changes. Such an approach is an endeavor into the science of approximation of price reaction in response to events and forecasts.

Another procedure follows a group of highly volatile issues which frequently make a move of at least 7 per cent within a single week and for which trading volume averages 40,000 or more shares each week. They are constantly measured against five, ten, and twenty-day price averages, and when they register sufficient technical strength or weakness, the computer gives buy or sell signals. This is another case where the computer makes such a procedure feasible. Without some means to accumulate, sort, and examine these large quantities of data in a short period of time, the system would be not only expensive, but the information would probably be out-of-date before action could be taken.

Haden, Stone & Company continuously researches into trading-volume behavior, considering the changing pattern of supply and demand for a stock, which is felt to be the critical determinant of its price. The firm's computer studies

the daily upside and down side volume of a stock against five, ten, and twenty-day moving averages. Looking upon each day's trading as essentially a tug of war between bulls and bears, the computer analyzes the changes in price compared with the current price and analyzes trading volume compared with the total capitalization of a company. When the trading volume of a stock approaches the total capitalization and the price is increasing, a significant drying up of the supply of the stock is in prospect. What the firm wants to determine is the stage at which the supply of a stock becomes virtually exhausted, for at that point a major breakthrough in price will occur.⁸ This supply and demand study, with numerous variations, is presently in different stages of research.

Many companies use the computer for internal purposes, not only to help select stocks and to time buy and sell signals, but also to prepare data to be sent to clients. For example, Chartercraft Compustrength Service technically computes the top twenty-five stocks of the week.⁹ Standard &

⁸Thomas, "Electronic Investing," p. 18.

⁹"Computers Spew Out Hot Advice," Business Week, May 18, 1968, p. 124.

Poor's uses a variety of approaches through their subsidiary, Standard Statistics Company, Inc. The division manages three to five billion dollars' worth of portfolios and issues two subscription services--The Outlook and Standard & Poor's Investment Advisory Survey. First, the computer selects the ten most attractive stocks on a fundamental basis. They next pass through the Trendline Division for technical analysis. Finally, the best stocks are chosen by consolidated opinion.¹⁰

Although there are advantages of the procedures to which computers have been assigned by technicians, there are other points to be considered. One of the counter positions concerns the accusation of self-fulfillment that has been leveled at technicians for many years. The argument is that technicians are not prophets and can in no sense predict the future price of a share of stock simply by looking at the stock's record of price (and/or volume) behavior any better than anyone else. Many antagonists of the chartists claim that any success that they have is due to either luck and/or the fact that the technicians themselves cause it by their concerted action. These attackers claim that the movement of the price of a stock is based on what it is worth in terms

¹⁰Ibid.

of earnings, dividends, and future growth, and its movements are not affected by its previous price movements and volume. These latter factors are what technicians use as their basic tools. Continuing, the anti-chartists believe that what really happens when a chartist predicts the correct movement is that the stock moves in the predicted direction only because many technicians are basing their buy and sell actions on the same pattern or signal. This gives the stock the initial thrust; then other investors see this movement and join in. As more and more sideliners (those thousands of investors who make buy and sell decisions only after there has been a substantial and clearcut movement of the price of a stock in one direction or the other) join in, this accentuates the movement. Then the chartist looks with pride on the extended movement which he feels was foretold by the particular chart pattern and/or indicator that he was using.

One of the most popular object patterns of the technician is the head-and-shoulders formation. It is the plotting of prices in bar graph form that results in a formation which has three mounds in a row. The one in the middle is called the head and is normally higher than the mounds on each side, which are referred to as shoulders. Time is plotted on the horizontal axis and price is plotted on the vertical axis. The important part of the pattern comes at the end

of the pattern. That is, as the right part of the right shoulder is being completed, technicians begin to watch very closely the day-to-day action. At this point in time, they draw a line, approximately horizontally, that connects the bottoms of the head and the two shoulders. This line is usually referred to as the neckline. When the last part of the right shoulder is completed--that is, when the descending plotted price line intersects with the horizontal line--this is the crucial point. If the price drops below the horizontal line by 3 per cent, a bearish sell signal is given.¹¹

While the chartists argue that the penetration of a neckline indicates that the stock is overvalued because many people are now becoming aware of the fact and are now selling, their opponents disagree. The non-chartists say instead, what really happened was that hundreds, and sometimes thousands, of chartists were watching this pattern. When it made this particular move in question, they all sold, and this gave the stock its initial thrust mentioned above. After

¹¹Actually the process of drawing the neckline, the selection of the shapes, and the decision as to when to sell on the last descending leg are more detailed. For example, some prefer to sell immediately when the descending line hits the horizontal line. Others prefer to wait until the price drops 3% below the price at which the horizontal line was drawn. But the above description is complete enough to illustrate the point that is often leveled against chartists.

this action, and usually because of it, the non-chartists add, any continuing drop is because of the snowballing effect also discussed in the previous paragraph. As to the computer's effect on this technical procedure, it probably is a case of a quantitative change rather than qualitative. That is, it appears that most writers on this subject feel that the computer has not changed the situation; rather, it has only made it more severe. It is argued that with the advent of the computer, technical analysis will be more prevalent, and therefore, there is the possibility that computer equipped traders may be creating the very patterns on which they are basing their trading action.

Another area of concern is the anticipatory problem, which is generally attributed to the rapid reporting ability of the computer. Many systems utilize not only the computer itself but also on-line and real-time attachments. With these improvements one of the more common technical tools, the 200-day moving average, is printed out at the end of each day. In the past, if a stock went above its 200-day moving average, many technicians took this as a signal to sell.¹²

¹²D. L. Thomas, "Where the Action Is," Barrons, August 28, 1967, p. 8.

Now with the movement of this average so up to date, it is common to find extensive selling beginning even before the stock reaches this line. Hence, many feel that the quickness of the computer is causing premature buy and sell reactions. Some feel that the computer has introduced an element that has brought chaos to the market where more orderliness rather than less is needed. In fact, it appears that some of the hard-line technicians are looking with more appreciation on the Wall Street adage, "The market can do anything." If the computer has made technical use far more prominent, the consequence may exaggerate the violence of price swings. For instance, if investment companies are using the computer more for technical purposes than previously, this could result in sending numerous funds in the same direction at once, thus producing sharp swings.¹³

Some technicians believe that the stock market is oligopolistic in nature, and that there is thus an unequal distribution of critical information throughout the market place. As the awareness of critical information gradually

¹³T. R. Daners, "Trends in Fund Investment Policy Under Varying Stock Market Conditions," Commercial and Financial Chronicle, June 20, 1968, p. 2445.

spreads, it influences the actions of market traders, and recurring patterns and continuing trends in price movements are produced as expected. Others have attacked this belief. Some of these attacks have taken the form of so-called random-walks which argue, among other things, that the market is not oligopolistic but competitive and that there are enough well-informed analysts operating within a free market to result in instantaneous adjustment of price to value. If price does adjust instantaneously to value, then successive security price changes would be statistically independent. In other words, one could not use past prices to forecast future prices; or stating it in rather harsh terms, technical analysis would be a useless occupation. If the last statement is true, then many computer programs that have been developed around price-volume relationships and changes appear to be a wasted effort.

To help resolve this argument several methods of testing the random-walk hypothesis are available. The computer is being employed to test the theory more thoroughly by incorporating a greater number of stocks and by observing their price movements over a longer period of time. Though the random-walk theory can garner certain statistics which are quite interesting, the opponents are prompt to point out that such methods have certain built-in deficiencies. Considering

evidence to date, it appears that the random-walk theory versus the technical theory debate will not be resolved within the near term. One writer describes the confrontation as

The random-walk hypothesis cannot be proven. All that can be indicated is that the specific strategies investigated do not yield profits which are greater than those which would be yielded by a random method of selection.¹⁴

¹⁴R. A. Levy, "Technical, Fundamental and Random Walk Selection," p. 1372.

CHAPTER V

ACCOUNTING, FINANCIAL DATA, AND INVESTING

Problem Areas in Accounting

The consistent preparation of financial statements is extremely important to investing, since such data as earnings, current ratios, debt-equity ratios, and yields are computed from these reports. However, since alternate ways to prepare financial statements exist, problems are created for analysts. The following statements do not provide a thorough examination of accounting procedures, but rather describe problem areas in accounting which are pertinent to the use of the computer in the stock selection process.

Frequently, companies publish two or more sets of financial results. For example, four possible earnings-per-share computations are derived from:

1. normal operating earnings divided by currently outstanding shares,
2. normal operating earnings plus or minus all unusual items that affect the company's economic welfare divided by currently outstanding shares,

3. normal operating earnings divided by currently outstanding shares plus shares which might be issued because of conversion contracts, and
4. normal operating earnings plus or minus all unusual items that affect the company's economic welfare divided by currently outstanding shares plus shares which might be issued because of conversion contracts.

The first alternative is by far the most common presentation. However, events frequently occur which are not usually considered part of a company's normal operations. An example of this might be an expropriation of foreign subsidiaries (such as occurred in 1969 to some of the American owned copper companies in Chile and Zambia). It is often the policy of many companies to report such a loss in a manner which will not affect their earnings-per-share figures. This reasoning is based primarily on the belief that many users of financial statements read only the earnings-per-share amount (often the last figure at the end of a long column of figures), and since most readers do not fully understand accounting techniques, the reported earnings-per-share figure should represent the company's normal operations. These company managers feel that such a figure will be more valuable to the majority of financial statement readers, and their position is shared by many accounting and financial

authorities.

Conversely, other accountants, stockholders, company managers, and financial analysts feel that all items affecting the company's welfare--good or bad--should be included in the income statements and thus influence certain key figures as earnings and earnings per share. Under the all-inclusive concept, the second earnings-per-share figure is also presented. Some argue that an all-inclusive figure should be the only one reported.

In addition to the issue of whether or not items should be omitted when computing earnings, there is the question of which items should be left off if such omissions are allowed. One of the leading authoritative accounting bodies states that the only item which may be omitted from the computation of net income is prior-period adjustments.¹ Their position on this matter is often referred to as the current operating performance theory.

While the American Institute of Certified Public Accountants allows prior-period adjustments to be omitted, the American Accounting Association warns that such omission is

¹Opinions of the Accounting Principles Board, No. 9 (New York: American Institute of Certified Public Accountants, Inc., December, 1966), p. 112.

dangerous. In fact, their earlier statements of position in 1936, 1941, and especially in 1948, strongly supported the idea that all items should be placed on the income statement. However, their former position appeared to be relaxed somewhat in their Statements of 1957 and 1966.²

The third earnings-per-share alternative is the result of using an unusual number of shares in the divisor. Normally, treasury stock and certificates that may be issued at some future date because of prior commitments (e.g., shares reserved for conversion privileges and stock option plans) are not included. Treasury stock and stock option plans, especially the former, rarely are a problem because very few companies include these shares in the divisor. However, because of the increasing popularity of conversion plans (e.g., issuing convertible bonds and debentures with warrants), there are many accountants and analysts who feel that the divisor (the number of shares) should include at least some of these shares, particularly those which appear to have a good chance of coming into existence via conversion in the near future. Other accountants and analysts believe

²The 1957 statement is entitled Accounting and Reporting Standards for Corporate Financial Statements--1957 Revision, and the 1966 statement is entitled A Statement of Basic Accounting Theory.

that the maximum number of shares that may be added because of conversion should be included. The American Institute of Certified Public Accountants presently advocates that where there are convertible plans and the potential dilution is material, supplementary pro forma computations of earnings per share should be furnished, showing what the earnings would be if the conversions took place.³

The fourth earnings-per-share figure that is presented in some corporations' financial statements is earnings with extraordinary items included, divided by a "fully converted" number of shares. Extraordinary items may result from transactions such as gains or losses from sales of fixed assets or subsidiaries, additional income tax assessments or tax refunds due to settlement of pending tax cases, and write-offs of intangibles such as goodwill or organizational costs.

Another area where financial or accounting data can be misleading because of alternate accounting approaches is in accounting for mergers.⁴ By 1969, conditions were aggravated because of the rapid increase in conglomerate type combinations involving firms of different industries with widely

³Opinions of the Accounting Principles Board, No. 9, p.123.

⁴The terms merger, consolidation, and combination have both general and specific meanings. For this study, unless specifically so stated, these terms will refer to any "coming together" of two or more companies.

varying accounting procedures. A major difference arises if the merger is considered a purchase or a pooling of interests, and often it is most difficult to make this determination. There are certain criteria which are used to determine the nature of the transaction. A purchase assumes that one firm is terminated and started again by another entity. Frequently, it is characterized by (1) new management in the acquired company, (2) the purchased company being acquired by payment of cash or equivalent, and (3) the type of business being altered and the assets used in a different manner. Conversely, the reverse of these conditions infers that the merger is a pooling of interests and assumes both companies remain in operation. The present managements in both companies remain, and instead of a cash payment, stock is issued to the original owners of both companies. Also, both companies remain in their respective types of business.

The assumed nature of the transaction (i.e., whether purchase or pooling of interests) will affect the accounting entries used to record the transaction which, in turn, will influence the financial statements and the popular earnings-per-share figures that so many stock analysts and investors follow. In a purchase transaction, the assets and liabilities of the company acquired are recorded on the books of the acquiring company at cost. In a pooling of interests, the

assets and liabilities of both corporations remain unchanged.⁵ Thus, if a purchase is assumed and if a larger price is paid for the company than is shown by the total equity on the acquired company's balance sheet, then some of the assets will probably be recorded on the acquiring corporation's books at a higher figure than original book value.

The assets most frequently adjusted for purchase price differentials are fixed assets, but more importantly, depreciation will increase if fixed assets are written up. The increase in depreciation will decrease earnings, which results in a smaller earnings-per-share figure. On the other hand, if the transaction is handled as a pooling of interests, the assets and liabilities are not revalued. Hence, depreciation, earnings, and earnings per share for the newly combined company will be, in most instances, the same as if these respective amounts were computed for each company in its own set of books and added together.⁶ In this event, even though a larger value may have been given for the company than that

⁵In some cases there may be certain accounting entries to bring the books closer to fair market value or to some other desired figure because of prior events, but these are primarily for adjustment purposes and not for recording the acquisition.

⁶This statement assumes no unusual items such as a tax loss of one company that could not be used except via a merger.

shown by its equity on the balance sheet, the earnings-per-share figure will not change. Since management is not eager to report lower earnings-per-share, the pooling of interests procedure is usually selected when the price paid is greater than the value of the net assets. This procedure is acceptable in transactions involving a legitimate pooling of interests, but problems arise where, by using pertinent criteria, it appears that the true nature of the merger is a purchase. Such actions result in a loss of confidence in reported accounting information and make it difficult to accurately analyze a company's financial position.

Accounting procedures also affect the analyzation steps of the investor due to different treatments afforded the investment tax credit. Even though the credit may be repealed, the effects of this tax law will affect financial statements and investors for years into the future since some companies have investment credit carry-overs from previous years. Also, the effects will remain because analysts usually compare important figures for several years in order to determine trends and exceptions. Thus, the curtailment of the investment tax credit in a given year will necessitate adjusting past, current, and future statements in order to obtain comparable results.

A third area of difficulty is caused by the various ways of accounting for the investment credit. When the investment credit act was originally passed in 1962, the American Institute of Certified Public Accountants published Opinion No. 2, "Accounting for the Investment Credit," which recommended that the allowable investment credit be reflected in net income over the productive life of the acquired property and not in the year in which the asset was placed in service.⁷ This procedure would not inflate a firm's reported earnings in years in which large amounts of fixed assets were purchased.

Two years later, the American Institute of Certified Public Accountants published a second bulletin on this subject. In this opinion, the Accounting Principles Board reaffirmed that the spreading of the credit over the life of the purchased asset was preferable. However, in this bulletin, the Board also gave approval for the alternate method of taking the full credit in the year in which the asset was purchased.⁸

⁷"Accounting for the Investment Credit," Opinions of the Accounting Principles Board, No. 2 (New York: December, 1962) American Institute of Certified Public Accountants, p. 7.

⁸"Accounting for the Investment Credit," Opinions of the Accounting Principles Board, No. 4 (New York: March, 1964) American Institute of Certified Public Accountants, p. 22.

The unpopularity of deferred recognition and the fact that the Securities and Exchange Commission was accepting either method in financial statements filed with that agency likely accounted for the revised opinion. As to the reason of unpopularity, the authority of opinions published by the Accounting Principles Board rests on their broad acceptance. Without such acceptance, the opinions lose much of their effectiveness. The Board recognized that many companies were not following the opinion issued in 1962 calling for deferral, and total recognition of the credit in the year of acquisition was condoned. Thus the use of alternate methods influences reported earnings and complicates the work of the analyst and investor.

Still another problem area is how to handle income taxes where the company uses a different accounting method for reporting purposes and tax purposes. When such is the case, the tax provision will be different from the amount that is actually paid. Some accountants feel that only the amount of taxes actually payable should be recorded on the income statement, as this is the amount that represents the actual liability to the government. Their argument is that whenever justification is endorsed to use figures that do not agree with the actual facts of the transaction, then manipulation becomes possible. Such procedures lessen the

confidence that financial statements should possess.

Conversely, those who recommend allocation of tax debts argue that the tax figure should be consistent with the other amounts on the financial statements. They maintain that it is wrong to compute and report sales, salaries, depreciation, and other amounts on the accrual basis and use the cash basis to report income taxes. These accountants believe that the actual debt is, in reality, the amount that would be paid in the current year if the different accounting procedures were not used for the preparation of the tax return, and thus this "true" amount should be reported.

Because of various circumstances, different tax figures can result. One of the more common is using the straight-line depreciation method for the financial reports and one of the accelerated depreciation methods (i.e., double-declining balance or sum-of-the-years-digits) for the tax return. The reverse of the above condition is possible, but since the accelerated depreciation method allows higher depreciation amounts earlier, which lessens the tax, it is generally used for tax purposes. Lower initial taxes give the company more working capital in the current and near current years. Another device by which corporations can reduce their current year's income tax is to use an inventory method that will report a greater expense in the current year

than some other inventory procedure. In times of rising prices, corporations using the LIFO (last-in, first-out) inventory method can charge a greater expense to the current year's tax return than if they use FIFO (first-in, first-out). Accordingly, the last ten to twenty years have seen an increase in the adoption of LIFO inventory methods due to this nation's continued inflationary economy. Other possible differences between tax requirements and reported results include depletion allowances, installment sales, and loss reserves on loans by financial companies.

