Portfolio performance evaluation of institutional investors: An empirical investigation of selection ability via the levels of institutional ownership, risks, firm size, and R&D expenditures

Jawook Baek
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PORTFOLIO PERFORMANCE EVALUATION OF INSTITUTIONAL INVESTORS: AN EMPIRICAL INVESTIGATION OF SELECTION ABILITY VIA THE LEVELS OF INSTITUTIONAL OWNERSHIP, RISKS, FIRM SIZE, AND R&D EXPENDITURES

by

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A Dissertation Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Business Administration

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We hereby recommend that the dissertation prepared under our supervision
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ABSTRACT

The purpose of this study is threefold:

• To evaluate how the portfolio performance of institutional investors differs from the market index portfolio, first, as a whole, and second, as several different institutional ownership portfolios.

• To investigate the relationship between the institutions’ superior stock selection ability and firm quality attributes such as beta, volatility, firm size, and R&D expenditures. Most previous academic work has focused on institutional investment behaviors, finding the relationship between institutional ownership and firm quality attributes, based on only mutual funds.

• To develop a decision model for future institutional investors’ portfolio performance based on the explanatory variables used in this study. The dependent variable is portfolio gross return, and firm quality attributes are independent.

The study group is selected from firms listed on the Compact Disclosure database during the period Jan. 1989 - Dec. 1996. Approximately 8,000 NYSE, AMEX, and NASDAQ companies are employed in this study. As analytical tools,
Sharpe’s measure (1966), Jensen’s alpha measure (1968), and Jobson and Korkie’s Z-statistic (1981) are used.

From the results of the study, one may conclude that institutional investors as a whole are not superior stock selectors; however, specific institutional ownership portfolios performed in a superior manner. The institutions’ superior selection ability is partly related to such firm quality attributes as small firm and stock volatility effects. Previous studies find that institutional ownership is related to firm size; however, institution’s portfolio performances are found to be inversely related to size. Higher beta is not found to contribute to institutions’ superior portfolio performance. This study found that institutional investors act in a hyperopic manner when tested with R&D expenditures. However, amounts of a firm’s R&D expenditures are inversely related to institutions’ superior performance. Unexpectedly, stock volatility is found to contribute to institutions’ portfolio excess returns, based on Jensen’s measure.

Finally, all firm quality attributes employed in this study as explanatory variables appear to be significantly related to portfolio returns. All variables are positively related to portfolio gross returns except R&D, which is inversely related.
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CHAPTER 1

INTRODUCTION

Institutional investors\textsuperscript{1} provide the largest and most popular types of publicly available portfolio management services. They charge fees for their services, and they manage trillions of dollars of marketable securities.

As large shareholders, institutional investors gain economies of scale in information gathering and analysis of investments, and they possess better knowledge about the market than individual investors (Black, 1992). They employ stock analysts who draw on sophisticated computer-aided information networks when evaluating the appropriateness of company expenditures. Individuals typically do not have access to these resources. Institutional investors can process information more thoroughly before making investment decisions, and as a result, they can make more rational investment decisions than can individuals (Kochhar and David, 1996).

Corporate stock holdings by institutional investors have increased substantially since Berle and Means (1932) conducted the first published study on stock ownership. Institutions held $2.68 trillion in stocks at the end of 1992, a 48\% jump from the $1.8

\textsuperscript{1}Pension funds, insurance companies, banks, investment counselors, mutual funds, and financial institutions.
trillion held in 1990. Institutions held 46.8% of the outstanding publicly traded equity in the United States as of beginning of 1993 (WSJ, Dec. 8, 1993). Those investors engaged in approximately 75% of the dollar volume of trading on the New York Stock Exchange (Brown and Brooke, 1993). Recent New York Stock Exchange (NYSE) surveys showed that institutional investors accounted for about 70% of its daily trading volume (Szewczyk et al., 1992).

Growth created a great amount of interest in institutional investors, and their performance stimulated considerable research related to performance and investment choices, as well as continual monitoring and evaluation by investors. The monitoring created incentives to make sound investment decisions that outside parties would deem reasonable, well-informed, and prudent (Badrinath et al., 1989), thus implying that institutional investors should provide fiduciary duties in handling client capital.

Institutional investors began to apply a “safety-net” rule (named by Badrinath et al. in 1989) as a guide in determining investment choices. Managers who breached their fiduciary duty were subjected to severe penalties under both common law and the Employee Retirement Income Security Act of 1974 (ERISA). Such restrictions on institutional investors affected the behavior of institutional investment. For example,

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2As of September 30, 1996, institutional investors held 44.25% of the outstanding publicly traded equity listed on the NYSE and AMEX. Institutions held $3.880 trillion of overall market value of stocks based on these two stock markets (Compact Disclosure, 30 September 1996). This study utilized data from 1906 of the 1979 firms listed on the NYSE. Similarly, it used data for 483 of the 566 firms listed on AMEX. It excluded the statistics for the other 73 NYSE-listed firms and the other 83 AMEX-listed firms because of missing market value or institutional holdings information. Institutional investors held more NYSE stocks than AMEX stocks. (44.46% of NYSE stocks and 28.7% of AMEX stocks).
institutional investors concentrated their activity on the stocks of large firms because of the more volatile behavior of small firms (Badrinath et al., 1989).