The switching of accounting methods from year to year makes trend and industry comparisons difficult, and since these techniques are used in analyzing stocks, inconsistency distorts the relationships. There is an accounting principle against frequent change from one method to another, called the consistency concept, which has long been embodied in accounting theory. Without it financial statements may be prepared to reflect any final result desired; manipulation would be rampant. Included in the concept is the expectation that whenever a change is made, certain conditions must be met. First, it should be for a legitimate reason other than distorting reported gains or losses. Second, the fact that a change occurred should be made quite evident even to the casual reader. Third, its effect should be clearly noted.

Included in the explanation should be what certain pertinent amounts, especially the alternate earnings-per-share figure, would have been if the change had not been made.

Effects on Investing

Let us now consider the problem--what does the analyst do with accounting data which includes two or more figures for the same item? Also, what can he do with a figure that is legally correct, and is even correct based on prevailing accounting principles, but is a figure that he suspects is different from what it should have been if certain accounting procedures were followed instead of the ones actually used? An example of this might be when the company uses accounting procedures for pooling of interests when by most criteria it appears that the actual transaction was much closer to a purchase.

This condition presents a puzzle to the analyst-investor, but it presents an even greater problem when the user of the data is a company that employs a computer in stock selection. Before the computer, the analyst had questions when two figures were issued, but generally he could conduct his analysis and concentrate on the one he felt to be closer to the real situation. At the same time, however, he would keep the other figure in mind, constantly permitting

it to influence his reasoning. This action is a subjective ability which the computer lacks. Therefore, when two figures are issued by a corporation, the computer-assisted investor must decide which he will use. If he selects the wrong figure, he will probably obtain incorrect results, which could prove very costly to him.

Because of the diversity in accounting procedures, many analysts have made suggestions that the accounting profession take action to eliminate the issuance of more than one set of financial results. This subject is one with which the accounting profession has been struggling for some time. It is conceded that the need for more uniformity is great, but it is believed that (1) this goal is not an easy one and (2) many people who argue so adamantly for more uniformity have either little accounting education or are not fully aware of the complexities of financial statement preparation. Uniformity is desirable, but it must be achieved with orderliness and fairness or else the one set of figures finally acquired will have less value and not more. To overcome this problem, some analysts have established procedures so that both figures are used. In effect they run the program twice, once for each figure as if they were analyzing two different companies. These dual final results are then considered subjectively by the decision makers. They attempt to choose between them to

arrive at a profitable decision. However, this dual run is not only more time consuming and expensive, but neither result may be correct. Another avenue taken to overcome accounting problems is the use of probabilities. Briefly, the analyst selects approximations as to the probabilities that each figure might have to the actual condition, which are then entered and run in the computer. Although much work has been done in both of these areas with the aid of the computer, the subjective ability of the mind plays a part in each.

The procedure of comparing, which is one of the most practiced analyzation steps, is another area of concern. Most financial and economic data have little meaning alone; their value comes from placing them beside similar figures for other years, other quarters, and other companies. This procedure is performed in order to determine the direction in which the enterprise is moving. If a corporation is performing quite well and starts a decline, it is necessary to determine this fact before it regresses too far. An example of this procedure is comparing the quarterly performance of a company with its results for the same quarter last year, which is one of the most observed of all financial relationships. These particular data are so important that many news services report them for general consumption for some of the larger American corporations, such as American Telephone & Telegraph, General Motors, and United States Steel. If these

giant corporations, which employ thousands of workers and affect so much of our economy in other ways, are losing ground, these facts could easily mean that the economy may also be declining. In fact, if only these three companies laid off a substantial number of their employees, the whole nation would soon feel the economic effects of the reduction in personnel. The reason is twofold: First, the direct effect of these employees' earnings not being fed into the economy would be quite noticeable, and because their spending is not present, other workers will be laid off because of the resulting decrease in demand. Second, the fact that these companies' products will not be available for use will cause further layoffs. For example, when United States Steel decreases its output, corporations that use steel generally also cut back production--thus creating more unemployment. When the snowballing effect takes place, the original action is greatly magnified.

Thus, when so much unemployment comes about and the economy loses momentum, a recession can easily ensue, thus causing corporate earnings and stock prices to fall. This decline can be attributed to at least two reasons. First, when the level of business decreases, profits usually decrease, primarily because in most businesses today a large

portion of total expenses is fixed. Thus, a continuing large turnover in sales is necessary for a profit. Second, stock prices drop because of the psychological aspect. The stock market is often influenced by news events, some of which may not affect the market directly, but the emotional or psychological influence can at times cause the market to move drastically. For instance, about a decade ago the President of the United States had a heart attack which did not affect any corporation or industry directly. However, the stock market suffered a substantial drop.

Because comparison of certain economic and financial data, such as quarterly earnings, can reflect the status of the national economy, analysts-investors are very interested in these periodic "temperature measurements." Although this macro aspect is significant and influences the decisions of many analysts-investors, possibly even more important is the use of the comparison procedure in the micro sense. In this approach analysts-investors compare quarterly earnings reports for specific companies for the purpose of helping to decide whether or not to buy or sell a specific stock.

Numerous publications, such as the Wall Street Journal, devote space to printing timely quarterly earnings and those for other time periods. For example, when the second quarter's earnings are reported, some companies also present earnings

for the first six months. This presentation gives the reader current quarterly earnings compared with the same period last year, as well as allowing the reader to consider the latest trend, that is, the first quarter's earnings in relationship to the second quarter's earnings.

The comparison of quarterly and annual earnings per share is very often carried forward into the future in the form of estimates. For example, many stock brokerage firms which publish information about various companies often list estimated future earnings per share. One of the most common presentations of information in these publications is the listing of per-share annual earnings for two or three years, including next year's estimate. In most cases, these earnings-per-share data are presented in a prominent place and frequently are at the beginning of the article for each stock discussed. A very common form is the stating of last year's, this year's estimated, and next year's estimated earnings per share. This format gives the analyst-investor a quick look at what direction the company is expected to move. Although it is impossible to say which financial facts have the most influence on an investor, it is believed that the earnings-per-share figure stated for three-four years and earnings per share stated for the last four-five quarters may be the most commonly used facts. This appears to be true of institutional

investors, discussed in a later chapter.

The problem of alternate accounting procedures also creates problems when employing the screening process. One of the criteria frequently selected is the growth rate, especially of earnings per share. Usually only one figure is placed into the computer for each item. The result is that when the computer is instructed to examine 1,000 stocks using five to ten criteria, one of such being the earnings-per-share growth rate, the computer can use only the earnings-per-share figures that were placed into the machine. Thus, in cases where the figures placed into the machine have competing figures that may be just as appropriate, these alternate figures are not considered at all. Of course, both figures could be entered and some computer programs allow for this, but this course is time consuming. It probably raises more questions than it answers. For example, where does the analyst draw the line in determining whether to enter an alternate amount? What basis does he use? Can his basis be used for companies in different industries? Should the size of the difference between the alternate figures influence his decision? Who makes the decision as to when alternate amounts are to be placed into the machine? In large brokerage firms, does the one who decides on which figures will be used have the same philosophy about which data is important and how it

should be computed accounting-wise as the account executive who will be using the computer printouts?

The introduction of alternate amounts has many obstacles in its path. On the other hand, if alternate figures are not placed into the machine, possible buying prospects are not discovered. Before using the computer, the analyst-investor could consider the stock, keeping in mind both figures. With the computer he may never see the stock because all stocks are on an unreadable magnetic tape.

However, the proponents of the computer point out that any stock bypassed because of this alternate-figure problem could have been easily omitted from consideration if the computer were not being used. Such omission would be due to the fact that without the computer only a small fraction of the total number of stocks which the computer can examine would be considered by manual means. Thus, the user of a computer would argue that even with this drawback, the speed of the computer surpasses the survey powers of a person.

Most computer-assisted analysts would also add that the problems of alternate accounting figures can be overcome almost entirely if the screening procedure is handled correctly. They would instruct the machine to select those stocks that met, for example, three out of five criteria. Then in situations of alternate financial data and where the single

figure placed into the machine might otherwise have caused the stock not to be selected, that particular stock will now be printed out. This result is obtained because the stock does not have to meet all of the criteria, as would be the case if the program were written so that only stocks that met all five of the criteria were selected.

After the stock has been printed out, the appropriate recognition can be given to any particular attribute that is thought to be as important as the one in the machine. Hence, analysts can scan and initially investigate literally thousands of stocks, impossible without the computer, and still not omit any desirable prospects because of alternate accounting procedures. Before leaving this point, it should be noted that there are occasions where alternate accounting procedures may cause problems even with the flexible system described above, as occurs where the alternate procedures affect three or more of the criteria set to select prospects. Some stocks may be overlooked, but these instances should be rare. Also, the job of selecting the one best-of-all stock from the thousands of stocks available is analogous to finding the needle in the haystack.

When changes are made by companies in their accounting procedures, the computer is a useful aid in making past figures comparable. For example, a company may change from

FIFO to LIFO for its inventories or from the straight-line method of depreciation to the double-declining balance method of depreciation. This substitution makes the current year incomparable with previous years. When a computer is available, the previous year's data that is influenced by such a change frequently can be adjusted without too much difficulty. If this information is not on the computer, all records which contain this data must be located and altered. For one company, five to ten different amounts would have to be converted depending on the type of company and the type of accounting system used. For instance, a manufacturing company with a cost accounting system would probably have more alterations if the depreciation method were changed than would be the case for a wholesaler. With the manufacturer, a large part of the depreciation becomes a part of inventories, which is not true of non-manufacturing companies. One may add the fact that many analysts prefer to have figures available that date back five to ten years; thus, if seven figures need adjustment and the analyst desires to see a ten-year history, seventy figures would have to be altered.

With the computer, a series of programs can be written that will adjust each item of data for each year. Once these instructional programs are written, alterations are not as difficult. All that remains is to supply the computer with

the new information along with the previously prepared instructions, which will rapidly update the records. This fact is probably more important than most people realize. Because of the difficulty and expense in trying to keep all of the information adjusted to current conditions on thousands of companies, this task is rarely done by firms that do not have computers. Thus, it may be that frequently bad buy and sell decisions are made because of the lack of adjusted information. Continuing the aspect of accounting procedure changes and the attempt to keep past data on a current basis, some advisory companies and brokerage firms are experimenting with programs that will hopefully make many of these adjustments almost automatically. The programs would be very complex, but they could save considerable time if they can be perfected. For example, if a change in the depreciation method took place, the computer would be informed of the old and new methods. Utilizing previously prepared programs with this information, the computer would analyze the company's financial data and select and adjust the appropriate figures. If this part of the adjustment aspect can be perfected to where it is practical, it will be another area where the firm with the computer will have an advantage over the firm that does not possess one.

One means of overcoming non-comparability problems

is to have only one set of accounting rules. In fact, COMPUSTAT has followed this approach and has devised its own set of accounting definitions. Thus, even though there are diverse accounting concepts, COMPUSTAT avoids this difficulty by using fixed accounting definitions.⁹ Accordingly, the vital aspect of comparability of companies within a given industry is made available to users of this service. Extra work is necessary at the beginning by Standard Statistics Corporation's personnel because they have to examine all their data for compliance with the accepted rules. Where financial statements have been so prepared, there is no problem. Where they have not, the accountants at Standard Statistics Corporation must, in effect, prepare a second set of financial statements. Standard Statistics Corporation's personnel apparently believe that these adjustments are worth the initial cost and that their customers share this belief.

Since accounting is an art and not a science, situations arise where equally competent accountants handle a given set of circumstances differently, and analysts-investors, especially ones using computers, must be aware of these possible pitfalls. However, the computer's speed of scanning,

⁹"Wall Street's Newest Drudge and Genius," Business Week, July 9, 1966, p. 117.

comparing, and analyzing is helpful in overcoming this drawback. In fact, some feel that in the long run the computer will not only overcome the difficulty, but will have an overall positive influence on investing. Finally, whether the computer is one of a company's analyzation tools or not, more uniformity in accounting is needed. Though this is not a small task, constant work toward this goal should be undertaken.

CHAPTER VI

INTERACTION BETWEEN THE STOCK MARKET AND COMPUTER-ASSISTED INVESTING

Effects of the Computer on Analysts and Investors.

The introduction of the computer to the stock market has been received with differing viewpoints. Millions of dollars have been spent on computers and research into stock behavior with reportedly good results. On the other hand, some analysts feel that the computer's ability is overrated. Computers have affected investors to the extent that a few companies actually owe their existence to the process called stock selection via computer. For example, Compufund was set up by David Goodstein, who had been very successful in his own investing while using a computer. He decided to set up a fund to carry on those procedures. George Chesnut turned his system of technical analysis by computer into American Investors, Inc. Another firm which probably owes its existence to the computer was formed by William O'Neil. He entered the field in 1959 securing from several market experts their trading strategies, then programming a computer

as closely to their procedures as he could. Since 1964, he has spent \$2 million on research for developing a microfilm service that provides daily charts on over 2,000 stocks.¹ Considering size, the largest mutual fund in 1967, Investors' Diversified Services, began experimenting with 1,200 stocks on a day-to-day basis.²

Other evidence that illustrates the impact that computers are having is the actions of the approximately 350 advisory services around the country. Many of these services have purchased computers and actively push this fact in their advertisements. In many cases they have found that this appeal has been very helpful in attracting new customers and retaining old ones. The public has traditionally felt that it has been at a disadvantage vis-a-vis the professionals and large investors. Therefore, use of computers, it is claimed, is a method by which the public can reduce this handicap. Advisory services' main usage of computers is apparently the screening process. Computers are used in other ways, and what follows is a brief summary of some of the advisory services' methods.

Spear and Staff reports that it offers an approach

¹Thomas, "Computerized Gunslingers," p. 3.

²Thomas, "Electronic Investing," p. 3.

for in-and-out traders which instantly analyzes every trade in a group of stocks. The service, called INSTAN, is available for approximately \$200 a month, complete with a read-out printer for home or office. It is offered to Spear & Staff's subscribers rather than institutions. Electronic Stock Evaluator Corporation plans to do just the opposite as they intend on selling their advice primarily to brokers who are expected to distribute it to more than one hundred institutions. An interesting fact in this case is that the president of Electronic Stock Evaluator Corporation says he also tells institutions how they can legally manipulate the market by block trading. It is professed that with the speed of the computer diagnosing every trade immediately and the huge sums of money available to these institutions, they can force technical turns on many stocks. Then after the market reacts, the institutions can get out with a profit. The president of Electronic Stock Evaluator Corporation also believes the public is doomed as institutions continue their highly active trading.³

³"Computers Spew Out Hot Advice," Business Week, May 18, 1968, p. 124.

ISEC Corporation, of Princeton, New Jersey, leases an analog computer with which a customer can project his own earnings estimates. The firm will also provide the lessee with current market action and ISEC's own ratings. A green light flashes a buy signal, and a red light flashes a sell signal. It also has a needle gauge that purportedly measures risk. The president of the company admits that at first people laughed, but he claims that their initial model portfolio of ten stocks worth \$10,000 invested in March, 1966 was worth \$34,000 two years later.⁴

The status aspect is another reason why some advisory services have adopted the computer. In fact, a few services admit that one of the main reasons for using the computer is to maintain their subscription list. These firms feel that people believe that if stock selection is performed by a computer it is more valid than if performed by human hands. On the other hand, some services de-emphasize their computer usage. They claim that the professional is aware that the computer does not perform miracles and that there is a lot of intuition to successful investing.

⁴Ibid.

In addition to the uses of the computer by investment companies, brokerage firms, and advisory services, another large segment of the market also affected by the computer is the pension fund trustees and companies which administer their own pension fund investing. They, like the investment companies, also have millions of dollars to invest. Although much has been written about the pressures on investment companies to outperform each other and the overall market, pressure also comes from companies which have placed large amounts of funds with pension fund trustees. Naturally, they want to secure as large a yield as possible, since the more yield they receive, the less the company has to contribute in order to meet the total required amount that is to be paid out to pensioners.

There are two different ways in which the computer has affected these organizations. The first method is in using the computer for stock and portfolio selection. Their procedures and problems are very similar in this endeavor to investment companies, and will not be repeated. The second aspect deals with evaluating the performance of pension fund trustees. One example relates to the pressure, or at least persuasion, by Mobil Oil Company in regard to the companies with which it has contracted to administer its pension funds. This company chose six different pension fund trustees to

administer its fund and established a complex method utilizing the computer to compare the performance of each. It was devised so that each trustee would be on equal footing with each other. The portfolio managers at each of the trustee institutions are apprised of the evaluation of their performance and ranking relative to the other portfolios. The availability of future funding to each institution is to a great extent based on its performance relative to that of the other trust portfolios.⁵

The opinions of some of the market participants as to the value of the computer for stock selection are varied. Certainly this belief by management will dictate to a large degree how much time and money a company will devote to it. Some analysts feel the computer will never be a large factor in stock selection because it does not possess human intuition, and the stock market is very subjective and unpredictable. Thus, they believe that any object or system that must rely 100 per cent on tangible, objective information can never be very successful in an environment such as the stock market. Some analysts believe that the computer will never perform satisfactorily in the visit with the company's

⁵E. A. Fox, "Comparing Performance of Equity Pension Trusts," Financial Analysts Journal, (September-October, 1968), p. 121.

management and the examination of the actual plant and its products for important information. Similarly, situations which cannot be programmed include: talks with the company's customers, extent of nepotism, the possibility of lessened competition in the future, the undesirability of one-man companies, and miscellaneous items such as sloppy house-keeping in the plant.

Nevertheless, some investors counter by saying that when more is learned about computers even these subjective elements can be installed into them. It is claimed that analysts can eventually place into the computer items of the economy such as forecasts of consumption of certain products, estimates of discoveries (perhaps as a correlation to exploration expenditures), and even talks with management, extent of nepotism, and talks with the company's customers.

Because of the relatively high cost of computers and the people to operate them, the computer in 1969 served mainly the larger firms. However, in some cases there have been attempts to bring this tool to the smaller investor. One such move was made by the ISEC Corporation. The company's goal was to make available an eighteen pound solid-state desktop analog computer. The planned price was \$335 plus \$150 per year for input data. It would be designed to take simple market statistics, together with the price and

earnings growth of individual stocks, compare the data, and return buy and sell advice. The company claimed the investor needed only a daily newspaper to augment the input data.⁶

Another condition for which computers are responsible is automatic opinions. Merrill Lynch, Pierce, Fenner and Smith, Inc., started its opinion retrieval system many years ago. The company placed in its computer facts and opinions on approximately three thousand stocks. When a client asks for an opinion on a certain stock, the account executive can secure this information in a matter of minutes. The requests and answers are handled over the company's own teletype terminals. This system saves much of the account executive's time in gathering data and searching through piles of correspondence looking for the company's "latest" report and opinion on that particular stock. It is especially useful for stocks not actively traded (the opinions of which are printed less frequently than for the more popular stocks) because the research department keeps each stock current in the company's computer. Although the firm issues printed matter, it could, if desired, reduce the cost of printing thousands of flyers. The computer also has the intangible benefit of making the

⁶"Wall Street's Newest Drudge and Genius," Business Week, July 9, 1966, p. 117.

account executive look very efficient by being able to accumulate the current data in such a short time.⁷

Perhaps the main advantage of this system is that it can keep opinions very current. Usually opinions are updated each night--some during the day if necessary. Thus, if some adverse event happens to a company, this can be placed into the computer within the hour and thus be available to all who inquire thereafter. Frequently, the research department may not feel that it would be wise to issue an opinion for various stocks and thus at varying times a "no opinion" is issued. When the situation changes and an opinion is issued, such issuance is also very efficient. The account executive knows to check the computer if he wants the latest facts about his company's position on any particular stock. Even stocks that have no significant new developments are reviewed every two weeks.

Another interesting aspect of this system is that the dialogue is not just a one-way street from analyst to account executive. The computer also keeps a record of requests on companies. If an account executive asks about a certain stock

⁷Of course the company's opinion is not always valid, as it advised against buying Loew's in 1966 at 25 and placed it on a buy list at 60 some three years later after the stock was split 7-1/2 to 1.

and receives a report, the system holds his name for a specified number of days. If within this period of time the recommendation on that particular stock is changed, the broker which requested the opinion is notified of the change. This can be relayed to the client to keep him informed of the latest developments.

Another change for which the computer is responsible is the consideration of more data. In addition to the usual company financial data such as sales and earnings, another commonplace feature will eventually be the placing into the machine of such data as the economic statistics of gross national product and Federal Reserve figures.

Some brokerage houses have extended the use of the computer beyond that of stock selection to include the broader aspect of portfolio management. One firm has developed a program simulating the mental processes of an intelligent portfolio manager. It scans the issues held by a client and compares the holdings with the client's investment objectives. It then makes recommendations based on a master list of opinions prepared by the company's analysts. Besides telling the client to buy, hold, or sell specific stocks, it may urge a greater or lesser degree of diversification. This firm

reported that in most cases investors were overdiversified, as did Alfred L. Kahl.⁸ It is interesting to note that before a computer analysis is released, it is reviewed by a staff security analyst who frequently disagrees with the computer and substitutes his own recommendations. Nevertheless, portfolio analysis has been speeded up at this particular firm by the computer, as such analysis takes only one minute (with hopes of getting this down to six seconds). It then receives about a twenty-minute review by the analyst.

Boston Company, Inc. found that some industries always come up undervalued in their model (i.e., banks and discount stores), and some always come up overvalued, such as drugs and the information system group (e.g., IBM).⁹ The company believes that this can be corrected mentally but feels that it is better to develop a separate model for each type of industry. This means more involvement with the computer and a more complicated analysis program. This firm asks the analyst to project earnings and not the price, as price determination is

⁸Alfred L. Kahl, Jr., Investment Management and the Computer: Limitations and Prospects.

⁹G. C. Howard, "Use of Computers in Investment Analysis," Commercial and Financial Chronicle, (December 8, 1966), p. 2036.

left to a small investment-policy group. These earnings are expected to be forecasted with a computer. The firm also compared their estimated earnings with actual earnings, and omitting the sign, obtained the total amount that the actual earnings differed from estimated earnings by industry. Airlines and nonferrous metals deviated greatly, but banks and tires were close. This operation was helpful in showing the analysts how they might improve their projections. When earnings were being considered, it gave the decision makers something to keep in mind as to the rough probability of the projected earnings' accuracy.

The computer method of projecting future earnings used by the above firm was exponential smoothing (using past earnings data to forecast future earnings). This method amounted to a somewhat mechanical projection which weighted the recent years more heavily than earlier years. The firm intends to make many probes into whatever interrelationships appear to make sense. The computer will do thousands of correlations between series assigned to it. The management of this company also believes that the best way to accomplish the above objective is on a time-sharing basis, and it is anxious to participate in some time-sharing system, such as White, Weld & Company's, as soon as one is available that will fit into its pattern of operations. Management believes that

such a system will greatly enhance the speed and flexibility of its investment programs.

Some other important areas where the computer is used in investment research are the following: (a) the evaluation of put options and short sales as a method of reducing risk, (b) the study of industry price movements, (c) the analysis of the relationship between industry price movements and price movements of component securities, (d) the examination of the contribution to be made by price-earnings ratios and earnings growth-rates, as well as numerous additional fundamental factors.¹⁰

The advent of the computer has fostered sophisticated research and has resulted in some complicated mathematical procedures such as calculus. One procedure computes the rate of change of increasing or decreasing buying support in terms of the first derivative (acceleration) and the second derivative (rate of change of acceleration). In 1967, one firm used the above procedure to detect forthcoming weaknesses in certain stocks. It noted that dollar injection failing to keep pace with rising prices was often a reliable indicator. Consequently,

¹⁰R. A. Levy, "Technical, Fundamental, and Random Walk Selection," p. 1373.

this company made several sell recommendations that saved their clients considerable sums. Some of these sell recommendations were Addressograph (in November, 1967, it was 84 and subsequently dropped to 67) and Boeing (in October, 1967, it was 107 and later fell to 47).¹¹

Analysts will need increasingly larger amounts of easily accessible data. It is not far fetched to expect centrally located banks of computer information to soon become available to investment analysts, thereby giving them access to knowledge beyond the reach of a single organization.¹²

Effects of the Computer on the Market

After having discussed the effects that the computer has had on the various groups which operate in the market, such as investment companies, advisory services, and brokerage firms, let us now examine the changes which the computer has caused in the operation of the exchanges. The two parts of this chapter are perhaps interrelated because as the above

¹¹Thomas, "Computerized Gunslingers," p. 30.

¹²J. Gumperz, "Computer as a Financial Tool; Some of the Advantages and Limitations," Financial Analysts Journal (May, 1966), p. 119.

group's actions affect the market, what happens in the market place certainly affects the actions of these groups.

One of the most important effects the computer can have on the market is that it may cause a large amount of speculation. Some analysts feel that as more computers are used and techniques become more standardized, increased speculation or at least great fluctuation in volume and prices may result. Such events could occur when many large investors receive the same message (because of similarly programmed techniques) and all buy or sell simultaneously, thus causing drastic price changes. Also, this increased volume often brings others into the market and results in a snowballing effect. Increased speculation due to computers may also exist because they give managers of funds (who now have billions of dollars at their discretion) more confidence; thus, they move more aggressively and in larger volume, taking greater chances, again resulting in more fluctuations and often resulting in considerable speculation as others join in.

Both of these reasons seem logical, and it may be only a question of degree; however, there are opposite views. The contrary opinion believes that large fluctuations will not occur because (1) techniques will not become that similar, since there is so much latitude in programs and (2) there have always been large buyers, and they have often bought at the

same time for economic or political reasons.

The argument of many different possible programs has much to offer. Other than the screening technique (and even it can have literally hundreds of different forms due to the many factors that can be used such as yield, price-earnings ratios, expected earnings, and financial ratios), the number and variety of programs and procedures are almost limitless. The former group may believe that of all the thousands of possible techniques, only a few will be worthwhile. If everyone learned of these few and most everyone adopted them, perhaps their fears would be justified.

However, markets change, as do stocks in vogue and those out of demand. Also if a few procedures did gain unusual popularity, it is probable that these particularly better techniques would quickly lose their advantage. One reason to believe that they would decrease in value is that many would start taking buy or sell actions before certain events actually occurred in order to make their move before other investors. This fact is important because investing cannot be very profitable if an investor does not take action before the market moves. If he waits until after the market's reversal movement, he will either make little gains after commissions have been deducted or he may lose. The second contrary reason--that there have always been large investors

who in the past have sold upon the same economic and/or political news--given by those who say there is little or no reason to fear that speculation will accompany the computer also has merit. Their rationale is that one can look back and find numerous instances where prices were pushed up and down quite drastically along with similar buying and selling actions of large investors.

In a paragraph above, the point of anticipation or "making a move before others" was mentioned briefly. The aspect of early information is claimed to be one of the computer's main advantages. With its speed it can rapidly scan millions of pieces of data to detect any particular situation which the analyst may feel to be a forerunner of a change in the price movement of a stock. This observation may increase the investor's profits by allowing him to buy at the beginning of a rise in the stock's price.

One factor that many analysts believe is a tipoff is insider action, which is buying and selling by those investors who are supposed to be in a position to learn of important events before the majority of all other investors. For example, company officers, because of their positions, are often watched to determine what their buy and sell actions are. It is reasoned that if a company president starts buying his stock, there must be something fortunate about to be

announced concerning the company. Of course, this is not always so, and there are even laws (but very weak laws in the author's opinion) against such usage of privileged information. Nevertheless, this is one factor that is watched by many investors. The first faint trace of insider accumulation, previously all but invisible to most investors, now can be sensed much easier with the computer. It is said that Bernard Baruch and his friends would get inside information about a company and quickly begin to accumulate the stock. The buying would be done secretly and would not show up until the price was where they wanted it. By then it was too late and too costly for anyone else to buy in. The computer may change this considerably because it has the ability to scan tremendous amounts of data and to rapidly utilize sophisticated analyses of trading volume; machines so programmed can report any unusual activity.

The above discussions, concerning insider activity and the possibility of computer users getting the same message at about the same time, are illustrated by the following case. Some years ago, Natco, a Pittsburg manufacturing company listed on the New York Stock Exchange, did not enjoy a heavy volume of trading. However, voting control of it was purchased by a buyer from Atlanta, Georgia, and he moved into other lines. Many in Pittsburg and Atlanta saw what he was

doing with the company, and they started buying and created a flurry of upside volume. The computer of one of the leading brokerage firms spotted this volume breakout and signaled a buy sign. The firm recommended it to their customers. The price of the stock continued to rise rapidly, and after about one year from the initial signal, it was selling at about five times its earlier price.

It is likely that other computers at other brokerage firms also detected this accumulation pattern and also gave buy signals. So everyone seeing the same signal on their computers led to mass buying and the resulting increase in price. Thomas further states that

With 100 odd high-speed EDP machines constantly scanning the ticker tape in search of buy signals and with investment advisors representing millions of dollars of buying power hanging on every flick of a diode, it is not surprising that every few days some little known or forgotten stock suddenly soars to the top of the most actively traded list.¹³

The anticipation or "getting ahead of the rest" aspect is receiving attention in another manner from Mr. Alan E. Feuerstein, vice president of research at Standard Statistics Corporation. He believes, because of the sophistication achieved thus far, and expected in the future, that investors who

¹³Thomas, "Where the Action Is," p. 3.

want to get ahead of the other computer-using investors will have to go further in the predicting stage. He states that they will have to develop systems based not only on estimated earnings of a company but on conditions in the economy and in major industries that will shape the individual company's earnings.¹⁴ To do this, computers already are at work experimenting with models of the economy and of major industries in order to determine what impact a boom or decline in one industry will have upon the prospects of another. One such connection was found to be the increase of flying and profits of the makers of plastic spoons. The reasoning is that airline travelers drink a lot of coffee and use spoons to stir it.

Another possible undesirable effect of the computer is that investment company shareholders are expecting more spectacular results from managers. Such demand has forced many managers to take chances that they would not have taken previously. This increasing expectation is due to two things: (1) increased profitability by some institutional and brokerage houses which have computers and which have stated directly or indirectly that part of the reason for their successes was

¹⁴Thomas, "Computerized Gunslingers," p. 33.

their use of computers, and (2) the general publicity about computers; that is, many feel that if a company has a computer, then more success is expected from that firm. Furthermore, in their quest for quick capital appreciation, high performance funds tend to ignore--or at least relegate to a secondary role in the decision making process--such fundamentals as earnings, yield, and net asset value. Many depend on computerized technical analysis to tell them which stocks are going up or down--market psychology seems to have become all important. There is apparently a growing number of persons who believe that computers in the hands of professionals and large investors have made Wall Street even more perilous for amateur investors than in earlier years.

The effect of the computer will also show up on the persons who work daily with investing. Although much of their duties will remain the same, some analysts will learn new tasks, many of which will involve the computer itself. For example, it will soon be possible for portfolio managers and financial analysts to use a high speed computer with the ease of a desk calculator. Some predict that computers will eventually be designed so well that no extensive knowledge of computers and computer languages will be required. The analyst will have at his fingertips not only more data than he had before, but more importantly, he will have faster access to it

than before.

As to data, it is suggested that a minimum data base would include 500 to 1,000 companies, and for each company the following data should be available: (1) selected balance sheet and income statement items for the last ten to twenty years, (2) selected quarterly income statement items for the last five to ten years, and (3) monthly prices for the last fifteen to twenty years with adjustments for capitalization changes, and (4) daily prices and volume, again with adjustments, for the last one to two years, and (5) estimated expected sales, earnings, and dividends, for the next one to five years.¹⁵ It is important to point out that these data would have to be continually updated. Admittedly, this increases the cost of the system and places it out of the price range for smaller investors who desire to go it alone.

Earlier it was noted that the computer is bringing changes in the concepts, beliefs, and procedures of analysts. It is believed that as more usage of the computer becomes the norm, old-fashioned, uneducated hunches, and shrewd intuition will be of lesser value. Furthermore, it is felt that a new

¹⁵Joseph J. Gal, "Man-Machine Interactive Systems," Financial Analysts Journal, (May-June, 1966), p. 128.

breed of men is running the computer programming; there may be a movement from emphasis on economic and financial to mathematical or engineering backgrounds. For example, the head of computer research at Shields & Company is John Hammerslough, a mathematician; the director of Electronic Stock Evaluation at W. E. Hutton is Brooks J. Harral, an expert in mathematical models. Similarly oriented specialists were running computer operations at Jesup & Lamont, E. I. Dupont, and Merrill Lynch, Pierce, Fenner & Smith, Inc.¹⁶

Another influence that the computer seems to have had on the market place involves mergers. In 1968, mergers and acquisitions were being completed at an unprecedented rate, but by 1969, the "urge to merge" had slowed considerably because of the government's recent actions in this field and falling stock prices. Another possible reason for the decline in the number of mergers is managements' computer evaluation of proposed combinations, with some found to be less attractive than once thought. Decreases in the number of actual and probable mergers in the market generally have a dampening effect on market bouyancy, because in most cases, one or both stocks engaged in merger talks or rumors usually rise during the exploratory talks. Therefore, another manner is seen

¹⁶Thomas, "Electronic Investing," p. 3.

where the computer appears to be affecting market behavior and thus stock selection.

Most followers of the market seem to agree that the computer will be an overall plus factor. However, there are other considerations which have yet to be discussed. One is the aspect of cancellation of the benefits of the computer. Most analysts realize that as computers prove their worth many will obtain them and then everyone will be back at the same level of competition, except for the degree of effectiveness that can be secured from each system by the various competing investors. In this sense, the computer bears a similarity to weapons. Whenever a country develops a new weapon, another country usually develops an effective defense for it and/or starts using a weapon very much like the first country's invention. Therefore, the countries are back on par with one another.

Another aspect which could possibly turn into a very serious problem is that some group might be able to falsely introduce certain price and volume patterns. With this ability, someone might force the price up and then get out at a certain point in the pattern leaving the unknowing investor with an undesirable stock. Although this is probably a very remote possibility, appropriate safeguards and constant scrutiny should be established to prevent such an event. A

talk with auditors and certain company personnel who have witnessed large sums of money embezzled from companies with the computer's help should dispell any false confidence.

CHAPTER VII

SURVEY ON THE USE OF THE COMPUTER BY LARGE INSTITUTIONS

Reasons for Selecting Institutions

The most significant part of this study was an inquiry of the largest open-end and closed-end funds, management groups, and bank trust departments to determine as much as possible about the use of the computer in their stock selection processes. This survey involved a questionnaire being mailed to sixty such businesses. The first section of this chapter will explain why this particular grouping of institutions was selected. The rationale of the content of the questions and mechanics of the inquiry will be explained in the second section. The findings and interpretations of the inquiries will be presented in the following two chapters.

There were three major reasons why these types of companies were selected. First, because computer systems are presently so expensive, only large firms can afford them. Also, they have the capital to perform day-to-day operations such as screening, comparing, and performing routine calculations and to engage in substantial research. Second, these

companies are large enough to profoundly affect the market with their buying and selling. Third, these firms have a direct influence on the market as compared to other firms which primarily have only an indirect effect. That is, after completing their analyzation procedures, institutions go directly into the market to buy and sell, thus having an immediate effect. Contrasted with this position are companies such as advisory services and brokerage firms. Although these companies do buy some stock for their own accounts, their purchases are not nearly as great. Advisory services and brokerage firms primarily only render advice to their clients on which stocks to buy and sell and when. Although clients frequently take their advice, often it is ignored.

Most of the following material describes the size of institutions and their influence on the market. In mid 1967, investment companies held forty-six billion dollars' worth of assets. Trust accounts at banks held about ninety billion dollars. The annual dollar flow to purchase investment company shares amounted to about 2.5 billion. Because of this size, one writer states that the buying and selling of stocks and bonds in large blocks by these institutions frequently cause wide swings in security prices which are of prime interest to the twenty million United States

stockholders.¹ In 1956, institutional investors, including bank-administered personal trust funds, owned approximately 25 per cent of the market value of all stocks traded on the New York Stock Exchange. In 1968, they owned approximately 33 per cent of these stocks. A decade from now, or possibly much sooner, they are expected to own at least 40 per cent of stocks and to account for more than 50 per cent of all trading that is conducted on the Exchange.² Institutional trading is rapidly becoming the most important influence on market trends and prices.

Because of their large size and influence, at least three areas of concern have been raised, which are listed below:

- (a) Institutional investors can cause--and on occasion have caused--sharp fluctuations in the prices of individual stocks. In one case on the American Stock Exchange, a single institution purchased 137,000 shares of a stock over a four-day period, pushing the stock's price from 21 to 26-1/4.

¹Donald E. Vaughn, "Management Procedures for Selected Types of Institutional Investors," Business Studies NTSU (Denton, Texas: Fall, 1968), p. 105.

²H. C. Sherwood, "The Growing Power of Institutional Investors," Business Management (July, 1968), p. 23.

Within a week, the stock jumped to 33 whereupon the institution sold most of its holdings, causing the stock's price to fall to 19-1/2.