Much research during the last 30 years questioned whether any investment strategy could consistently produce results superior to those obtained from simply holding the market portfolio. Did they determine that institutional investors possessed a real power to earn an above-normal rate of return in the securities market? Did those institutional investors earn more than individual investors with less inference capabilities than institutions? Or did they earn more than the passive strategy of holding a market index portfolio? Research has produced neither a universally accepted answer nor a theory to underlie the answer.

Recently, researchers have questioned whether other institutional investors could produce results equal to those of mutual funds. One such research team, Bogle and Twardowski (1980), concluded that among institutional investors, mutual funds provided the highest equity rates of return. The collective literature, however, has not stated whether collective institutional investors functioned as superior portfolio performers compared to benchmark index funds.

**Statement of the Problem**

Despite the rapid growth of institutions' corporate stock holdings, performance evaluations of institutional investors do not completely account for investment behavior. Previous research has revealed relationships between firm attributes and ownership of common stocks; however, no published work that studied the relationship between each
attribute and institutional portfolio performance was found. Additionally, past research has not identified what effects, if any, institutions had on capital markets or on corporate strategies.

The negative relationship of a firm's volatility and institutional ownership might be positively related to institutional portfolio returns (i.e., a security with high risk should have provided a high return to risk averse investors.) Safety-net theory has suggested that institutional investors prefer large firms to small firms. However, there is evidence that small firms generated greater risk-adjusted rates of return.

An investigation of whether the performance of institutional investors, taken as a whole, exceeded the performance of the overall market should have concerned professional investors and financial-markets researchers. For example, as the safety-net theory implied, an inferior performance by institutional investors might have resulted from selecting securities emphasizing safety rather than return. This result might come from considerable prudence by institutional investors in their portfolio management.

Most previous studies in this area have concentrated on mutual funds' performance. However, mutual funds could not represent the panoply of institutional investors because each investor might have different interests as well as different transaction costs. If institutional investors performed as superior investors, where did the extra returns come from? Did they originate in beta (\(\beta\)), stock volatility (\(\sigma\)), or firm size effects? Finally, did this superior selection ability of institutional investors, taken as a group, contribute to the rapid growth of institutional holdings of corporate stocks?
Capital-market researchers need to investigate whether institutional investors have superior portfolio selection ability. Employers must meet prudent investing standards under the Employees Retirement Income Security Act (ERISA), and evaluate how the need to fund retirement benefits can affect their long-term earnings. If they or their portfolio managers select superior portfolios, the firms' returns ability will improve. Employers typically rely on institutional investors such as insurance companies, investment advisors, or specialized mutual funds acting on behalf of pension funds to perform portfolio selection.

**Scope and Purpose of the Study**

This study analyzes the cross-sectional predictability of equity returns in institutional investment portfolios. It emphasizes individual security characteristics rather than portfolio properties, and it focuses on determining factors that influence portfolio excess returns. The study uses five variables: percentage of institutional stock holdings, systematic risk (represented by $\beta$), return volatility (represented by standard deviation), firm size, and R&D expenditures. It investigates the causes of extra returns from institutional portfolios without discriminating between types of institutions.

This study encompasses the following:

1. Compares the monthly return behavior of portfolios dominated by institutional investors with portfolios dominated by individual or other investors, such as an index fund.

2. Examines portfolios to determine whether stock portfolios held in greater percentage by institutional investors exhibit higher risk-adjusted rates of return than those with less holdings by institutional investors.
3. Tests whether institutional investors exploited the small firm effect in the investment. (High returns from investments in small firms relative to returns from investments in larger firms suggest that institutional investors cautiously employed small firms, also, in their investment selection.)

4. Tests for market risk-return relationship as implied by the CAPM. (In other words, this study tests for a positive or negative relationship between levels of risk and portfolio returns in the context of institutional ownership of corporate stocks.)

5. Tests the relationship between individual stock volatility and institutional portfolio returns. (This test makes it possible to see how the \( \sigma \)-return relationship differs from the \( \beta \)-return relationship.)

6. Examines whether a firm's R&D spending relates positively or negatively to the rate of return in the institutional portfolio.

7. Jointly estimates the effects of the five factors (firm size, systematic risk, volatility, R&D, and levels of institutional ownership) on portfolio returns of institutional investors.

**Organizational Plan**

Chapter 2 reviews related theory, Chapter 3 reviews empirical studies, and Chapter 4 reports the hypotheses. Chapter 5 describes the sample, data characteristics, and the methodology used in the study. Chapter 6 presents the results of testing procedures. Chapter 7 summarizes the study, presents conclusions, and makes recommendations for further research.

**Attributes of Institutional Investment Behavior**

A recent study by Badrinath et al. (1989) found that institutional ownership is positively related to firm size, firm beta (\( \beta \)), trading liquidity of a security,\(^3\) the number

\(^3\)Trading liquidity was measured by the most recent year's annual trading volume in the firm's stock divided by the total number of shares outstanding.
of years of exchange listing for the firm, and is negatively related to firm specific risk, which is represented by stock volatility. Firm size, systematic risk and volatility were found by Badrinath et al. to have a statistically significant relationship with institutional ownership. The selection of variables for this study is based on the results of the Badrinath et al. study. In addition, the research and development (R&D) expenditures measure, which implies a firm's growth opportunity,\(^4\) is included in this study to see how it is related to portfolio returns in terms of various institutional ownership.

In the capital asset pricing model (CAPM), \(\beta\) represents systematic risk which cannot be eliminated by diversification. According to CAPM,\(^5\) the market compensates systematic risk, but not total risk. Previous research has indicated that high-\(\beta\) funds generally "outperformed" low-\(\beta\) funds relative to market-based portfolios of equal systematic risk (McDonald, 1974).