- (b) Institutional investors try to obtain information about a corporation that it would not ordinarily give out to other investors. This divulgence places the corporation in danger not only of giving out information that could be used against it but, more importantly, of violating the full disclosure provisions of the Securities and Exchange Act.
- (c) Institutional investors occasionally try to influence the policies and procedures of individual corporations. Sometimes, they can force a corporation's management out of office or compel one company to be taken over by another. An example was Madison Fund, A New York based closed-end fund, which conceded that it played an influential role a few years ago in arranging the takeover of Nopco Chemical by Diamond Alkali. At the time some 35 per cent of Nopco's stock was owned by Madison or by people termed friendly to Madison.
- However, there are arguments against these accusations, and some of these are presented. If institutions have sometimes caused drops in the prices of individual stocks, they have more often been a stabilizing influence on the stock

market as they have bought when others have sold--most notably in the severe market decline of May, 1962. It is also argued that when they do sell, they attempt to avoid causing a sharp drop in a stock's price. As for requesting extra information, some argue that these inquiries have been beneficial to all investors. It is claimed that they have not only caused companies to provide more information, but it has improved quality as well. That is, it is argued that institutional investors have requested information that is far more meaningful than what has been divulged in the past. If this statement is true, it is a desirable result, as there are many investors, accountants, and others who feel that more meaningful accounting and financial information is needed. Institutions claim management will not volunteer information on matters about which it is not asked, but it will provide information in answer to questions nobody else has asked before.

As to the charge of influence in corporate decisions, the question is asked--have businesses actually been the losers? In fact, some stock market observers believe that institutional investors should play a larger role in company affairs. One who holds this view is Keith Funston, former President of the New York Stock Exchange, who says,

Institutions cannot and should not avoid their responsibilities to make use of the rights and

privileges they have as shareholders. The passive share owner who expresses criticism of developments in a company by phoning his broker to sell the stock is not making his full potential contribution to the corporation process.³

Another area of concern is how often funds buy and sell, which is important because a group of investors that have half a billion dollars to invest but which buys and sells every three months will have more influence on the market than a group of investors with one billion dollars to invest but which buys and sells only one time a year. Thus, it is necessary to be cognizant of the turnover rate. In 1967, mutual funds alone had a turnover rate of nearly 39 per cent, a sharp jump from the rate of about 17 per cent only three years earlier.⁴

Although funds are very large, their power is limited. One major constraint is that open-end funds are forbidden to own more than 10 per cent of a company's outstanding stock or to invest more than 5 per cent of their own assets in one company. Thus, the ability of open-end funds to bring large amounts of pressure via a large per cent of ownership is curtailed. However, numerous funds may be operated by a single management group, and thus more influence may be possible by this avenue. Although these rules do not apply to

³H. C. Sherwood, "The Growing Power of Institutional Investors," Business Management (July, 1968), p. 25.

⁴Ibid.

closed-end funds, there are not as many closed-end funds, and also they do not have as much money to invest as open-end funds. So still there is some limitation.

Bank administered trust funds are also large enough to have an important effect on the market. Although the amounts of assets are very substantial, they presently have less impact on the market because of their lower turnover rate. For example, a study by the New York Stock Exchange a few years ago disclosed that the apparent turnover rate in various professional hands was as follows:⁵

Selected mutual funds	20%
Pension funds	14%
Life insurance	7-1/2%
Bank administered trust funds	2-1/2%

The turnover rate for bank administered trusts will probably rise in the future because banks are being forced by competition to become more performance minded. Besides a low turnover rate, bank trust departments do not have the market price

⁵C. W. Buek, "Trust Companies and Banks as Institutional Investors," Commercial and Financial Chronicle, February 9, 1967, p. 610.

impact of mutual funds due to limited assets and other restraints.

Procedure and Rationale of Questionnaire

The four-page questionnaire (See Appendix) consists of twenty-two questions in three sections. Major areas covered include: the use of the computer in the screening process, its usage in the final selection, and general type questions. In some instances, the subjective type of inquiry and reply may have been preferable, but the objective form was chosen for most questions with the expectation that a greater return would be secured because of the shorter time element in completing it. However, elaboration was allowed for, as questionees were invited to answer any question in the narrative form which they felt could be answered better in that manner.

The questionnaire concerns only the use of the computer in the stock selection process and does not include the myriad of other tasks commonly handled by the computer, such as regular bookkeeping procedures and share computation.

Questionnaires were sent to sixty different companies: twenty to funds, divided evenly between open-end and closed-end funds, twenty to management groups, and twenty to trust departments of banks. The largest twenty in each category were selected at the beginning.⁶ Several substitutions were made

⁶The names of the institutions to which questionnaires

because of duplication and geographical reasons. However, the primary criteria for selection was size, because the larger firms would more likely use the computer in the stock selection process and perform research with it. While investigating the possibilities of such a study, it was learned that most banks do not use the computer in their stock selection processes. After talking and corresponding with several bankers, it appears that only the larger banks are engaged in this activity, but it was found that increased usage of the computer is expected in the future.

One of the severest problems in researching a subject such as this is the secrecy aspect. In this respect, institutional stock selection procedures are treated like an invention and closely guarded. If someone is working on an invention, he is not apt to be overly generous in divulging information, especially how to make it. Stock selection is similar because those who have a profitable method are not anxious to reveal it. In fact, stock selection may be more secretive than inventions; after an invention has been perfected and patented it can be discussed more freely. Such freedom does not exist with stock selection procedures, as they cannot be patented, causing investors to be even more

were sent are listed in the Appendix.

reluctant to talk. For example, Dennis Dwyer of Bankers Trust Company, a leading experimenter in the field, says "If we found a way to beat the market, we wouldn't be talking to anybody; we would put bigger locks on the door."⁷

The questionnaire was divided into the three sections of screening, final selection, and general, and after examining the articles that have been written about the use of the computer by stock analysts, it was found that the screening process is probably the most commonly used procedure. However, in the next few years as research increases, other procedures and programs will likely become more popular. After the screening procedure narrows the field of selection to a small number of prospects, a method is necessary to choose the one or more stocks that the company will actually buy or sell. The third group of questions attempts to secure information that is not covered in the first or second sections, because companies may not have their stock selection procedures drawn up into two distinct divisions of screening and final selection. Also, subjects such as research, degree of success, and opinions as to strong and weak points of a computer system, are included in this last group of questions.

⁷"Wall Street's Newest Drudge and Genius," p. 118.

Throughout the questionnaire both the fundamental and technical approaches are covered by appropriate questions, since companies that utilize the computer are divided in their allegiance between these approaches, just as analysts were divided before the advent of the computer. In most questions, several alternate answers were given so that checking was often the only step necessary. Blanks were included for those instances where the company's situation was not listed. The answers provided were selected with the hope that they would be the most common ones and thus save time for the recipient who would only have to make a checkmark. Also, they were selected in order to assist the respondent in understanding the question. That is, the answers were intended to serve also as indicators because certain terms have various meanings to different analysts.

The questions concerning the screening section were intended to determine how common this procedure is and what limiting criteria are used. The identities of such limiting factors are most important, as they are indicative of the organization's philosophy on investing. For example, a respondent checking the yield and price-earnings ratio factors indicates that the company's approach to investing is probably conservative, but the degree of conservatism is not yet determined. However, if the respondent also stated that his

limitations were at least 5 per cent for yield and less than ten for the price-earnings ratio, a more definite picture of the company's investment practices is permitted. By imposing the above limits, the screening procedure will primarily select relatively stable stocks. Conversely, if the respondent checked the factors of growth rate and price-earnings ratio but placed a limit on the price-earnings ratio factor of only twenty-five or thirty, he would indicate that his organization is not confining its investments to conservative stocks. The firm is undoubtedly expecting capital gains rather than dividend income. Provision was also made for the reporting of any technical factors which the respondents might use. The remaining questions of the screening section were inserted in order to determine how the companies secured their data and procedures.

The second section of the questionnaire relates to the final selection phase which is more detailed and subjective than the screening process. In fact, this area is probably the most difficult about which to inquire and answer, since in many companies, it does not lend itself to easily categorized objective questions and answers. Nevertheless, the questions contained in this section attempt to isolate some of the procedures employed. If the respondent is a technician, this section pinpoints several aspects of his investment

approach, because there are questions pertaining not only to the indicators often used (such as price-volume analysis and the 200-day-moving average) but also to object patterns (such as head-and-shoulders and saucers). These questions attempt to determine not only which factors are used but which are computerized. Also, inquiry is made into the possibilities of precipitous actions at the advent of some particular movement of the stock, such as a breakout movement.

Inquiry is also made into the time period considered significant in support-and-resistance-level investment practices. This period is of consequence for at least two reasons. It is important to the analyst-investor directly because if he makes a buy or sell judgement based on his belief concerning the time periods involved and if the movement on which he is basing his decision is premature, then he is either buying or selling too early. Another reason why this time aspect is significant is because of the possible concentrated action that might follow. If many technicians begin following only one or two patterns, this condition could result in much action occurring when that particular pattern appears. For example, if support-and-resistance procedures are found to be very popular and if most investors believe that a three-month time period is relatively reliable, then upon the advent of a breakthrough after approximately a three-month consolidation there

will be a large amount of similar activity. In addition, this event will probably bring about further similar activity, and this snowballing effect can easily create wide swings in a stock's price.

If the action referred to above was buying, the price would be forced up to a very high price-earnings ratio, and it would be in a very vulnerable position for a considerable drop when investors finally realized that earnings did not expand as much as the market action had indicated. Some of the support-and-resistance techniques involving volume statistics are quite complicated, but the computer, when programmed to do so, will prepare much of the compilation. Thus, because the computer will provide certain calculations which may be interpreted as buy and sell signals, wide swings in the price of a stock are possible via a mechanical selection device. A related aspect to this point can be theorized. If someone could determine with accuracy that many investors do rely on support-and-resistance-level techniques with certain time spans, he could act just before completion of the time period and buy before the large movements get underway. Of course, acting before the pattern and time period were completed could be risky, but if the person were correct, such a practice would be profitable.

In the third section of the questionnaire, the first five questions have three objectives. The first goal is an

attempt to determine how much the computer is used in the organization's stock selection process. The first question asks this directly, but questions two through five complement it. The second objective is to determine how the organization ranks factors which are felt by the fund managers to be important for a successful investment program. The third objective is to determine which procedures are part of their computer programs. Question six is related to the chapter on accounting principles and the problems encountered because of alternate acceptable accounting principles. Some analyst-investors use figures as reported and some adjust the reported amounts where they feel it is necessary, as does Standard Statistics' COMPUSTAT system. Questions seven through ten are inquiries into the relative success which the company has had and also deal with areas not specifically mentioned in previous questions.

CHAPTER VIII

FINDINGS AND INTERPRETATIONS OF SURVEY

Introduction

This chapter and the one following present the findings of the questionnaires sent to institutions. In addition to reporting the findings, interpretative comments are made as each question is discussed. The questionnaire invited additional comments and explanatory remarks if desired. Numerous respondents provided additional clarifying statements that resulted in greater understanding of their answers. However, some indiscernible responses were given which were not accompanied by explanatory remarks. The question arose as to whether or not to omit these answers. These replies were included for two reasons: (1) for the benefit of full disclosure, and (2) although they might be questionable to some readers, they may be understood by others. Replies were omitted only in cases where they were so incomplete as to be misleading. Explanatory remarks were added where deemed necessary.

Questionnaires were mailed to sixty of the larger institutions, and the number transmitted and returned from

each type of recipient are presented in Table I.

TABLE I
QUESTIONNAIRES MAILED AND RECEIVED

Institution	Number Sent	Number Returned	Percentage of Response
Open-End Funds	10	9	90
Closed-End Funds	10	7	70
Banks	20	16	80
Management Companies	20	17	85

Of the sixty mailed, a total of forty-nine were returned; this represented a return of 82 per cent. Considering the technical and complex nature of the data requested, this is a good return ratio. Also, this type of information is sometimes considered classified by a firm that has achieved good results from employing it.

Of the forty-nine questionnaires returned, seven respondents stated that they did not use the computer in their stock selection process. Another five replied that although they did not use it internally in their decision-making processes, data prepared by a computer were used in various instances. For example, some of these companies reported using material prepared by COMPUSTAT or from some advisory service.

They used these materials for such purposes as ratio analysis and screening by manual means. The remaining thirty-seven respondents stated that they employed the computer directly in varying degrees. Thus, three out of each four reporting groups employed the computer in portfolio management.

Screening Technique

Let us now consider the responses to the first section of the questionnaire, the screening process. There were five questions in this category. The first question asked simply if the screening procedure was used at each organization. Twenty-one replied "yes" and fifteen answered "no." In addition to the straight "yes" or "no" replies, one respondent answered that he sometimes used the screening procedure, however, his firm had just adopted the computer in the selection process, so this procedure may be practiced more in the future. A second stated that the procedure was employed occasionally. One of those which reported "no" added that they were in the testing stage and would probably adopt the screening procedure in the future. Another replied that the screening procedure was one of their methods, but not in the manner as was presented in the questionnaire. The company did not elaborate on their method. One firm stated that although the computer was employed to a large extent for this step, they had other

means. Three reported that while this technique was currently being practiced, they still considered it to be in the development stage.

Question two inquired into (1) the specifications used in the screening run and (2) limitations imposed thereto. Table II reports the answers to the first part of the question. The most common criteria limitations for fundamental factors were growth rate of earnings per share, price-earnings ratio, and yield. Several other specifications were reported, but none of these enjoy widespread usage. Some correspondents explained that different criteria were used depending on the present conditions. However, whether conditions referred to the national economic picture or some other situation was not explained. Table II reveals that the screening procedure is performed with fundamental factors far more than with technical criteria. Some thirteen companies used only fundamental factors in screening; eight companies reported that they used both fundamental and technical factors; and there were no instances where only technical factors were used.

Presumably, the main reason for heavy reliance on fundamental factors is because they lend themselves more readily to filtering techniques than technical factors. A second probable reason for small usage of technical factors in the filtering step is because most users of technical tools employ

these in the timing stage rather than for locating a stock. In fact, many analyst-investors feel that the technical approach is better for determining when to buy and sell, and the fundamental approach is better for determining which stocks to buy and sell. A third reason why screening may not involve technical tools to a large degree is due to the difficulty of securing sufficiently accurate and up-to-date data. One respondent commented that very little technical screening is done because of significant inaccuracies in its source data file. Table II also discloses that there is practically no uniformity among the technical factors employed.

TABLE II

SPECIFICATIONS IMPOSED IN THE SCREENING RUN

Specifications	No. of Companies Using Specification
<u>Fundamental Specifications</u>	
Growth Rate of Earnings Per Share	8
Price-Earnings Ratio	7
Yield	7
Return on Equity (past)	3
Return on Equity (future)	2
Sales Per Share Change	2
Year to Year Change in Earnings	2
Projected Return (Dividends + Appreciation) For Two-Three Years	2
Profit Margin Change	1
Ranked According to Risk/Reward Ratio	1
Measure of Appreciation and Risk Potential	1
Upside Potential More than Twice the Downside Potential	1

Table II (Continued)

Specifications	No. of Companies Using Specification
Probability of Projected Return Being Below Some Lower Limit	1
Outstanding Market Value of Common Stock Less Than \$100 Million and Greater Than \$50 Million	1
Company Sales Size	1
Common Stock Availability	1
Sales Growth of 5 Per Cent or More	1
Profit Margin Equal or Greater Than Previous Year	1
Ploughback	1
<u>Technical Specifications</u>	
Momentum Studies	1
Price-Volume Relationship Used to Determine Cumulative Accumulation and Distribution Patterns	1
Price-Earnings and Price Relative to Dow Jones Index and Standard & Poor 's Index	1
Centered Twelve-Month Moving Average of Price-Earnings Ratio Compared to Actual Price-Earnings Ratio	1
Price-Volume Relationship as an Indi- cation of Buying or Selling Pressure	1
Rate of Change in Price	1
Volume (Percentage Turnover) Related to Moving Average (Price)	1
Volume of Trading Value Per Month Greater Than \$30 Million	1
Ranked Relative Strength	1

In question two the respondents were asked what limits were used with the factors in the screening process, and their responses to this inquiry are as follows: There were eight specific instances where the earnings-per-share growth rate was used as a factor. One bank and one management company each

stated that the growth rate had to be at least 10 per cent. A second bank reported 12 per cent and a management company, 15 per cent. A third bank replied that the minimum limit was 15 to 20 per cent over a five-year period, depending upon the portfolio manager. Although the firms may have had good results, the 15 per cent and above limits appear to be relatively severe. One used the expected earnings-per-share growth rate factor in conjunction with yield and the former limit was 7 per cent. One questionnaire had only the factor checked with no indication as to a limit. Another did not check the factor or stipulate a rate but referred to using the factor only in a narrative response. Several respondents, especially banks and management groups, stated that they did not have overall company limits. They applied different limits, depending on the user, such as the portfolio manager in banks and the type of fund being managed in the case of management companies. A similar comment was that various criteria were employed, depending on the specific problem at hand and industry being studied.

For the limit of the price-earnings ratio factor, one stated that it must be less than fifteen times and another reported twenty times. A third respondent stated that it must be less than 80 per cent of the five-year high average. However, this answer did not specify which five years were to be

considered. The period could be made up of the last five years or the five all time high years. The former would seem to be more appropriate in order to secure as much current relevancy as possible into the procedure. However, the all time highs might be better if a more encompassing standard is desired. One required that the current price-earnings ratio be less than the historical average. This appears to be not only a conservative position but one that should bring favorable results over a period of time. One management group specified that the company's limits would range from less than ten to twenty depending on the fund. One reported only that the limit varies, and one respondent did not designate a specific number.

Of the seven that reported using the yield factor, two stated that dividend yields had to be at least 4 per cent and 5 per cent, respectively. A third used yield as an alternate to future growth rate of earnings per share; that is, among other limits one was that future growth rate of earnings per share must be at least 7 per cent or yield must be over 4.0 per cent. One respondent specifically stated that no limit was used. Another explained that the limiting rate on the yield factor, which ranged from 0 to 5 per cent, depended on which fund was using the screening run. This came from a management group corporation that manages two or more

different funds. One bank reported that its yield limit varies, but the typical limit is 5 per cent. Another comment was that the factors and limits depended on the current market, and the limit set for the yield factor would be influenced by the average prevailing market yield.

It is common practice for funds to be subdivided into separate divisions with three or four different goals. For example, one may concentrate on dividend yield and be conservatively oriented in its operations. Another may be divided between common stocks, preferred stocks and bonds, and be even more conservative. On the other end of the range, a fund might engage primarily in the buying and selling of highly speculative common stocks, caring little for dividend yield and attempting to garner large capital gains. Another variety may include in its portfolio convertible issues. Of course, there are funds in between these, and some purchase only tax exempt securities for those persons in high income brackets. There are many shades of investing so that one who desires to invest in funds has quite a selection from which to choose. He can select a fund that is very conservative or very speculative. Thus, the answer provided by the management group referred to above--that of having a sliding yield limit of 0 to 5 per cent--agrees with what might be expected. The company probably has funds ranging from quite conservative to

very speculative.

Several bank respondents made comments similar to those made by management groups concerning their selection of factors and limits imposed. Many banks assign different trust officers to serve as portfolio managers in charge of separate groups of clients' portfolios. Although there appears to be some degree of central or overall guidance for the entire trust department, there is considerable latitude given to each portfolio manager to decide what procedures he will use. His procedures and goals must ultimately, of course, conform with those of the client either expressly or implied, or else the customer will take his account to another bank. However, within this framework the manager has considerable discretionary power. For example, one comment from a bank noted that it did not have one specific computer program to run for all portfolios, and the programs which it does possess are not run on a routine basis. Each program is unique to the portfolio manager who is using it to meet the portfolio objectives of his customers. The bank employs the screening procedure but only at the request of the portfolio manager or the bank's customers.¹ Therefore, this diverse

¹This comment leads one to think that customers themselves may engage in their own investment programs using the bank's computer equipment. Of course, the customer would be charged for this use, but the interesting point is that perhaps

arrangement, as far as the factor itself and the limits prescribed are concerned, is similar to the management group discussed above. That is, it depends on the individual portfolio manager.

The only other parameter which had a limit was that the upside potential of a stock had to be more than twice the downside potential. However, no information was given as to how the company calculated these potential benchmarks. None of the other factors supplied were accompanied with limits. One respondent which did not indicate any specific factors stated that their program was capable of screening any mathematical formulation of data on the COMPUSTAT tapes.

If a larger number of companies had designated the types of limits which they imposed, a greater insight into their investment philosophies would be possible. The lack of replies with limits may be due to companies not desiring to divulge their trade secrets. However, presumably one of the primary reasons for the small number of firms which listed their limits is due to the diversity of their operations. That is, for some of their sub-funds or portfolios, they probably impose very tight limits on yield and price-earnings ratio,

this might be a method by which the individual or small investor can make use of the computer just as large investors are able to do.

but for others, the limits are likely to be considerably more liberal. Designating one specific figure for each factor when numerous limits are used would not be appropriate. Therefore, because of multiple limits, it is assumed that numerous companies did not report any at all.

One bank that used rate of return as a factor reported that it utilized a return-on-equity model, using earnings estimates and historical data from COMPUSTAT. For the total return figure, the projected growth rate of earnings, the projected multiples, and normal earnings were used as basic inputs. These are supplied by the analysts at the bank and involve filters in the form of rankings. Thus a specified percentage, for instance the upper 5 per cent, is selected for further study. This type of filter is used in place of specific factors such as yield and price-earnings ratios. Furthermore, the bank's filter technique is used to generate new ideas and possibly to check consistency of recommendations, for example, the price-earnings and growth rate of certain companies which they purchase.

The source of the companies' raw data used for screening runs was the subject of the third question, and this information is contained in Table III.

TABLE III

SCREENING RUN DATA

For the Information Used in the Screening Run:	
Number of companies that accumulate their own data	1
Number of companies that purchase their data from other sources (e.g., COMPUSTAT)	11
Number of companies that accumulate and purchase their data	10

The majority, by about a two to one ratio, secure their data for screening purposes from someone else, presumably due to the fact that it is very expensive to collect information on thousands of companies for five or ten years. On the other hand if a few companies collect these huge amounts of data, though this collection operation is still very expensive, the cost can be lowered by sharing the cost via selling them to numerous users. This operation would be more economical as the information does not have to be tailored to any particular user since it can be rearranged very swiftly by a computer into any grouping desired. Nevertheless, the fact that ten respondents reported not only purchasing data but preparing additional facts themselves indicates that purchased information does not completely satisfy the needs of all investors.

The next question inquired about the authorship of the firm's programs, that is, whether the company writes its

own or adopts pre-packaged programs. Results of this query appear in Table IV.

TABLE IV

AUTHOR OF PROGRAMS

Number of firms that use only programs which they have written themselves	15
Number of firms that use only pre-packaged programs	1
Number of firms that use programs which they have written and pre-packaged programs	6

The majority of firms prefer to construct their own programs. This is the reverse of the results shown in Table III where most firms purchase their data rather than accumulate them. However, the findings in Table IV seem appropriate rather than paradoxical because in contrast to the computation of raw data shown in Table III, programs are tailored specifically for each company's own goals and philosophy. The findings from this question also have other ramifications. The fear has been expressed that with the computer, increased mechanical investment decision-making would ensue. If many investment companies used similar computer programs in their investment procedures, this could result in hundreds of large investors arriving at the same buy or sell decisions at the same time. The consequence would be sharp moves in the

particular stocks involved, and wide price oscillations would prevail. However, since only seven companies use pre-packaged programs, and only one of the seven employs pre-packaged programs exclusively, this fear is probably overrated. With twenty-one of the twenty-two reporting companies employing their own programs, to a degree at least, concentrated identical buying and selling decisions based on similar computer programs seem improbable.

The identities of any pre-packaged programs being used and their suppliers were the objectives of the last question in the screening section. However, for the seven companies indicating that they used pre-packaged programs to some degree, the only specific answer given was financial and statistical routines from the IBM Corporation. One other questioner reported that the programs varied. Incidentally, although the **firms were** not asked to identify the source of raw data used in the screening run in question three, some stated that they secured their data from COMPUSTAT.

Final Selection Procedures

The first question in this group inquired about the application ratio between the computer and subjective means in the final selection process. Table V contains the results of this question.

TABLE V

USE OF COMPUTER IN FINAL SELECTION

The Use of the Computer in the Final Selection Process:	
Number not using it at all	12
Number using it very little	7
Number using it considerably	10
Number using it completely	0
Total Reporting	29

The degree of use of the computer is spread relatively evenly among the alternate answers except no company stated that it was used completely. In addition, two correspondents did not check any of the above options but instead wrote in the word "moderately." In all likelihood, if the "moderately" option had been included, it would have received even more indications.

Ten companies reported that application of the computer was used considerably in the final selection process. This is noteworthy because most analysts, investors, and respondents to the questionnaire believe that the final selection stage is where the subjective function is primarily exercised. In fact, some analysts and investors feel that only procedures such as screening and computation of ratios are appropriate

for the computer. On the other hand, perhaps these ten companies have been able to develop programs that encompass some of the subjective decision-making steps that are practiced in the final selection stage. This finding implies an expanding role for the computer. Two others reported that the extent of computer service varied depending on the situation. Although it was not stated, it is surmised that these different cases might well be the specific types of funds being considered such as growth versus yield.

The second question asked if certain relationships or factors are employed and if they are programmed into the computer or considered in a subjective manner. Price trading-volume relationships are shown in Table VI.

TABLE VI

PRICE TRADING-VOLUME RELATIONSHIPS

	Programmed Into The Computer	Considered In Subjective Manner
Number that use price trading- volume relationships:		
Of the entire market	2	14
Of individual stocks	5	15
Total	7	29

Although these relationships are used by over half of the companies which reported using the computer, these concepts are primarily considered subjectively rather than being a part of computer programs. This observation is true not only for price trading-volume relationships for the entire market, but also for individual stocks. Although many investors follow price-volume relationships very conscientiously for individual stocks (in fact thousands of dollars are spent for various charts and graphs which illustrate these figures), it is significant to observe that practically the same number of companies consider the entire market as important as individual stocks. This is surprising since so many investors seem to observe individual stocks rather than the entire market for these relationships.

The identity of other factors used in the final selection stage was the objective of part (b) of question two. In addition, whether or not they were programmed into the computer was asked. Results of these inquiries are reported in Table VII. The high degree of diversity in investing can be seen in Table VII. Twenty-one different factors were indicated by one or more companies. Furthermore, it is believed that if additional blank spaces had been provided and/or if the companies had listed all factors which they use, the total number of different criteria reported would be even

TABLE VII

OTHER FACTORS

Number of Companies Using:	Programmed Into The Computer	Considered In Subjective Manner
Granville's On-Balance Volume	1	1
Growth Rate of Earnings Per Share	10	10
Growth Rate of Sales	7	9
Price-Earnings Ratios	3	1
Price-Earnings Ratios Trends	1	0
Eiteman-Geiger P.V. Series	1	0
Net Before Tax Growth Rate	1	0
Future Growth of Earnings Per Share	2	1
High-Low Price-Earnings	1	1
Future High-Low Price-Earnings	1	1
Gain-Risk Ratio	1	1
Growth in Capital	1	0
Rate of Return	1	1
Stability of Growth	0	1
Growth Rate of Price	1	0
Other Fundamental Factors (such as Price, Debt, P/Book Value, and Earnings Potential)	0	1
New Product Development	0	1
Profit Margins	1	0
Future Company Developments	0	1
Economic Outlook for Company	0	1
Quality of Management	0	1

larger. The number of procedures that are programmed into computers and those that are not are about equal.

Significantly, the two most commonly used factors are both growth factors, one of earnings per share and the other of sales. This finding reenforces the popularity of the earnings-per-share figure. This importance is one of the reasons why the accounting profession and others are in active pursuit of accounting principles that will give more uniform and more reliable earnings-per-share figures. Some of the factors listed in Table VII raise questions as to their method of preparation and meaning. In only one case were explanatory remarks given by the questionee. However, all items are presented for completeness in reporting.

The third question inquired as to what buy or sell decisions are made upon the breakout from certain object or chart patterns. It also asked if that event alone was the only criterion used to make the decision. One answerer reported that the company watched for the head-and-shoulders pattern but only as a signal to sell. This same company also indicated that sometimes they use the saucer pattern as a signal to buy. Relative ratio charts were reported as being employed in both the buy and sell decisions by a second respondent. The company gave no explanatory comment as to how its relative ratio charts are prepared or applied.

A third company reported that the head-and-shoulders formation is considered in selling, and the saucer pattern is observed in both the buying and selling determinations. The company also uses a "Line" formation and breakout pattern in its buying decisions. No explanation was given as to exactly what the latter pattern looked like or how it was applied. However, it could be the practice of drawing lines in a manner that will touch certain high and low points in a bar chart which records the price history of the stock in question. This chart has time on the horizontal axis and the price of the stock on the vertical axis. Each day's (or week's) high and low prices are plotted as a bar extending from the stock's highest price down to its lowest price during the period. There are differences as to how and where lines should be drawn, but a common practice is to draw two lines--one that touches the major low points in the chart and another that touches the major high points. This pattern frequently takes the shape of a long narrow rectangle. When a stock's price moves out from between these two lines, the move is considered a breakout and often points the future direction of the stock's price.

Another firm questioned did not check any specific pattern but reported that the company frequently used whatever pattern developed which appeared to be bullish whether

it be a head-and-shoulders, saucer, triangle, or rectangle pattern. Similarly, one bank reported that while no specific technical analysis program was in effect, various technical analysts present their opinions to the investment department officers where their opinions may or may not be followed. Numerous banks mentioned having a technical analyst group. Thus, it appears to be common to have a number of analysts who are primarily, if not entirely, technical specialists and whose opinions and advice are considered along with that of the fundamentalists' advice.

Another company disclosed that it had technical analysts who do this type of work but that none of it is performed by the computer. Although computers have long been able to print out patterns, the above statement is not surprising as computers are just now beginning to be programmed in order that they will print out stock performance patterns. One company stated that no decision is based solely on chart patterns, but observed many patterns and combined these with the current fundamental situation in reaching a decision.

The question pertaining to object patterns also asked if any of the formations were used as the only criterion when the buy or sell decision was made. Not one replier revealed that a certain pattern would be the sole determining criterion. In fact, two stated that other factors are used in addition to

any particular formation. Three replied that absolutely no technical work was performed by their organizations. The remainder of the questionees left this question blank. The way the question was worded it appears that all other companies do not use the object or chart pattern portion of the technical approach. If this statement is true, then it implies that there may be considerably less technical influence in the market than many investors presently believe. However, some so-called high performance funds use the technical approach more than others.

The usage of non-object price patterns such as the 200-day-moving average and support and resistance levels was the subject of question four. These two examples were listed to help make the question more understandable. In addition, they were chosen because numerous advisory services and other publications use them very frequently, which leads one to believe that they are respected and enjoy widespread following. However, if these findings bear a reasonable similarity to practices of thousands of other investors, such factors do not have the following that is commonly ascribed to them.² This

²Some technical users may have interpreted question four to ask for positive response if only those specific methods were considered when making the buy or sell decision. Thus, these procedures may be applied more than the response indicates since they may be among numerous factors considered.

is due to the fact that of the total number of questionnaires returned, only three indicated that these are used. One company checked both the 200-day-moving average and the support-and-resistance levels. One other checked only the support-and-resistance-level pattern. One responded that they were used as flags; that is, they were attention-getters in the sense that when those actions occurred, the company concentrated its examination efforts on any stock that met either of the prescribed conditions. Another reported that actions were taken whenever there was a change in the long-term outlook for growth in earnings per share. Two others reported that they used no mechanical processes at all.

The duration of the time period considered to be the most meaningful for support-and-resistance levels was the objective of question five. Only three responded. One checked the period of one to three months, and another designated four to six months. The third company stated "the longer, the better," but did not specify any particular length of time. The few responses to this question **implies** that the support-and-resistance-level pattern is not used very often; also little can be determined as to the identity of the most respected time period.

CHAPTER IX

FINDINGS AND INTERPRETATIONS OF SURVEY-CONTINUED

Computer Usage and Factors Employed

The first question of this group attempts to estimate the amount of usage of the computer in the stock selection process. While the inquiry in the second section dealt with only the final selection phase, this question probes for an estimation of the entire selection process. Findings to this inquiry are shown in Table VIII.

TABLE VIII

ESTIMATES OF COMPUTER USAGE

Estimated percentage of the entire stock selection process in which the computer is employed	
Number of companies indicating 0-20%	28
Number of companies indicating 21-40%	5
Number of companies indicating 41-60%	3
Number of companies indicating 61-80%	0
Number of companies indicating 81-100%	0

Although the above are estimates, they provide an approximate portrayal as to the extent which the computer plays in stock selection. The overwhelming estimated percentage of use is between 0-20 per cent. If this sample is near the actual situation, some of the articles claiming extensive computer use may be exaggerated, which indicates that the act of investing remains largely a subjective process. Based on the above results, analysts who entertained the fear that they might lose their positions to a computer should feel secure since there appears to be sufficient need for them. In fact, the only consequence about which they might have to worry is if computer systems can be made more humanlike. Such is predicted for the future when the computer is understood and harnessed more fully, and the black box may then pose a real danger to present day analysts.

Question two inquired as to approximately how many different factors, such as yield, price-earnings ratio, and earnings, each organization utilized. Table IX reports on this query. The majority of companies use six to ten factors, which agrees with reports from various investors and account executives. The rationale seems to be that when the number of factors becomes very large, the picture of the stock becomes clouded. Consequently, many persons have commented that they prefer to

select about six factors which they consider to be the most important and base their decisions on these, practically ignoring others.

There are probably two reasons for limiting the number of factors considered. The clouding effect is especially a concern when there are thousands of stocks to examine. For example, if the thousands of stocks have been culled to fifty and twenty factors are used, some 1,000 units of information must still be considered. The second reason why factors are probably limited to only a few is because when numerous attributes are considered, the less significant may receive as much attention or weight as the more important criteria. Ranking or weighting becomes very difficult. Therefore, it is easy for less notable factors to cancel out major data. When this occurs, the chances of making an incorrect decision are increased.

TABLE IX

NUMBER OF DIFFERENT FACTORS EMPLOYED

Number of companies using:	
1 - 5 factors	7
6 -10 factors	13
11 -20 factors	5
21 -40 factors	0
41 or more factors	2

Large numbers of factors can be considered more efficiently for each stock with a computer. However, the computer cannot perform subjective functions, and there is a tremendous amount of opinionated decisions made in the stock market. Subjective decision-making is not as unusual as thinking that the stock market rises and falls with women's hemlines (as has actually been stated in print), but in all probability it accounts for a sizable number of daily buy and sell decisions.

The computer can be programmed to place weights on the factors so that the weighting problem might be overcome, and work is progressing in this direction. In a few years this procedure should begin to bear fruit, and some funds may employ twenty or more factors.

The second reason for asking questions one and two of this section was to determine if companies that used their computers to a large extent employed a greater number of factors than those which used their computers to a lesser degree. If such a correlation exists, this would support the argument that the computer has helped analysts to consider more factors by overcoming the two areas of difficulty mentioned above--(1) the clouding effect and (2) the weighting problem. Although there were some companies which reported a higher than average computer percentage-use and a higher than average number of factors, there were not enough of these instances to state

dogmatically that a significant correlation exists.

A few questionees added qualifying remarks about the number of criteria employed. One respondent said that eleven to twenty factors were used for all but one program and that one program used only one to five factors. Another commented that for comparative evaluation, six to ten factors were examined, and for the overall analysis, forty-one or more were considered. The company added that the number and identity of factors varied depending on which stock was being studied due to the fact that certain factors are necessary in analyzing some stocks but useless in evaluating others.

The third question is quite complicated, as it asks for three different items of information. First, it requests the names of specific factors that the organization believes to be most significant in stock selection. Second, it asks that these be listed in order of importance to the respondent so that an idea could be garnered as to which factors institutions deem to be the most significant. Third, companies were asked to designate those factors included in their computer programs. The question provided eight numbered blanks; some companies listed eight factors while others listed less than eight.

Responses to the third question are contained in Tables X, XI, XII, and XIII. Four tables are used because the information received from this question is quite voluminous.

Table X illustrates the findings for earnings and factors related to earnings, and for price-earnings ratio, and its related criteria. Table XI illustrates findings for the yield, margins, and sales factors. Table XII presents findings for price, financial position, and capital outlays. Table XIII indicates findings pertaining to the economic environment and all other relationships that do not fall within the above categories. Question three may be the most important in the questionnaire because it asks for the criteria which analysts and investors feel are the most significant. Since the response to this question was very high, it allows an insight into the underlying tools and measurements on which analysts and investors rely. The identification of instances where the computer is mobilized provides additional knowledge as to the role which it plays in stock selection.