Stock volatility, which represents the total risk of a security (or portfolio), can be viewed as consisting of non-diversifiable risk (\(\beta\)) and diversifiable risk. Non-systematic risk represents the portion of an asset's risk associated with random causes that can be eliminated through diversification. It is attributable to firm specific events,

\(^4\)Long and Malitz (1983) and Titman and Wessels (1988) used R&D expenditures and advertising as a proxy for the firm's growth opportunities.

\(^5\)CAPM shows that the equilibrium rates of return on all risky assets are a function of their covariance with the market portfolio such that \(R_{jt} = R_{jt} + (R_{mt} - R_{jt})\beta_j + e_{jt}\). Where \(R_{jt}\) = the return on security or capital asset \(j\) at time \(t\), \(R_{mt}\) = the return on the market index, \(R_{fn}\) = the riskfree rate of return, \(\beta_j = \text{covariance}(R_{jt}, R_{mt})/\text{Var}(R_{mt})\), and \(e_{jt}\) = abnormal return for security \(j\) at time \(t\). More details about the CAPM will appear in Chapter 2 and Chapter 5.
such as strikes, lawsuits, regulatory actions, loss of a key account, and so forth. In this study volatility (standard deviation) carries a broader conceptual meaning than systematic risk.

The small-firm effect puzzled researchers for several years after discovery by Banz (1981) and Reinganum (1981). They observed that common shares of small firms earned, on average, higher risk-adjusted returns than those of large firms. Later studies showed that the small-firm effect occurred mostly in the first few trading days of January.

Hansen and Hill (1991) established a positive relationship between levels of institutional ownership and R&D expenditures. Two factors possibly explained this relationship: (1) Institutional investors had the competence to make a rational decision concerning share values (Heiner, 1983), and (2) many institutions effectively locked themselves into their stock holdings (Aoki, 1984). Since then, researchers have sought to determine whether greater R&D expenditures—with positive relationships to higher holdings by institutional owners—had any relationship with the rate of return.

Institutional clients’ objectives vary. Some clients place their savings with institutional investors to earn higher returns than they could obtain on their own. They reduce risk by holding an interest in a large and varied pool of securities, and the process allows a greater degree of liquidity (Pozen, 1994). Therefore, institutions might have more advantages of economies of scale and professionalism than individuals. If so, a higher R&D expenditure level relates positively to a greater rate of return in the collective portfolio of institutional investors.
According to the active investors' hypothesis (Jensen, 1991), institutions closely monitor firm managers and the strategic management of the firm, and they have better knowledge about the firms they select for their portfolios. Institutions typically do not invest for the short term (Kochhar and David, 1996); rather, they look for long-term benefits. The long-term orientation implies that institutional investors do not act in a myopic manner, and that as superior investors, they seek to actively influence corporate business decisions.

**Performance of Institutional Investment and Efficient Market Hypothesis**

Most performance evaluations of institutional investment over the last 30 years focused only on mutual funds, because of the availability of accurate data (Bogle and Twardowski, 1980). These studies focused on the evaluation of institutional investment performance, particularly whether any investment strategy could consistently produce results superior to the most "naive" strategy of simply holding the market portfolio. The classic studies of the late 1960s generally concluded that mutual funds—after deducting operating expenses, management fees, and brokerage commissions—underperformed common market indices.⁶ These studies argued that with operating expenses and brokerage commissions added back to the fund returns, mutual funds produced a neutral performance. In other words, actively managed investment portfolios did not yield higher returns than those earned by randomly generated

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⁶See Jensen (1968), Sharpe (1966), Treynor (1965), and Friend et al. (1962).
portfolios. Previous researchers suggested that their evidence supported the "strong" form of the efficient market hypothesis, which holds that current prices of securities completely reflect the effects of all relevant information. Efforts to acquire and analyze this information cannot produce consistently superior results. Therefore, they characterized mutual funds' efforts to "beat the market" as futile.

There are few differences in the results on the mutual funds' performance reported by the studies of the 1960s and 1970s. Some differences in the results appeared. McDonald (1974), Mains (1977), and Kon and Jen (1979) (MMKJ) concluded that because of transaction costs and management fees, mutual funds as a whole showed neither significantly "superior" nor "inferior" performance. Put another way, the mutual funds were neutral performers. However, some managers had shown superior ability in stock selectivity and market timing.\(^7\)

Given the selected levels of systematic risk, managers in the mutual fund sample in MMKJ did not consistently predict security prices well enough to outperform the naive policy (combinations of the riskless asset and market portfolio) by a margin sufficient to recoup all management fees and brokerage commissions. This finding is consistent with the "strong" form of the efficient market hypothesis and the evidence in Jensen (1968) or Kon and Jen (1979). MMKJ's results could not reject the idea that mutual funds should abandon security selection and market timing activities in favor of

\(^7\)Stock selectivity, which is known as "security analysis," means mutual funds' superior ability to forecast price movements of selected individual stocks (i.e., micro forecasting). Market timing means fund managers' ability to forecast price movements of the general stock market as a whole (i.e., macro forecasting).
buy-and-hold policies. However, Mains (1977) began acknowledging the overall superior selectivity performance of the mutual fund managers through some modification in Jensen's methodology in the late 1970s.

More studies of the superior abilities of mutual funds' managers in selectivity performance and market timing activity occurred in 1980s.8 Although more rigorous studies with many different methodologies9 have attempted to rebut the evidence of the first generation of studies, their common conclusions in the 1980s differed little from those of the 1970s. Even though the later researchers discussed partial evidence concerning mutual funds' superior abilities, they found neither skillful market timing nor clever security selection abilities in abundance in observed mutual fund return data. Thus, they agreed with the general conclusion of the prior literature that mutual funds could not, collectively, outperform a passive investment strategy.

In the 1980s, several studies on mutual funds' performance produced a modified efficient market hypothesis (EMH) whereby only some investors (i.e., informed traders) can afford the cost of collecting and acting on information. Hence these informed traders will earn higher returns than passive investors, but their profits from stock selection should only offset the costs of collecting information (Ippolito, 1993). This revised EMH, as introduced by Grossman and Stiglitz (1980), gives a different idea of

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EMH, emphasizing that security prices include all available information after a set of active investors expends resources to ensure this result. After allowances for expenses (and in equilibrium), the two investment strategies produce equal results. The market, as a whole, benefits from the activity of active investors because when they act on new information, others observe their actions, copy the actions, and thereby drive the market toward values that incorporate all available information, even though not all investors actually possess all information.

Those past studies have furnished partial evidence that some fund managers have superior ability. However, the overall findings generally agree with the hypothesis that actively managed mutual funds (net of expenses) do not perform significantly better than index funds. This conclusion does not suggest that all fund managers efficiently expend resources in search of new information all the time, nor does it suggest that fund managers as a whole spend money wisely in every period.

Evidently, most of the previously mentioned studies utilize performance data of mutual funds without using collective institutional investment performance data. Therefore, those researchers did not determine whether industry-wide data would produce results similar to those found in the individual studies using data for mutual funds.

**Firm-Size Effect and Institutional Holdings Relationship**

Previous research has identified that institutional investors receive partial excess returns, but has not identified the causes of those partial excess returns. One causal
factor may be the firm-size effect. Small-firm-effect research has thus far sampled data for individual stocks traded on the NYSE, AMEX and OTC markets. The results indicate an inverse relationship between the market value of firms and their excess returns.

This study samples securities partly or exclusively owned by institutional investors in an attempt to determine whether institutional investors prefer small firms to large firms in their portfolio construction. If so, institutional investors with greater equity position in small firms would more likely maximize portfolio returns than those with a strong equity position in the large firms.

Because institutional holdings and risk-adjusted average rates of return also vary with firm size of the stock in the portfolio, some investigators looked at the relationship between institutional ownership and firm size. Demsetz and Lehn (1985, p1167) found an inverse relationship between ownership concentration and firm size measured by the market value of equity. Large firms exhibited a distinct separation between ownership and control. The large market value of the firms and the wide dispersion of shareholdings meant that institutional owners could not hold a sizable percentage of a given firm's shares. The more-concentrated ownership structures of smaller firms, however, may have facilitated relatively substantial institutional holdings of their stock. Therefore, Demsetz and Lehn theorized a possible inverse relationship between firm size and institutional ownership.
R&D Expenditures

A recent study by Hansen and Hill (1991) on the relationship between the levels of institutional ownership and R&D spending reversed the previous views that institutions invest for the short term (Chote and Linger, 1986; Drucker, 1986 in Hansen and Hill). Most of the research that used financial data for the late 1970s and early 1980s had characterized institutional portfolio managers as myopic investors who prefer to look at short-term stock prices. Consequently, that research had concluded that firms owned significantly by institutional investors tended to reduce their R&D spending. In the long term, reduced R&D spending would cause declining innovation, low productivity, and reduced competitiveness (Thurow, 1985).

Kochhar and David (1996) rebutted this traditional view. They concluded that institutional investors look for long-term benefits from their investments in the equity of a firm. This study seeks to determine whether a positive relationship between institutional holdings and R&D spending affects a portfolio's stock return.

Data Formation

This study utilizes monthly return data from January 1989 to December 1996 for stocks traded on the NYSE, AMEX, and OTC which meet the following additional criteria:

1. They must have data such as assets, stock price, and R&D expenditures available on Compact Disclosure.

2. The stocks must be held by at least one institutional investor.
This study employs a two-way grouping procedure to form portfolios for testing purposes. The entire sample of firms is classified into five portfolios based on the degrees of each of those variables.

For example, to test for firm size effects, the total assets of all firms are calculated as of October of each year from 1989 to 1996. Firms are ranked on the basis of their assets and placed into one of five portfolios. Hence, a small firm portfolio, a large firm portfolio, and three intermediate firm portfolios are created. Second, the monthly returns of firms within each portfolio are combined with equal-weights ($I/N$) to calculate the monthly return of the portfolio. Those five portfolios are compared, first, to each other (i.e., between a small firm group and a large firm group), and second, to market returns to see if there are any abnormal risk-adjusted returns. Each year new rankings are calculated, and the process is repeated. Two statistics, which are Jobson and Korkie's (1981) transformed Sharpe measure as well as Sharpe measure and Jensen's alpha measure, are applied to detect any firm size effect using these five portfolio returns. Remaining variables follow the same procedure as the firm size test.