The diversity of investing is illustrated in Tables X, XI, XII, and XIII as there are 152 factors, 66 of which are different. Although there may be a few duplications due to varied wording by the respondents, there remain a large number of disparate factors. In cases where slight variations were listed by companies which were believed to be referring to the same factor, the answers were combined. However, unless it was reasonably certain that such was the case, answers were listed in exactly the manner that they were stated by the companies.

Tables X, XI, XII, and XIII illustrate three main points:

- (1) The quantitative aspect which is shown in Column 1 --that is, the number of companies reporting that they use that particular factor,
- (2) The qualitative aspect is shown in Column 2. It is also very desirable to know how significant the various companies believe the factor to be. For example, if six companies reported using the current ratio as a criteria but each ranked it only in the seventh or eighth position, this fact would not be as noteworthy as four companies listing estimated future earnings and ranking it either first or second. Thus, Column 2 provides the reader with a quick reference to the importance that the companies place on each factor,
- (3) The number of firms including each particular criterion in their computer program are shown in Column 3.

By far the most common benchmark is earnings as is disclosed by Table X, where forty-five instances were listed. Price-earnings ratio, which is partly composed of earnings, was listed as an important consideration by twenty-three firms. Also worthy of note is that the element of future behavior in earnings appears in three different classifications and was reported by fifteen companies. These three subgroups are

TABLE X
MOST SIGNIFICANT FACTORS IN STOCK SELECTION

Factor	(1) No. of Companies Reporting Factor	(2) No. of Companies Ranking Factor as Follows: (1 = Most Important)								(3) No. of Companies Including Factor in Computer Program
		1	2	3	4	5	6	7	8	
		<u>Earnings</u>								
EarningsTrend (Growth)	12	4	3	3	1	1				5
Estimated Future Earnings	8	4	4							5
Future Growth of Earnings Per Share	6	2	3	1						3
Earnings	4	3		1						3
Earnings Per Share	3	1	1	1						2
Growth of Earnings Per Share (Past)	2				1	1				1
Stability of Growth of Earnings Per Share	2			1			1			0
Net Earnings Before Taxes	2	1		1						1
Market Expectations of Future Earnings	1	1								0
Earnings (Past)	1		1							1
Dilution in Earnings Per Share	1						1			1
Risk of Earnings	1			1						0
Relationship of EPS to General Economy	1				1					0
Variance of Earnings	<u>1</u>				1					<u>1</u>
Total	45									<u>23</u>

TABLE X (CONTINUED)

Factor	(1)	(2)								(3)
	No. of Companies Reporting Factor	No. of Companies Ranking Factor as Follows: (1 = Most Important)								No. of Companies Including Factor in Computer Program
		1	2	3	4	5	6	7	8	
<u>Price-Earnings Ratio</u>										
Price-Earnings Ratio	11	2	2	4	2	1				6
Price-Earnings in Relation to Other Price-Earnings Ratios	4			1		2		1		2
Estimated Price-Earnings Ratio	3		2	1						2
Price-Earnings Ratio Trend	2		1				1			1
Price-Earnings Ratio (Past) (Range)	2			1	1					1
Price-Earnings Ratio Relative to Industry	$\frac{1}{23}$	1								$\frac{0}{12}$
Total										

estimated future earnings, future growth of earnings per share, and market expectations of future earnings. The number of firms reporting these three factors were eight, six, and one, respectively. Also, it is likely that some of the repliers that listed earnings trend or growth probably had in mind not only the past but also future earnings. If so, even greater respect is given to future earnings, since this factor of earnings trend or growth was listed twelve times. Therefore, if these twelve instances are added to the fifteen known future earnings criteria, a total of twenty-seven occurs, which is more than one-half of the total earnings designations of forty-five. The aggregate also exceeds the occurrence of any other benchmark.

Another point that is impressive is the qualitative importance placed on earnings. A look at Column 2 of Table X clearly bears this out as there were sixteen instances where it was listed first in importance. There were twelve cases where earnings were listed as second in prominence. Thus in twenty-eight of forty-five reportings, this criterion was rated first or second. No other financial fact has nearly as much respect qualitatively. In fact, for some relationships, the number one rating was given only once, and for a few items, the number one rating was not awarded at all. The high rating of earnings is especially notable in the instances where future

expectations are concerned. Estimated future earnings received four each of first and second ratings; future growth of earnings per share was awarded the first place specification by two companies and second place by three companies. These designations indicate that estimated future earnings of a company may be the most paramount of all factors considered by institutional investors. It is further believed that this factor is probably also important to other investors. Thus, much attention and study are being devoted to estimating future earnings and employing this factor in investment analysis.

Column 3 of Table X reports on the number of companies including each particular factor in their computer programs. Twenty-three out of forty-five companies included the earnings criterion in their computer procedures. Estimated future earnings and earnings trend (growth) were each included five times in computer programs.

Two aspects are important to the above observations and the subject of this study. First, earnings and earnings per share are objective figures; that is, they are not principles, concepts, or other intangible aspects such as "What would competition do if we did . . ." or "What will be the economic effect of an increase in the discount rate?" Because of their objectivity, they can be employed with the computer

with ease and can be entered into the various computer programs as they are. For example, in the screening procedure, earnings can be one of the limiting criteria that must be met before the stock will be printed out as a candidate. Also, it can be used in the screening procedure either as it is, a monetary amount, as a percentage change over last year, or in some other relationship, such as an average of several years' earnings. Also, due to their objectivity, earnings can be adopted easily into other stock selection procedures completed with the use of the computer such as in econometric models. Estimated future earnings can be used in probability studies, and these techniques are becoming more common.

The second reason why the observation of heavy reliance on earnings and their objective nature are of concern to this study is the research presently being conducted with simulation techniques in estimating future earnings. Although budgets and forecasts have been used by businesses for many years, computers have allowed much more sophistication in this area. Because of their speed, they allow considerably more variables to be included in models. Variables outside of the company such as economic and political events can now be programmed into the models. Thus, the search for more accurate future earnings estimates has progressed considerably. It appears that the use of estimated future

earnings is one of the key considerations in stock selection processes, especially by those who utilize the computer.

Table X reveals that the second most common relationship reported is that of price-earnings ratio. It is assumed that most respondents listing this ratio meant current price divided by the current year's estimated earnings. This is the usual case, and the one commonly used by Standard & Poor's in their publication entitled Stock Guide, especially those issues for the latter months of the year. However, other definitions could have been intended. For example, some could have had in mind a ratio based on current price divided by last year's earnings or current price divided by the last twelve months' reported earnings, which Standard & Poor's Stock Guide also occasionally uses; others could have intended a price-earnings ratio in relation to other price-earnings ratios which four companies specifically stated.

The qualitative aspect of this factor is also of some consequence. Although there are not as many first and second place rankings reported for this factor as for earnings, there were three companies which gave first ratings and five designations of second place. Thus, this factor ranked relatively high in regard to significance placed upon it.

It should be pointed out that one-half of this relationship is composed of earnings, which by itself was found

to be the most significant factor. Therefore, it appears quite safe to state that earnings evidently play the giant role in the stock selection process.

Column 3 discloses that twelve of the twenty-three firms employ price-earnings in their computer programs. This inclusion is significant because the price-earnings ratio is an objective figure which can be easily handled by the computer, especially in procedures such as the screening process. In fact, all of the points concerning objectivity and the computer in stock selection, which were stated in the above section on earnings, likely apply to the price-earnings ratio.

The findings pertaining to yield and dividends are presented in Table XI. Although yield ranks third with margin in the number of times reported, it is surprising that yield is not more popular. Dividends represent the return to the owner on the assets he has invested, and thus the goal is to secure the largest yield possible. It follows that yield should ordinarily be rated highly by investors and should possibly have been listed more than the thirteen times as illustrated in Table XI. Furthermore, the rankings, as shown in Column 2, reveal that it does not carry a high degree of qualitative respect. Although two companies classed it first in importance, most questionees gave it rankings of

TABLE XI
MOST SIGNIFICANT FACTORS IN STOCK SELECTION-CONTINUED

Factor	(1)	(2)								(3)
	No. of Companies Reporting Factor	No. of Companies Ranking Factor as Follows: (1 = Most Important)								No. of Companies Including Factor in Computer Program
		1	2	3	4	5	6	7	8	
<u>Yield</u>										
Yield	11	1		1	2	3	1	1	2	5
Changes in Dividend Policy	1					1				1
Overall Expected Rate of Return (Dividends + Price Appreciation)	$\frac{1}{13}$	1								$\frac{1}{7}$
Total	13									$\frac{7}{7}$
<u>Profit Margins</u>										
Return on Capital Margins	5		3		2					3
Growth in Capital Per Share	4			1	2	1				3
Profit Margin Trend	2	1					1			1
Return on Capital Trend	1							1		0
Total	$\frac{1}{13}$		1							$\frac{1}{8}$
<u>Sales</u>										
Sales Trend (Growth)	4	1	1		1		1			2
Sales	3		1	1	1					2
Stability of Sales	1			1						0
Per Cent of Sales of Industry	1								1	1
Income	$\frac{1}{10}$					1				$\frac{0}{5}$
Total	10									$\frac{5}{5}$

fourth or lower. About half of those listing yield used it in their computer programs.

The possible explanation to this finding could be the recent emphasis on capital gains and speculation. In the decade ended in 1965, yields via dividends on stock continually dropped. At the same time more and more investors seemed to be trying to get rich quickly via price appreciation. This was evidenced by the price actions of the so-called glamour stocks. Frequently prices have risen to levels where the price is fifty to one hundred times earnings. Often the company is relatively new, pays little or no dividends, or has a poor debt-equity position. In short, speculation seems to have exerted a strong influence on the market, especially during 1960-1968. Thus investors have deserted the more stable stocks and have ventured into more volatile investment prerogatives.

Another evidence of this switch from less stable stocks which usually pay a larger yield is to compare the Dow Jones Industrial Average with the New York Stock Exchange Composite Index. The Dow Jones Industrial Average is composed primarily of old, established, and stable stocks, most of which pay a relatively good dividend yield. The New York Stock Exchange Composite Index contains all of the common stocks listed on the New York Stock Exchange and thus includes numerous newer

and less stable stocks. In the latter 1960's, the New York Stock Exchange Composite Index outperformed the Dow Jones Industrial Average. The cause of this separation was due to investors buying the less established companies, which presumably have a greater chance of price appreciation. The older companies, with their higher dividend yields, have been relegated to a secondary position. Institutions have apparently changed their investment philosophy from rather conservative, where dividend yield has occupied a place of prominence in the past, to a more adventurous policy where price appreciation is being actively pursued.

Profit margins and those relationships similar to them were designated thirteen times as Table XI illustrates. Qualitatively, profit margins and return on capital were about average. Although one firm responded with a first designation in this group, most rankings were centered around fourth. The number of firms that adopted these financial facts in their computer programs were slightly more than those which did not. A small problem with this criterion is knowing exactly what the respondents had in mind when they listed margin. There are various uses of this term. Some use it when referring to the dollar profit after all items have been subtracted from revenue; others use it to refer to profit before income taxes and extraordinary items. Still many others

consider it to be a percentage-of-revenue figure. Fortunately, all of the above possibilities are similar and vary only as to extent and mode of computation. They all provide about the same results, especially when they are compared with like data for other time periods or other companies. The factors of return on equity capital and growth in capital per share are standard enough not to be a problem. It might be that these items should be included with earnings which were presented earlier, since they are closely related. If so, this would add prominence to the earnings criterion in the analyst's investment program. The argument that margin should be included with earnings could be made on the basis that profit margins are earnings with only a different name and sometimes a varying mode of calculation. However, these margin designations were presented in a separate section, as they were reported to retain the respondents' actual answers.

The next category was changes in sales, and as Table XI illustrates, ten companies consider these data in their investment program. Qualitatively, sales ranked about average as Column 2 discloses, although one firm reported that it considered sales as the most important item. Exactly one-half of those employing sales in their investment programs used it with their computer.

Consideration of sales is important for at least two

reasons. The first is that when sales increase, profits usually rise, and vice versa. The second reason is that sometimes a company will have an increase in sales while earnings are flat or decreasing. Such a situation generally means that expenses are out of control and should alarm analysts who should, in turn, inquire into the causes of the predicament. Investigation is very necessary where fixed assets comprise a large majority of total assets on the company's balance sheet. When sales increase, the fixed expenses of depreciation and amortization remain almost constant, and therefore, net profit should not only advance but should do so at a greater rate than sales. Hence, analysts should contrast changes in sales with earnings. **Percentage** changes in both criteria should be scrutinized with care.

Table XII presents the findings for price, but only ten firms listed it as being utilized in their selection processes. Qualitatively, price was not rated high, as most rankings were fourth or lower. One-half of those who consider price employ it in their computer programs. The lack of popularity of price is surprising, especially in today's market environment which seemingly places little emphasis on yield, financial position, and stability and instead pursues capital appreciation even to the extent where it is common for price-earnings ratios to reach astronomical heights. Such

TABLE XII
MOST SIGNIFICANT FACTORS IN STOCK SELECTION-CONTINUED

Factor	(1)	(2)								(3)	
	No. of Companies Reporting Factor	No. of Companies Ranking Factor as Follows: (1 = Most Important)								No. of Companies Including Factor in Computer Program	
		1	2	3	4	5	6	7	8		
<u>Price</u>											
Price Volatility	4					1	1	2			1
Price	3		1		2						3
Price Movement Compared to Volume	1			1							0
Price Up Versus Down Potential	1	1									0
Current Market Price Compared With Historic Price Range	$\frac{1}{10}$				1						$\frac{1}{5}$
Total											
<u>Financial Position</u>											
Possible Financing	2		1						1		0
Balance Sheet Ratios	2					1			1		1
Capital Structure	2				1		1				0
Size of Firm	2					1		1			2
Liquidity Ratios	$\frac{1}{9}$							1			$\frac{0}{3}$
Total											
<u>Capital Outlays</u>											
Capital Expansion	1								1		1
Capital Expenditure Trends	1			1							1
Research & Development Expenditures Trends	$\frac{1}{3}$			1							$\frac{1}{3}$
Total											

large ratios are the result of the constant bidding-up of prices in the belief that they will continue to rise even higher. Market phenomena such as the so-called go-go funds and the public's apparent abandonment of a sound investment philosophy have helped immensely in fostering the belief that prices can continually go up with little chance of reversal. Of course, every two or three years, and as evidenced by the bear market which started in May of 1969, investors learn the hard way that prices do not rise forever.

A possible explanation as to why only ten companies listed price and why it was not ranked very high qualitatively is perhaps due to the need to look beyond the price and to examine data that will affect price at a later date. This finding could explain the high popularity of estimated future earnings. Thus, it may be that many analysts and investors feel that price is only a dependent variable which is completely influenced by independent variables such as earnings and sales. In fact, this is probably how most analysts feel, and perhaps the difference between analysts is only of degree as to how much the price movement is influenced by criteria such as earnings. Furthermore, some analysts believe that if attention is devoted primarily to price, the investment action will be taken too late. That is, they feel that buying should be based on anticipation as to what the future will be and not on

current or past events, such as last quarter's earnings. This belief could account for the small number (ten) of companies that listed price as significant and the large number (forty-five) that listed earnings which is a variable that can influence price.

Accounting data which measure a company's financial position are shown in Table XII. These were listed by only nine repliers, and in practically every case they were reported as having little importance as disclosed in Column 2. These reports are also surprising, since much is read and heard concerning the value of ratios such as current ratio, debt-equity ratio, and many others. Perhaps part of the reason why ratios and financial position are not rated as highly as might be expected is due to the lessened emphasis on the more conservative aspects of investing and the increased stress on price performance, rumor of possible mergers, and, in many cases, pure speculation. For example, during 1969 the price of the stock of Natomas Corporation ranged from approximately 40 to 130 and back to 63. One of the reasons for the rise in the price was due to oil discoveries by this company in the Far East. However, a considerable amount of price movement (the stock experienced large price fluctuations, sometimes five to ten points in one day) was caused by speculators, gambling that the price would move

drastically up or down within a few days thus providing them with a quick trading gain. The act of speculation departs from the usual investment practices of considering such data as financial ratios.

The small number of questionees that employ ratios in their computer programs were also unexpected. Only a third of those listing financial ratios and position reported using the computer for these criteria. It is possible that the reason given above--that of less devotion to traditional analytical procedures--applies here also.

The number of instances where various types of capital outlays are utilized as factors in the stock selection process are reported in Table XII. Only three companies reported adoption of these events, none of which were highly rated. Each of the three correspondents indicated that the computer was used with these criteria. Generally when a company expands and/or invests in larger research and development programs, increased earnings are expected. Sometimes there is an initial delay in earnings until the new plant is in full production or the new product has met with large acceptance by consumers. However, many analysts make investment decisions on long-term earnings expectations and ignore initial setbacks. As with the last few financial facts, the lack of attention given to changes in capital outlays may be

due to decreased emphasis on the traditional and fundamental approach to investing.

The top portion of Table XIII reports the instances of economic statistics. Not only was the number small, but qualitatively these items rated very low, which was also unexpected. The lack of popularity of economic data shown by this survey possibly is another example of desertion of the conventional analytical procedures. Instead, other procedures are employed to search for stocks that hopefully will provide a fast gain via a rapid price rise, irrespective of extremely high price-earnings ratios, low yields, or high debt-equity ratios. The stock prices for many large corporations have a high degree of correlation with the country's economic position. In fact, many economists consider the stock market as a leading indicator of the nation's business.