However, for institutional holdings and R&D expenditures variables, this study employs another two-way grouping procedure to form portfolios. The entire sample is classified based on the three levels of institutional holdings and three levels of R&D expenditures. Group 1 contains stocks with the smallest percentage of ownership by institutions, while groups 2 and 3 contain an equal number of firms with equally increasing percentages of ownership by institutions' holdings.
Next, each subset portfolio is rearranged from high to low R&D expenditures to form approximately three equal-sized data sets. The final step is to divide the data set sample firms into three groups corresponding to the three levels of R&D expenditures. Any stocks with negative book value or negative market value are removed.

This procedure, which is similar to the procedure of Chan et al. (1991), results in nine portfolio groups. This portfolio formation procedure is performed in October of each of the years 1989 to 1996 to reflect changes in the variable levels.

Two statistical tests are applied. One is Jobson and Korkie's (1981) transformed Sharpe measure. The Jobson and Korkie's method was useful in single comparison. The other is Jensen's alpha measure based on the CAPM. Treynor measure, however, will not be used in this test because this measure was inappropriate for investors who have all of their assets in a portfolio (Jones, 1996).
CHAPTER 2

REVIEW OF RELATED THEORIES

Introduction

This study analyzes the performance of institutional investor portfolios relative to other firm quality characteristics such as systematic risk (β), volatility, firm size, and R&D expenditures. It examines the correspondence between institutional portfolio performance and changes in percentage of institutional holdings of stocks. The basis for this study derives from theories of an efficient market, mutual fund performance, β analysis, volatility (σ), firm size, and R&D spending, as well as previous empirical research providing evidence supporting these theories.

This chapter briefly reviews EMH, institutional performance evaluation, β constant, firm size, and R&D expenditures in terms of institutional investor stock holdings.

Institutional Investor Holdings of Corporate Stocks and Institutional Portfolio Performance

Institutional investors represent one of the fastest growing financial intermediaries in the American economy. Pension funds, life and property-liability insurance companies, investment companies, commercial banks, and other financial
institutions exemplify these investors. Berle and Means called attention to the emerging power of institutional investors in 1932, and institutional holdings of corporate stocks have continually increased since then. The Federal Reserve (Szewczyk et al., 1992) reported that institutional holdings of common stock increased from approximately 15% of total outstanding equity in 1968 to over 30% in 1986. Recent research has examined the role of institutional investors in an attempt to determine how large investment institutions affected stock prices, firms' investment behavior, portfolio returns, executive compensation, and other aspects of market behavior.

**EMH (Efficient Market Hypothesis)**

In an efficient market, investors have a wide array of relevant information available in a timely and low-cost manner. Security prices, therefore, reflect this information quickly and fully. Fama (1976) postulated three levels of market efficiency: weak, semi-strong, and strong. Each gradation corresponds to the amount of "available information" that the price reflects. According to the strong form of EMH, prices fully and instantaneously reflect all available relevant information; therefore, current prices provide accurate signals for capital allocations. This theory, however, does not imply perfectly competitive capital markets or costless information. Nor does it rule out some clever managers and some poorly performing ones (whether by lack of skill or lack of luck); it merely implies vigorous competition in capital markets.
What if someone earns unusual returns after consideration of all transaction costs, even over a long period of time? Does this imply market inefficiency? Then why do anomalies occur even in an efficient market? Even fairly priced stocks pose firm-specific risk that managers can eliminate through diversification. Therefore, a professional portfolio manager with a well-diversified portfolio can still earn consistently greater-than-normal returns through either skillful ability or luck, even in an efficient market.\(^{10}\) However, not all mutual fund managers can earn abnormal returns. This means only a small number of professional investment superstars can consistently achieve superior performance.\(^{11}\)

Do markets perform efficiently? Yes.\(^{12}\) Most research on professional managers’ risk-adjusted performances concludes that markets act efficiently, but markets reward especially diligent, intelligent, or creative managers (Bodie et al., 1996).

\(^{10}\)For example, see Kon and Jen (1979).

\(^{11}\)Peter Lynch, Warren Buffet, John Templeton, and John Neff are among those mutual fund managers who have achieved a consistency of superior performance over an extended period (Smith et al., 1992; Bodie et al., 1996).

\(^{12}\)The strongly efficient markets hypothesis requires that security prices reflect all information; in this formulation, even private information is available to the marketplace. Therefore, no one who trades on short-term security price movements can earn a profit larger than what could be earned with a naive buy-and-hold strategy. According to the strongly efficient market hypothesis, even those who possess inside information would not be able to earn an abnormal profit from it.

However, some empirical studies show that corporate insiders and a small number of professional investors can achieve consistently superior performance. In the efficient market theory, this kind of observed phenomenon which, according to theory ought not to happen but indeed does happen, constitutes an "anomaly."
Ippolito (1993) introduced two approaches to a modern efficient market theory (EMT). The traditional view on EMH (across all three forms) holds that security prices already include all available information. The three forms of the EMH differ on the information considered available to the market. This traditional view implies equal returns across active and passive portfolios before subtracting trading and investment expenses, thus rendering active trading counter-productive. The other, a relatively new theory stressed by Grossman and Stiglitz (1980), argues that investors have an incentive to spend time and resources to analyze and uncover new information only if such activity will likely generate higher investment returns to the investors engaging in such private information creation and search. Thus, in market equilibrium, efficient information-gathering activity should produce favorable results.

Those two approaches explain how information gets embedded in prices. The EMT means that security prices include all available information after a set of active investors expend resources to obtain and act on it. The EMT means that, in equilibrium, investments in active and passive portfolios produce equal results (net of expenses).

**Institutional Performance Evaluation**

Because of the ready availability of data, financial analysts tend to use mutual fund performance as a proxy for all institutional investment performance. As a result, mutual fund performance has served as the basis for most of the historical review of institutional performance discussed in this section.
Ippolito (1993) raised doubt that mutual funds' performance results represent the totality of institutional investors' performance. Empirical studies do not yet address Ippolito's conjecture. Friend, Brown, Herman, and Vickers (1962)—and later Fama (1965)—conducted the first extensive and systematic study of mutual fund performance. However, these early researchers did not consider risk in the measurement of performance, so their studies did not provide appropriate empirical studies of mutual fund performance.

Treynor (1965), Sharpe (1966), and Jensen (1968, 1969) conducted the most-cited studies on mutual fund performance. These models are called "one-parameter performance measures,¹³" because these measures utilize one number that reflects both risk and return simultaneously in the evaluation. The one-parameter studies made it possible to rank performance data and compare them to a naive market standard. These one-parameter measures use the CAPM as the basis of the models used in studying mutual fund performance. However, these measures differ from the two parameters in the CAPM, developed by Treynor (1961), Sharpe (1964), Lintner (1965), Mossin (1966), and Fama (1968). CAPM takes an ex ante single-period model to forecast expected rates of return for financial assets. However, the one-parameter measures now serve as models for evaluations or rankings of portfolio performance.

Treynor (1965) devised a performance measure by relating portfolio excess return to its systematic risk (β) through the CAPM equation. Treynor's measure yields

¹³These measures, often referred to as the composite (risk-adjusted) measures of portfolio performance, mean that portfolio performance measures combine return and risk into one calculation.
return per unit of systematic risk.\textsuperscript{14} This measure, a reward-to-volatility ratio (RVOL), provides a way to rate the performance of a fund's investment managers. The slopes of characteristic lines decide performance rates among funds. The slope of the characteristic line measures the relative volatility of the fund's returns. The slope of this line—the $\beta$-coefficient—measures the volatility of the portfolio's returns in relation to those of the market index. Higher values of RVOL indicate better performance.

Jensen (1968) modified the characteristic regression line\textsuperscript{15} to make it useful as a one-parameter investment performance measure. Jensen's measure focuses on detecting fund managers' superior ability in selectivity, represented by alpha ($\alpha$), in a modified CAPM-based equation.\textsuperscript{16} A superior forecaster will tend to select

\textsuperscript{14}Treynor's index of portfolio performance, denoted $T_p$, for the $p_\text{m}$ portfolio is likely: $$T_p = \frac{\text{risk premium}}{\text{systematic risk}} = \frac{r_p - R_f}{\beta_p}$$ where $r_p$ and $R_f$ are the average rate of return of portfolio $p$ and risk-free rate, respectively. And $\beta_p$ is beta coefficient of the portfolio.

\textsuperscript{15}Sharpe (1963) developed a simplified model of portfolio analysis. While Sharpe called his model the "diagonal model" and others have occasionally referred to it as the "single index model," it is now generally referred to as the "market model."

\textsuperscript{16}Jensen's measure (1968, 1969) is based on the asset-pricing implications of the CAPM. If the CAPM is true and security rates of return are multivariate normal, then the expected return on any security (or portfolio), given the outcome of the market portfolio, is

$$E(R_p) = \tilde{\beta}_m (R_m - R_f) + \tilde{\beta}_p (\tilde{R}_m - R_f)$$ \hspace{1cm} (2-1)

Where $\tilde{\beta}_j = \text{covariance} (\tilde{R}_m, \tilde{R}_{jt})/\text{var}(\tilde{R}_m)$. $\tilde{R}_m$ and $R_f$ are the return on a market proxy and risk-free rate in period $t$, respectively.

Assuming that the asset pricing model is empirically valid, equation (2-2) says that the realized returns on any security (or portfolio) can be expressed as a linear function of its systematic risk, the realized returns on the market portfolio, the risk-free rate and a random error, $\tilde{\epsilon}_m$, which has an expected value of zero, where tilde denotes random variable.

$$\tilde{R}_m = R_f + \tilde{\beta}_p (\tilde{R}_m - R_f) + \tilde{\epsilon}_m$$ \hspace{1cm} (2-2)

By subtracting $R_f$ from both sides of equation(2-2), the excess return form
underpriced securities; hence, the portfolio will earn more than the "normal" risk premium for its level of risk. Estimating a regression based on the superior forecasting ability of fund managers, therefore, generates a non-zero constant in the regression equation. In this case, alpha simply indicates the vertical distance from the ex post CAPM. An alpha equal to zero indicates an equilibrium portfolio or asset. An alpha greater than zero creates a larger expected return than one would anticipate on the basis of the equilibrium relationship. An alpha less than zero signifies an overvalued security. The appraisal ratio refines Jensen’s measure and equals the ratio of Jensen’s $\alpha$ of the portfolio to the nonsystematic risk of the portfolio. It measures abnormal return per unit of risk that holding a market index portfolio could eliminate through diversification.

\[ \bar{R}_j - R_p = \beta_j (\bar{R}_m - R_p) + \varepsilon_j \]  \hspace{1cm} (2-3)

is obtained. The left-hand side of (2-3) is the risk premium earned on the $j$th security or portfolio.