In 1969, a good example of this correlation occurred. During the years of 1968 and 1969, inflation had been very strong. Tight money policies of the Federal Reserve had helped create the highest interest rates in the century. In May of 1969, the stock market began to react with an approximate 17 per cent drop from around 970 (measured by the Dow Jones Industrial Average) to approximately 800 by September of the same year. One of the reasons for the drop was that with extremely tight money and rising operating costs,

TABLE XIII
MOST SIGNIFICANT FACTORS IN STOCK SELECTION-CONTINUED

Factor	(1)	(2)								(3)
	No. of Companies Reporting Factor	No. of Companies Ranking Factor as Follows: (1 = Most Important)								No. of Companies Including Factor in Computer Program
		1	2	3	4	5	6	7	8	
<u>Economic</u>										
Macroeconomic Forecasts	1						1			0
Risk in Economic Environment	1								1	1
Total	2									1
<u>Other</u>										
Quality or Depth of Management	3	1		1		1				0
Opinion of Management	3	1	1		1					0
Risk-Gain (Reward) Ratio	2			1				1		1
Cash Flow	2						1	1		1
Labor Cost Ratio	1				1					0
Analyst's Judgement	1	1								0
Per Cent of Issue Held by Department	1						1			1
Historical Experiences as Indicated by Financial Statements	1								1	0
Marketability of Stock	1								1	0
Number-of-Personnel Trend	1			1						1
Depreciation and Amortization Analysis	1				1					0
Success in New Product Development	1						1			0

TABLE XIII (CONTINUED)

Factor	(1)	(2)								(3)
	No. of Companies Reporting Factor	No. of Companies Ranking Factor as Follows: (1 = Most Important)								No. of Companies Including Factor in Computer Program
		1	2	3	4	5	6	7	8	
Tax Status	1						1			1
Future Products	1		1							0
Past Record	1			1						1
Probability of Overall Rate of Return Being Below a Certain Level	1			1						1
Risk Posture of the Investor	1					1				1
Objectives of the Investor	1				1					1
Total	<u>24</u>									<u>9</u>

industrial production was expected to be lower by the latter part of the year, which would result in lower corporate earnings. Since the market is often a leading indicator, it began to reflect anticipated decreased earnings during the spring and summer months of 1969, and the drop to the 800 level by the Dow Average was the result. If the stock market is indeed a leading indicator of the economy, investment strategy must be arranged accordingly. Instead of making buy and sell decisions based on the present state of the economy, these actions should be based on what one respondent listed-- macroeconomic forecasts. As computers are put to greater use in employing economic models along with stock prices, more attention will likely be placed on economic data.

The latter part of Table XIII presents all relationships that do not fall under any other heading. A total of twenty-four items are presented with eighteen differing from one another. Again, the diversity of investing is evidenced. As to the qualitative aspect of importance placed upon these items by the reporting institutions, it ranged from very high to low. For example, there were five instances of first and second place ratings and four cases of ratings of seventh and eighth. The lack of objectivity in some of the criteria is evidenced by the fact that only nine of the twenty-four are included in the companies' computer operations. For example,

the quality of management and the opinion of management were listed three times each and their subjectivity make them nearly impossible to program into a computer.

One questionee did not list financial data as requested by question three. Instead he replied that the benchmarks employed by his firm vary according to project. In concluding question three, it should be observed from Tables X, XI, XII, and XIII that there is a correlation between the number of times a factor was listed and how it was rated qualitatively, that is, the degree of importance placed upon it via rankings. For example, the criteria earnings and price-earnings ratio were listed more than any other relationship, and both of these also had far more rankings of first, second, and third, than sixth, seventh, and eighth.

Other Areas

Question four in the General Section asked if regression analysis techniques were used to project various items. The following table records the responses to this inquiry. Regression analysis techniques are employed primarily for projecting the future sales of companies and industries and future price-earnings ratios of stock. In addition to the specific practices indicated in Table XIV, the following procedures were each listed once: (1) to project future earnings, (2) to

project price action relative to market indexes, (3) to project growth rates of earnings and sales, (4) to project current equilibrium of stock prices, (5) to project changes in models, and (6) for performance analysis.

TABLE XIV

REGRESSION ANALYSIS

	Number of Firms Indicating Usage
Use of Regression Analysis to Project:	
(a) the future sales of the company	13
the future sales of the company's industry	9
(b) the overall movement of the market	4
(c) future interest rates	3
(d) future price-earnings ratios of the stock	11

Two questionees reported that they used regression analysis for any category and group of variables they felt appropriate. Some stated that they were working on programs and expected to soon begin regular use of regression techniques. One replier stated that although the firm has the capability to perform these techniques, they have so far proven almost worthless. Considering all answers, it appears that regression analysis is worthwhile and its usage will increase.

Model building and simulation were the subjects of question five, and the questionnaire listed two possible methods for employing these techniques. The findings for this question are in Table XV.

TABLE XV

MODEL BUILDING AND SIMULATION TECHNIQUES

	Number of Companies Reporting Usage
Areas of Utilizing Model Building and Simulation Techniques:	
(a) estimated earnings with probable risk patterns	15
(b) estimated earnings with various diversi- fication options	7

A majority of the companies practice these techniques in order to estimate earnings with probable risk patterns. In addition to the two specific areas listed, the following applications were also reported: estimate of price-earnings ratios with probable risk patterns, industry and economic environment projections, evaluation and selection of models, and estimated price with risk patterns. Several reported that they were currently experimenting with various programs and models. The number of companies that reported usage of model building and simulation techniques in one or more areas

were approximately 50 per cent of the number of companies utilizing computers in their stock selection procedures. It is believed that this percentage will increase considerably within the next few years. As in question three, the financial fact of earnings occupied the most prominent position.

In conjunction with the chapter on accounting and its effects on investing, question six sought to determine if the correspondents' computers utilized earnings per share as reported or only after adjustments had been made. The results of this question are shown in the table below.

TABLE XVI

USE OF EARNINGS PER SHARE

Number of companies that use earnings per share as reported	4
Number of companies that use earnings per share after making adjustments where necessary	21

In addition to the specific answers, one company stated that it used COMPUSTAT data. Since Standard Statistics Corporation follows certain guidelines for all companies and adjusts reported financial data as received, this correspondent uses adjusted earnings-per-share figures also. Two firms reported

that they employ earnings per share as reported for historical purposes; however, for projections into the future, they use adjusted earnings-per-share figures. These admittedly limited findings suggest that analysts and investors have reservations in accepting accounting reports as they are currently prepared. Work should continue toward more widely accepted accounting principles until sufficient confidence in financial statements is secured, and adjustments become a rarity.

The determination of the rate of return earned on investments which were selected by computers was the objective of question seven. This inquiry was intended to determine the degree of success investors have had in stock selection utilizing the computer. One objective measure of success is the rate of return earned. However, response to this question was not sufficient to form an opinion. Only four revealed a specific rate of return. These replies were 10, 54, 15, and 35 per cent. The latter percentage was for the year 1968; the other percentages were not accompanied with dates. A few questionees stated that the rate of return depended primarily on the risk level selected, which would be the case where a management group manages multiple funds ranging from speculative to very conservative. Understandably, with risk being greater for the speculative fund than for the conservative

fund, the rate of return should be larger in the former than the latter. Thus a reply stating one of the rates or an average of all rates would be of little use. Because it is common for some funds to have several types of investment programs and banks to have various portfolio policies, it is assumed that this is the primary reason why few specific answers were received.

Another reason why specific responses on returns were rare is because some correspondents interpreted this question to refer to investment decisions made 100 per cent by the computer. Two replied that their organizations did not make investment decisions in this manner, and thus the question was not applicable to them. Because investors buy and sell at times other than at January 1 and December 31, every investment transaction would have to be adjusted to an annual basis in order to compute an annual rate of return. For companies without a computer this could be a time-consuming task. Three replied that the information requested was not available. One company stated that the overall rate of return is impossible to measure as the firm has thousands of accounts. If investing success with a computer is to be determined using rate of return in future inquiries, the mode of collecting the information will have to be altered so that it will allow for the problem areas discussed above.

With some computers now programmed to print out charts, the next question sought their identity. The following is a list of the charts reported for this inquiry.

1. Various criteria versus time
2. Profiles of portfolios
3. Moving five-year average of earnings
4. Centered twelve-month moving average of price-earnings ratio patterns
5. Actual price-earnings ratio patterns
6. Index of change in price-earnings ratios
7. Price-earnings ratio relative to the Dow Average and relative to Standard and Poor's 425 stock average.
8. Price at certain earnings levels versus actual price
9. Price, relative price, and relative price-earnings ratios
10. Price patterns
11. Relative ratio charts
12. Experimental graphs
13. Line charts (time series)
14. Bar charts
15. Scatter diagrams
16. Moving price patterns
17. Analysts' forecasts versus model forecasts versus actual relative strength charts.

In addition, one replier stated that the firm has sub-routines which can be used with practically any data. Another replied that the firm did not have any internally created computer-produced charts but purchased these types of charts.

Questionees were asked to list what they considered to be the more advantageous aspects or procedures of the computer in stock selection. The following lists the response to this inquiry.

1. Computer used as a flag or monitoring device to save the analyst's time and yet point out changing situations to him
2. Automatic "bell ringing"
3. Elimination of bias
4. Increases scope of analysts
5. Making practical statistical tools such as seasonal adjustments
6. Regression analysis
7. Smoothing for security analysts to use in research
8. Interplay of fundamental factors
9. To screen undervalued stocks systematically and efficiently
10. The considerable amount of human effort saved in the process
11. Management by exception
12. Elimination of routine clerical duties (statistical)
13. Deeper analysis and more orderly investment decision procedure; consistency of decision making and creative analysis
14. Ease of comparison between several analysts
15. Forces the digging out of more information
16. Consistent implications of analyst estimates
17. Eliminates handwork and saves time in selecting companies for further analysis
18. Forces the participants to think carefully about the implications of their judgements
19. Improves the productivity of researchers and portfolio managers
20. Generates analytical insight into problems by researchers
21. Very useful from a management-information systems point of view
22. Discipline of consistent methodology
23. Using statistical techniques to generate forecasts

In addition to the responses above, numerous repliers stated that a major advantage is the computer's ability to manipulate and process large quantities of data in a short period of time. Thus, it allows the consideration of a larger number of alternatives and the examination of a greater number of stocks. Also, quite a few respondents listed the

screening mechanism. The computer's ability to remove much of the routine and less creative tasks from the analyst's workload is evidenced in numerous replies above. Consequently, his productivity should increase both quantitatively and qualitatively.

Disadvantages and problem areas of the computer in the selection process were the subjects of the last question.

The replies to this inquiry follow:

1. Education of top management as to the potential of the computer
2. Expansion of the scope of the program
3. Faith in program (tied to projections)
4. Structural problems, for example, mergers
5. Difficulty in quantifying subjective information
6. Reluctance of analyst to utilize computer system fully
7. Reluctance of older men to believe in efficacy of the computer process
8. Invalidation of any attractive signal based on historical data, e.g., due to a radical **change** in the current earnings pattern
9. Subjective nature of some input information
10. Incorrect data: not updated, incorrectly entered into the data base
11. Getting men to use it
12. Reliability of hardware. For example, management dependent upon reports which are sometimes delayed by machine malfunction
13. Operational problems
14. Current lack of good reliable data base
15. Hesitancy on the part of portfolio managers to accept results
16. Mental inertia in working with point estimates instead of probabilistic ranges
17. Difficulty of participants in focusing on their role as part of an overall process
18. Too great a reliance on purely statistical approaches
19. Programming delays
20. Interaction between fund manager and the computer department.

In addition to the above remarks concerning the reliability of input data, other respondents listed its inadequacy but did not elaborate. This seems to be one of the most common difficulties. Questionnaires from companies that reported this problem were checked to determine if they accumulated their own data or purchased it. Three of these firms purchased all of their data, and two firms both purchased and accumulated their data. Thus, it appears that even purchased data have defects. Another reported common area of difficulty is the reluctance of various company personnel, particularly those in top management and/or older workers, to accept the possibilities of the computer.

Comparing the advantages listed for question nine and the disadvantages listed for question ten, it appears that overall the advantages considerably outweigh the disadvantages. This seems especially true considering that one of the most mentioned disadvantages--lack of acceptance by top management and others--is not a fault of the computer. Also, this opposition should diminish as younger executives who have worked with the computer replace present management. Furthermore, the other common disadvantage which was mentioned frequently--lack of reliable data--should also be alleviated in the near future as more experience is gained in collecting

and updating data. When these two drawbacks are overcome, or at least reduced, and more experience and deftness are gained in the future, the computer should occupy a place of prominence among a large number of investors.

CHAPTER X

SUMMARY AND CONCLUSION

In addition to the studies pertaining to specific procedures, systems, and approaches to investing, effects of accounting procedures on investing, and influence of the computer on the stock market and analysts, a questionnaire survey was conducted. The purpose of the mail inquiry was to gain a clearer picture of the actual stock selection practices of financial institutions, especially in regard to the employment of computers. Questionnaires were sent to sixty of the larger institutions as follows: ten to open-end funds, ten to closed-end funds, twenty to bank trust departments, and twenty to management group companies. Of the total mailed, some 82 per cent were returned. The questionnaire included inquiries into the three areas of screening, final selection, and general, the results of which are presented in Chapters VIII and IX.

One of the general findings concerns the fundamental and technical approaches to investing. Although institutional investors have been traditionally associated with fundamental techniques which employ balance sheet and income statement

ratios, the philosophies of some of these investors shifted somewhat during the 1960's to include various technical selection practices. There are occasional comments to the effect that this movement has been quite extensive.

Considering the computer's abilities to accommodate and rapidly manipulate data for many companies, it would seem that more investors would take advantage of these attributes, especially in the technical area. For example, the computer allows technicians to observe literally thousands of stocks as to their price and volume behavior; without a computer, they would have to confine their coverage to a smaller number. Numerous questions were asked concerning technical procedures, but little response was received. This finding was surprising for procedures such as averages and support-and-resistance-level techniques, particularly the latter. Technical procedures have yet to gain the acceptance and popularity possessed by traditional fundamental factors. However, as more investors become familiar with technical applications and the computer's ability to expedite these procedures, the technical approach will probably gain adherents.

Another general finding was the diversity of stock selection techniques. Although criteria such as earnings and price-earnings ratio are included in investment programs of

most of the respondents, over seventy different financial facts and procedures were reported. Notwithstanding the many different relationships, it was revealed that most companies choose only a small number to perform their analytical tasks. For example, the responses to question two of the General Section indicate that most companies employ only six to ten ratios at a time. Thus, companies probably select a few benchmarks which have provided the best results in the past and concentrate on them.

Only twenty-one out of thirty-seven respondents which used the computer reported using screening techniques. Whether it is the absence of reliable data, lack of understanding of the advantages, or some other reason, a large percentage of companies are not availing themselves of the benefits of the filter technique. For those companies which are taking advantage of the computer with this process, fundamental relationships are far more in evidence than technical elements. Presumably two major reasons for favoring fundamental factors are (1) technical data do not lend themselves as easily to this technique as fundamental criteria and (2) technical procedures are generally considered to be more beneficial for timing than for selection with which screening is primarily concerned. Both of the two most common specifications reported involved earnings--growth rate of

earnings per share and price-earnings ratio.

Information was requested concerning limits imposed during the screening run, and although some were reported, not enough were received to form a definitive portrayal of institutional philosophy as to what levels restraints should be set. More specific restrictions probably were not received because funds, management groups, and banks now operate different sub-funds and portfolios, each with varying goals. Funds that are established for stable growth in earnings and dividends will impose relatively tight limits as to past and present records of earnings, dividends, and financial ratios such as current and debt-equity. Conversely, those funds that are more speculative in nature will not incorporate tight restraints for the above factors. Thus, it is assumed, and supported by some responses, that numerous questionees did not specify particular limits since these would vary depending on the sub-fund or portfolio being considered. A majority of the companies purchase data for screening purposes rather than accumulating their own. However, the reverse is true relative to writing the company's programs as most prepare their own.

The extent of employment of the computer in the final selection process was found to range between "considerably" and "not at all." Also in the final selection stage, the

employment of growth rates of earnings per share and sales and price-volume relationships of the entire market and of individual stocks, were found to be relatively common. Inquiry was made into the extent of employment of the computer for the entire selection process. Over 75 per cent of the respondents indicated that an approximation would be between 0 per cent and 20 per cent. Although this percentage of computer usage was lower than expected, it is believed that in the future it will increase considerably.

The most commonly reported factor employed in stock selection was earnings; of particular significance is that many companies consider one variation of this criterion--expected future earnings--to be of utmost importance. Apparently, estimated performance in the future is responsible for making decisions involving billions of dollars. The second most popular financial fact was found to be price-earnings ratio. It is worthy of note that half of this relationship is composed of the most widely used factor--earnings. Unexpected, but perhaps understandable after due consideration, the criteria of yield, sales, price, and financial statement ratios appear to have lost some of their respect as they were not listed in large numbers. Especially surprising were the few companies utilizing economic data and procedures. An interesting observation was

the correlation between the number of times a ratio was reported and how it was rated by the respondents. For example, earnings ~~were~~ not only reported more than any other benchmark, but it also received far more first and second designations of importance than all the other possible ratings of three through eight combined.

In addition to seeking the most respected financial data, the questionnaires also inquired as to which were actually included in the companies' computer programs, and in each group, some incorporations into computers were found to be present. In some cases such as earnings, price-earnings ratio, yield, and profit margins, slightly over one-half of the companies employed these relationships in their computers. For other criteria, half or slightly less than half of the companies placed them in their computers. It is predicted that in the future these percentages will increase considerably as firms become more aware and convinced of the computer's capabilities.

Situations of recently expanded use of computers were found to exist at some firms. Examples of more advanced techniques are the use of regression analysis to project (1) the future sales of a company and its industry, (2) the overall movement of the market, (3) future interest rates,

(4) future price-earnings ratios, and (5) unique relationships of interest to the particular firm. Another advanced area reported is that of model building and simulation techniques in order to estimate earnings with probable risk patterns and variations. Also, a few firms are now having the computer print out various charts which contain such items as moving-average lines, price-earnings ratios, scatter diagrams, and numerous other relationships.

The responses to the survey seem to indicate a need for improvement in the preparation of financial statements from which analysts secure most of their data. An overwhelming majority of respondents stated that they adjusted the earnings-per-share figure as it is reported.

Although some areas of difficulty, such as errors in the data and lack of acceptance by management, were designated in the responses, these will probably be overcome; furthermore, even with these drawbacks, the benefits of computer-assisted selection procedures already outweigh the disadvantages. The various applications will likely continue to increase. It is further hypothesized that unless an investor gains access to a computer--whether in his own firm or by some other means, such as subscribing to an advisory service which possesses a computer--he will be at a disadvantage to investors who employ one. As exploitation of the computer continues, greater

sophistication and successes should ensue in the future.

Therefore, the investor without these advantages will fall further behind.

The investigation of the computer's possibilities is the primary reason for this study, because merely possessing the computer does not guarantee success; its potentials must be studied thoroughly so that it can be mobilized to yield the greatest benefits. This background study has at least two functions. First, it should be of value to anyone who plans on developing computer-assisted selection procedures for his own company. This study will provide a broad description of most of the common procedures for which the computer is presently being utilized. It will assist the company in deciding in which areas to experiment and provide guidelines as to the more popular factors, procedures, and limitations. Second, it can be used to help in teaching investment courses and preparing a program for investment research at universities. Colleges with business curriculums offer one or more courses in investments, but only a small percentage of these offer investment courses which utilize the computer for research.