As long as the CAPM is valid, this risk premium is equal to $\beta_j (\bar{R}_m - R_p)$ plus the random error term $\varepsilon_j$. Jensen’s (1968, 1969) measure of mutual fund $j$’s performance for period (observation) $t$ is

\[ \alpha = \bar{R}_j - R_p - [\beta_j (\bar{R}_m - R_p) + \varepsilon_j] \]  \hspace{1cm} (2-4)

Where $\alpha > 0$ indicates that the security (or portfolio) has yielded a return in period $t$ greater than the return on a combined investment in the market portfolio and risk-free asset with the identical level of systematic risk. This is possible because of a superior forecasting ability not available to others. Hence he will tend to systematically select securities which realize $\varepsilon_j > 0$.

Therefore, Jensen (1968) allows for a nonzero constant in (2-4) by using the estimating equation

\[ \bar{R}_j - R_p = \alpha_j + \beta_j (\bar{R}_m - R_p) + \varepsilon_j \]  \hspace{1cm} (2-5)

Where the new error term $\varepsilon_j$ will now have $\varepsilon_j = 0$, and should be serially independent $(0, \sigma^2)$. Equation (2-5) is called in this paper the "modified CAPM-based equation." $\alpha_j$ is the performance measure, and $\beta_j$ is assumed stationary. Thus if the portfolio manager has an ability to forecast security prices, the intercept, $\alpha_j$ in (2-5) will be positive.
Jensen's measure, however, has one crucial weak point: when applied to a multiperiod portfolio measure, it assumes a constant systematic risk through time to satisfy the assumptions of the estimating equation. However, this may directly conflict with the notion of a "managed" portfolio (Kon et al., 1979) because a mutual fund manager's ability relates closely to timing ability. This, in turn, means a non-constant level of $\beta$, whereas Jensen's measure, "constant systematic risk," means a constant level of $\beta$.

At approximately the same time that Treynor developed his measure, Sharpe (1966) also developed a way of measuring portfolio performance. Sharpe's measure differs little from Treynor's index, except that it divides the standard deviation of the portfolio return into the risk premium. Sharpe's measure, called a reward-to-variability measure (RVAR), divides Jensen's measure by the standard deviation of the return. It measures the excess return per unit of total risk. As with RVOL, the higher the RVAR, the better the portfolio performance.

However, Miller and Gehr (1978) found an upward bias in Sharpe's index, especially when it has a small (less than 50) sample size. Later, Jobson and Korkie (1981) devised a statistical test (called a transformed difference) for measuring risk-adjusted performance. Sharpe's portfolio performance measure does not provide a

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17Sharpe's measure divides average portfolio excess return over the sample period by the standard deviation of returns over that period. It measures the reward to total volatility trade-off. $\tilde{S} = \text{risk premium/total risk} = (\bar{r} - R_f) / \sigma_p$, where $\bar{r}_p$ = average return from portfolio $p$, $R_f$ = riskless rate of interest, and $\sigma_p$ = standard deviation of returns for portfolio $p$.

18This bias comes from Sharpe's sample variance estimator. For more detail, see Miller and Gehr (1978).
statistical decision on performance superiority. It simply provides numerical value. However, this transformed Sharpe measure made it possible to provide statistical properties of the traditional Sharpe's measure when using it for comparisons. This transformed Sharpe measure proved beneficial even for small sample sizes.\(^\text{19}\)

Jensen's and Treynor's measures can apply to any portfolio as well as to individual securities; Sharpe's measure, however, applies only to purportedly efficient portfolios\(^\text{20}\) (Friend and Blume, 1970).\(^\text{21}\) This difference comes from their different mathematical derivations.\(^\text{22}\) Jensen's measure and the other two differ in another way. Treynor's and Sharpe's measures can apply to one-parameter portfolio rankings, whereas Jensen's measure cannot because it measures only vertical deviations from the

\(^{19}\) For example, a Z statistic based on transformed differences for Sharpe's measure behaved well even at small sample sizes. Jobson and Korkie (1981) devised a transformed Sharpe measure by employing Taylor series expansions for approximations of estimators. This measure exhibits increased statistical power when used for single comparisons. Chapter 5, the section on methodology, will deal in more detail with Jobson and Korkie's transformed Sharpe measure.

\(^{20}\) An efficient portfolio has either the smallest portfolio risk for a given level of expected return or the largest expected return for a given level of risk. The efficient portfolio results from combining the risk-free asset and market portfolio (M) on the efficient set.

\(^{21}\) Investors who have all (or substantially all) of their assets in a portfolio of securities should rely more on the Sharpe measure than the Treynor measure. Sharpe's measure assesses the portfolio's total return in relation to total risk, which includes any nonsystematic risk assumed by the investor. However, for those investors whose portfolio constitutes only a (relatively) small part of their total assets, systematic risk may well equal the relevant risk (Jones, 1996).

\(^{22}\) If portfolio \(i\) is an efficient portfolio, equation (2-1) in footnote 17 becomes

\[
\frac{(E(R_m) - R_f)}{\sigma_m} = \frac{(E(R_i) - R_f)}{\sigma_i}
\]

(2-6)

because only in an efficient portfolio does \(\rho(R_i, \mu_m)\) become one.

Equation (2-6) states that the excess return per unit of risk for an efficient portfolio equals the excess return per unit of risk for the market portfolio. The right-hand side of equation (2-6) is the Sharpe index. This is a part of Sharpe's equation derivation. For more detail, see Sharpe (1964, 122) and Friend and Blume (1970, 563).
characteristic regression line. However, with a completely diversified portfolio, all three measures agree on the ranking of portfolios. Many mutual fund studies for the last 20 years have used these three one-parameter performance measures.