There are two primary reasons for the limited use of computers in investment courses. The first is lack of knowledge as to the capabilities of the computer in the selection process. It is hoped that this study can alleviate this drawback, to a

degree at least. The second reason is that research and teaching with the computer cannot be extensive without a sufficiently large data base. These are expensive, and even though the Standard Statistics Corporation has donated some packages, not enough are available so that all universities can avail themselves of this teaching opportunity. Nevertheless, a college can accumulate its own data bank, although in the first few years it will not be as complete as COMPUSTAT.

Some of the colleges that have COMPUSTAT or have prepared their own data bank have installed effective research and teaching procedures employing the computer. For example at one college, students develop stock analysis programs expressed in financial terms. The print-outs are available within a few days, and the results are analyzed in class. Graduate and other students are encouraged to use the computer and data tapes in security analysis and portfolio management research.¹ Several colleges have prepared manuals showing steps necessary to gain access to the tapes, sample procedures, and other information needed to enable students to write their own programs for their individual

¹Gruncwald, "Using the Computer in Investment Analysis," p. 13.

study. A few universities have made much progress in the area of teaching via actual individual research with the computer.

After a data bank has been collected, it is suggested that a library of investment research programs be prepared. The examination of the various possible applications presented in the earlier chapters of this study such as screening, correlation, and model building, and the testing of criteria and methods which were collected by the questionnaires will probably require years to complete. However, once these are concluded, a set of useful computer-assisted investment programs should be available for quick use. Furthermore, research in preparing these programs and their continual updating and improvement could be performed in conjunction with the teaching of graduate investment courses. Thus, students should gain more knowledge about investing than just reading a textbook and copying financial data in the library for assignment purposes.

BIBLIOGRAPHY

BIBLIOGRAPHY

Books

- Cohen, Jerome B. and Zinbarg, Edward D. Investment Analysis and Portfolio Management, Homewood, Illinois: Richard D. Irwin, Inc., 1967.
- Vaughn, Donald E. Survey of Investments, New York: Holt, Rinehart, and Winston, Inc., 1967.

Newspapers

- Dorfman, Dan. "Heard on The Street," Wall Street Journal, August 29, 1969.
- Elia, Charles J. "Heard on The Street," Wall Street Journal, May 9, 1969.
- Martin, Richard. "Heard on the Street," Wall Street Journal, December 9, 1969.

Professional Publications

- "Accounting for the Investment Credit," Opinions of the Accounting Principles Board, No. 2. New York: American Institute of Certified Public Accountants, Inc., (December, 1962).
- "Accounting for the Investment Credit," Opinions of the Accounting Principles Board, No. 4. New York: American Institute of Certified Public Accountants, Inc., (March, 1964).
- Opinions of the Accounting Principles Board, No. 9. New York: American Institute of Certified Public Accountants, Inc., (December, 1966).

Papers

- Clarkson, G.P.E. Portfolio Selection: A Simulation of Trust Investment. Englewood Cliffs: Prentice-Hall, Inc., 1963.
- Grunewald, Adolph E. "Using The Computer in Investment Analysis," Papers Presented at the First Investment Seminar. Gainesville, Florida: University of Florida, November 10, 1967.
- Kahl, Alfred L., Jr. Investment Management and the Computer: Limitations and Prospects. Ph.d. Dissertation, University of Florida, 1969.

Periodicals

- Ahlquist, H. E., Jr. "Computerized Stock Analysis Service." Best's Review, Life Ed. 69 (January 1969).
- Baumol, William J. "Mathematical Analysis of Portfolio Selection: Principles and Application." Financial Analysts Journal, (September-October 1966).
- Bean, A. M. "Portfolio Analysis and Stock Selection by Computer." Financial Executive, 35 (February 1967).
- Blake, C. W. and Riegler, D. W. "Data Processing--Key to Investment Success." Financial Analysts Journal, 24 (January-February 1968).
- Bower, Richard S.; Nugent, Christopher E.; Williamson, J. Peter; and Myers, Barbara C. "A Language for the Aid of Financial Fact Finders." Financial Analysts Journal (January-February 1967).
- Buek, C. W. "Trust Companies and Banks as Institutional Investors." Commercial and Financial Chronicle, 205 (February 9, 1967).
- Buff, J. H.; Biggar, G.G.; and Burkhead, J. G. "Application of New Decision Analysis Techniques to Investment Research." Financial Analysts Journal, 24 (November 1968).

- Cohen, K. J.; Schneider, Howard M.; and Hammer, Frederick S. "Harnessing Computers for Bank Asset Management." Bankers Magazine, 150 (Summer 1967).
- "Computer Investment: Timing, Gentlemen, Please." Economist, 222 (March 25, 1967).
- "Computers: Dial an Electronic Investment Analyst." Statist, 190 (July 8, 1966).
- "Computers Spew Out Hot Advice." Business Week, (May 18, 1968).
- Daners, T. R. "Trends in Fund Investment Policy Under Varying Stock Market Conditions." Commercial and Financial Chronicle, 207 (June 20, 1968).
- Eiteman, D. K. "Computer Program for Common Stock Valuation." Financial Analysts Journal, 24 (July-August 1968).
- Feuerstein, A. E. "Investment Decision by Computers." Bankers Monthly, 84 (September 1967).
- _____, and Maggi, P. G. "Computer Investment Research." Financial Analysts Journal, 24 (January-February 1968).
- Fox, E. A. "Comparing Performance of Equity Pension Trusts." Financial Analysts Journal, 24 (September-October 1968).
- Friend, I. and Vickers, D. "Re-evaluation of Alternative Portfolio-Selection Models." Journal of Business, 41 (April 1968).
- Gal, Joseph J. "Man-Machine Interactive Systems." Financial Analysts Journal, (May-June, 1966).
- Goodfield, Herbert E. "Adjustment and Projection of Life Insurance Company's Earnings Utilizing a Computer." Financial Analysts Journal, (November-December 1966).
- Grunewald, A. E. "Computer Assisted Investment Analysis." Michigan State University Business Topics, 15 (Spring 1967).
- Gumperz, J. "Computer As A Financial Tool; Some of Its Advantages and Limitations." Financial Analysts Journal, 22 (May-June 1966).

- Howard, G. C. "Use of Computers in Investment Analysis." Commercial and Financial Chronicle, 204 (December 8, 1966).
- "Investment Research; Current Trend." Economist, 228 (July 27, 1968).
- "Investment Research in the 70's." Financial Analysts Journal, (May-June, 1968).
- Jensen, M. C. "Performance of Mutual Funds in the Period 1945-1964." Journal of Finance, 23 (May 1968).
- Kenney, W. J. "Personal Trust & Investment Accounting." Trusts and Estates, 106 (March 1967).
- King, Benjamin F. "Market and Industry Factors in Stock Price Behavior." Journal of Business, (January 1966).
- Kirk, J. "How a Mutual Fund Picks a Stock." Banking, 58 (June 1966).
- Kisor, Manown, Jr. "Quantitative Approaches to Common Stock Selection." Business Economics, (Spring 1966).
- Lerner, E. M. "The Use of Computers in Security Analysis." Trusts and Estates, 106 (August 1967).
- Levy, R. A. "Technical, Fundamental, and Random Walk Selection." Commercial and Financial Chronicle, 207 (April 4, 1968).
- Markowitz, H. M. "Portfolio Selection," Journal of Finance. (March, 1952).
- McWilliams, J. D. "Prices, Earnings, and P-E Ratios." Financial Analysts Journal, 22 (May-June 1966).
- "Private Stock Exchange?" Forbes, (March 15, 1969).
- Schechter, Donald. "Computer Simulation of an Asset Management Program." Bankers Monthly, 85 (April 1968).
- Sherwood, H. C. "Growing Power of Institutional Investors." Business Management, 34 (July 1968).

- Spacek, L. "Umpiring the Earnings Per Share Results." Management Accounting, 50 (March 1969).
- Steglitz, Mark. "Management Science." Trusts and Estates, 106 (March 1967).
- Stone, D. E. "Caveats in Computer-Aided Financial Analysis." Financial Analysts Journal, 24 (January-February 1968).
- Suits, Daniel B. "Forecasting and Analysis With An Econometric Model." American Economic Review (March 1962).
- Thomas, D. L. "Computerized Gunslingers: Electronic Brains Increasingly Are Calling the Shots on Wall Street." Barrons 49 (March 24, 1969).
- _____. "Electronic Investing." Barrons (August 14, 1967).
- _____. "Where the Action Is: Computers Have Increased Volatility and Risk in Stock Market." Barrons (August 28, 1967).
- Vaughn, Donald E. "Management Procedures for Selected Types of Institutional Investors." Business Studies NTSU Denton, Texas: (Fall, 1968).
- "Wall Street's Newest Drudge and Genius." Business Week (July 9, 1966).
- Zabian, S. P. "Investment Decision Modeling (Computer Simulation)." Financial Analysts Journal, 22 (May-June 1966).

APPENDIX

INSTITUTIONS TO WHICH QUESTIONNAIRES WERE MAILED

Bank Trust Departments

First National City Bank
New York, New York

Chase Manhattan Bank
New York, N. Y.

Morgan Guaranty Trust Company
New York, New York

Manufacturers Hanover Trust Co.
New York, New York

Chemical Bank N. Y. Trust
New York, New York

Continental Illinois National Bank
Chicago, Illinois

1st National Bank
Chicago, Illinois

Mellon National Bank & Trust Co.
Pittsburgh, Pa.

Bankers Trust Co.
New York, N. Y.

Security Pacific National Bank
Los Angeles, California

Wells Fargo Bank
San Francisco, California

1st National Bank
Boston, Massachusetts

Irving Trust Co.
New York, N. Y.

National Bank of Detroit
Detroit, Michigan

Cleveland Trust Company
Cleveland, Ohio

1st Pennsylvania Banking and Trust
Philadelphia, Pa.

Harris Trust & Savings Bank
Chicago, Illinois

Republic National Bank
Dallas, Texas

State Street Bank and Trust Company
Boston, Massachusetts

Citizens & Southern National Bank
Atlanta, Georgia

Open-End Funds

Wellington Fund, Inc.
Claymont, Delaware

Affiliated Fund, Inc.
New York, N. Y.

Manhattan Fund, Inc.
New York, N. Y.

Eaton & Howard Stock Fund
Boston, Mass.

Loomis-Sayles Mutual Funds, Inc.
Boston, Massachusetts

Hamilton Funds, Inc.
Denver, Colorado

Chemical Fund, Inc.
New York, New York

Delaware Fund, Inc.
Wilmington, Delaware

American Mutual Fund, Inc.
Los Angeles, California

Enterprise Fund, Inc.
Los Angeles, California

Closed-End Funds

Christiana Securities Company
Wilmington, Delaware

Lehman Corporation
New York, N. Y.

American Research & Development Corp.
Boston, Mass.

Madison Fund, Inc.
New York, N. Y.

Alleghany Corp.
New York, N. Y.

United Corporation
New York, N. Y.

Barber Oil Corporation
New York, N. Y.

Adams Express Corporation
New York, New York

Niagara Shares Corporation
Buffalo, N. Y.

Standard Shares, Inc.
New York, N. Y.

Management Groups

Anchor Corporation
Elizabeth, N. Jersey

Equity Funding Corporation of America
Beverly Hills, California

First Investors Management Co., Inc.
New York, New York

Imperial Financial Services, Inc.
Minnetonka, Minnesota

Investors Counsel, Inc.
Houston, Texas

The Investors Group
Winnipeg, Manitoba (Canada)

Lexington Research & Management Corp.
Englewood, New Jersey

National Securities & Research Corp.
New York, N. Y.

Supervised Investors Services, Inc.
Chicago, Illinois

Vance, Sanders & Company, Inc.
Boston, Massachusetts

EGRET Corporation
Boston, Mass.

Dreyfus Corporation
New York, N. Y.

Founders Mutual Depositors Corp.
Denver, Colorado

Insurance & Securities, Inc.
San Francisco, California

Investors Diversified Services, Inc.
Minneapolis, Minn.

Keystone Custodian Funds, Inc.
Boston, Mass.

M.G.F. Management Ltd.
Calgary, Alberta, (Canada)

Unified Underwriters, Inc.
Indianapolis, Ind.

Putnam Management Co., Inc.
Boston, Mass.

Waddell & Reed, Inc.
Kansas City, Missouri

SURVEY ON

THE USE OF THE COMPUTER IN THE STOCK SELECTION PROCESS

In answering these questions, please confine answers to the selection process itself and not to any of the other more common procedures performed by computers such as bookkeeping, share computations, etc. Please note that in numerous questions, blanks have been provided for writing in answers not listed in the alternatives. Also, if you elect to answer a question in narrative form, please do so by writing on the back of the page and giving the number of the question.

- I. Screening--One of the computer's most efficient uses is the screening procedure where a large number of stocks are examined and certain candidates are selected for additional study because they meet one or more specifications such as a certain yield, P/E ratio, etc.
1. Does your computer utilize the screening procedure in your portfolio selection process? Please check.
Yes _____ No _____
 2. If Question 1 is yes, which specifications do you use in your screening run and what limits do you impose?
 - a. Fundamental:
 - (1) Dividend Yield at least _____%
 - (2) Growth rate of earnings per share (E/S) of at least _____%
 - (3) Price/Earnings (P/E) ratio less than _____
 - (4) _____
 - (5) _____
 - (6) _____
 - b. Technical:
 - (1) Price movement of stock in relationship to its 200-day-moving average as _____
 - (2) Price-volume relationship as _____
 - (3) Breakout from a certain support or resistance level as _____
 - (4) Others: _____

3. For the information used in the screening run, do you:
 - a. accumulate your own data _____
 - b. or purchase it from someone (e.g. Compustat?) _____
4. Have you written your own program _____
or do you use a pre-packaged program? _____
5. If you use a pre-packaged program, what is its name and the vendor's name?

II. Final Selection--Generally after several candidates have been nominated, the next step is to select one or two from this refined group. The following questions pertain to this final selection process.

1. The final selection process can be performed by the computer, by subjective means, or both. For this final selection process, is your computer used

not at all? _____ very little? _____
considerably? _____ completely? _____

Programmed into Considered in
the Computer Subjective Manner

2. a. Do you consider price trading-volume relationships
 - (1) of the entire market? _____
 - (2) of individual stocks? _____
- b. What other factors are used?
 - (1) Granville's On-Balance Volume _____
 - (2) Growth rate of E/S _____
 - (3) Growth rate of sales _____
 - (4) _____
 - (5) _____

3. What decisions are made upon the breakout from certain object or chart patterns? Also, please check if that is the only criterion used to make the decision.

<u>Pattern</u>	<u>Buy</u>	<u>Sell</u>	<u>The Only Criterion Used</u>
a. Head-and-shoulders	_____	_____	_____
b. Saucer	_____	_____	_____
c. _____	_____	_____	_____
d. _____	_____	_____	_____

4. Do any of the following precipitate a "buy" or "sell" action?
- the crossing of the stock's price with its 200-day (_____-day)-moving average when the price line crosses the average line from (above) (below) and when the average is (ascending) (descending) (moving horizontally) _____
 - breakout from a support or resistance level _____
 - _____
5. If support and resistance levels are utilized, what time span do you consider to be meaningful?
- 1-3 mths. _____ 4-6 mths. _____ 7-9 mths. _____
 10 or more mths. _____

III. General

1. What per cent do you estimate your computer plays in the entire selection process?

0-20% _____ 21-40% _____ 41-60% _____ 61-80% _____
 81-100% _____

2. Approximately how many different factors such as yield, P/E ratios, earnings, etc. does your organization utilize?

1-5 _____ 6-10 _____ 11-20 _____ 21-40 _____ 41 or more _____

3. Please list in order of importance the factors (e.g. yield, earnings, current ratio, etc.) that you feel to be the most significant in stock selection and check those which are programmed into the computer.

	<u>Programmed into the Computer</u>
No. 1 _____	_____
No. 2 _____	_____
No. 3 _____	_____
No. 4 _____	_____
No. 5 _____	_____
No. 6 _____	_____
No. 7 _____	_____
No. 8 _____	_____

4. Does your computer use regression analysis to project
- the future sales of the company? _____ of its industry? _____
 - the overall movement of the market? _____
 - future interest rates? _____
 - future P/E ratios of the stock? _____
 - _____
 - _____
5. In what areas does your computer utilize model building and simulation techniques?
- estimated earnings with probable risk patterns _____
 - estimated earnings with various diversification options _____
 - _____
 - _____
6. Does your computer utilize E/S
- as reported _____
 - or do you make adjustments where necessary? _____
7. Considering dividends plus capital gains, what rate of return has been earned on investments which were selected by your computer program? _____
8. What charts, if any, is your computer programmed to print out?
- _____
 - _____
 - _____
9. What do you consider the more advantageous aspects or procedures of utilizing your computer in the selection process?
- _____
 - _____
 - _____
10. What do you consider the more disadvantageous aspects or particular problem areas in utilizing your computer in the selection process?
- _____
 - _____
 - _____
11. Do you wish to receive a summary report of the results of this survey?
- Yes _____ No _____
12. Person and address to whom summary is to be sent.
- _____
- _____

VITA

Bruce Lewis Kersey was born in 1932 in Dallas, Texas. He graduated from North Texas State University with the degrees of B.B.A. and M.B.A. in 1959 and 1961, respectively and received the C.P.A. Certificate in 1960. From 1960 to 1964, he taught at University of Texas at Arlington, and from 1964 to 1967, he was Controller of a large hospital in Fort Worth, Texas. Currently he is a candidate for the Doctor of Philosophy degree in the Finance Department at Louisiana State University.

EXAMINATION AND THESIS REPORT

Candidate: **Bruce Lewis Kersey**

Major Field: **Business Finance**

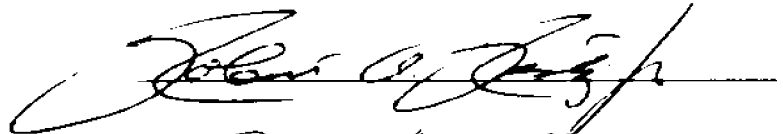
Title of Thesis: **Use Of The Computer In The Stock Selection Process**

Approved:


Major Professor and Chairman

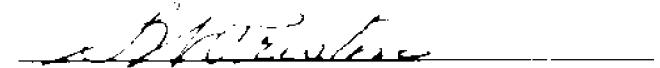

Dean of the Graduate School

EXAMINING COMMITTEE:









Date of Examination:

1-12-70