Most of the theoretical and empirical research in the 1960s focused on the performance of micro forecasting portfolio managers (i.e., individual stock pickers). Those empirical studies sought to determine whether, overall, mutual fund managers achieved abnormal returns. They based their measurements on a mean-variance capital asset pricing model framework that expressed the one-period excess return on security \( i \) as in equation (2-5) in footnote 16.\(^{23}\) Alternatively, those researchers sought a structural specification that would measure investment performance and identify superior performers like Treynor and Sharpe (1966).

Much of the mutual fund research in the 1970s and 1980s focused on identifying details of abnormal returns rather than simply determining whether managers achieved above-normal returns from their investment portfolios. Investment portfolio research in the 1970's and 1980's tended to address one of the three following areas: (1) forecasts of price movements of selected individual stocks (i.e., "micro forecasting"), represented by \( \alpha \); (2) forecasts of price movements of the general stock market as a whole (i.e., "macro forecasting"), represented by \( \beta \); and (3) \( \beta \)-constant.

\(^{23}\)Carlson (1970), Jensen (1968), Kon and Jen (1979), Mains (1977), McDonald (1974), and Sharpe (1966) are examples of research in this area.
Since theories related to the first two areas related closely to each other, this section of the study discusses these two areas, and the next section discusses β-constant theories.

Timing and Selection Ability

A number of studies have investigated mutual fund performance by looking at selectivity and timing. Those studies attributed superior performance to timing, selection ability, or some combination of the two.

Selection Ability

Security selectivity decisions involve the forecasting of price movements of individual common stocks. According to the security market line (SML) in the CAPM, the market has underpriced a security lying above the SML. For its level of risk, it has an expected return greater than that suggested by the SML as an "equilibrium" value. Similarly, the market has overvalued a security located below the SML. For its level of risk, it has a lower expected return than the corresponding CAPM "equilibrium" value. Therefore, the system tests superior ability in security selectivity by looking at the alpha distance as in (2-5) in footnote 17 above the SML in the CAPM. A positive or negative alpha of a portfolio results from regressing the excess return of the fund's portfolio against the excess return of the market portfolio. A portfolio manager with

superior forecasting ability who tends to select securities located above the SML will earn more than the "normal" residual premium for the portfolio's level of risk.

Allowance for such forecasting ability requires simply not constraining the estimating regression equation to pass through the origin. A nonzero constant in the market's excess return regression creates a positive "alpha" in the excess return regression; the positive alpha indicates superior selectivity talent on the part of the fund manager. Most of this financial research utilized Jensen's alpha (1966, 1968) measures.

**Timing Ability**

Market timing involves forecasting both general stock market price movements and interest rates. More accurately, timing involves shifting funds between a market index portfolio and a safe asset, such as Treasury bills (T-bills) or a money market fund. The alternative chosen will depend on whether the forecaster expects the market as a whole to outperform the safe asset. Additionally, it requires a decision to vary the total systematic risk of the portfolio in response to expectations concerning the size and direction of market price movements. Jensen (1968) suggested that a manager who (correctly) perceives a high probability that market returns will increase in the next period can increase portfolio return by increasing its risk. On the other hand, with an expectation of a down market, the manager can reduce losses by reducing the risk level of the portfolio. In the CAPM context, β manipulation represents timing ability.

The expected return of a portfolio depends on accurate estimates of not only each security's $\alpha_i$, but also each security's $\beta_i$. It also depends upon correct
macroeconomic forecasts of average market rate of return (\( \bar{R}_m \)) and risk-free rate (\( R_f \)). However, since the manager can forecast \( R_f \) with relatively high confidence, market timing basically refers to the average market rate of return forecast relative to the risk-free rate. The beta of the portfolio for a manager engaged in market timing should increase in direct proportion to the quantity \( (\bar{R}_m - R_f) \). This will, in turn, result in a greater expected return for the portfolio.

Alexander and Francis (1986) showed that a manager can change the beta of the portfolio in one of three ways. First, the manager can raise or lower the proportion of the portfolio invested in the risk-free asset, depending on the market forecast. Here the manager holds the relative composition of the risky portion of the portfolio fixed while allowing its overall proportion to vary in lockstep with alterations in the risk-free asset proportion (since the two proportions have to sum to 1). Second, while keeping constant the proportion of the portfolio invested in the risk-free asset, the manager can alter the composition of the portfolio's risk. Given the goal of raising \( \beta_p \), the manager can sell low-\( \beta \) stocks and replace them with high-\( \beta \) stocks. The third method for altering portfolio \( \beta \) simply utilizes some combination of the two previous methods.

Treynor and Mazuy (1966) pioneered the development of the curved characteristic line by adding a squared term to the usual linear index model. For example, an investor who can correctly predict bull and bear markets likely will shift more funds into the portfolio in the early part of a bull market. This shift in funds will make the portfolio characteristic line curve upward.
Fama (1972) and Jensen (1972) developed theoretical structures for evaluating an investment manager’s micro- and macro-forecasting performance. A comparison between the ex post performance of the manager’s fund and market return provides a basis for that evaluation. Jensen (1972) developed a method for identifying the separate contributions of micro- and macro-forecasting. It requires an understanding of the market-timing forecast, the portfolio adjustment corresponding to that forecast, and the expected return on the market.

A number of researchers—Kon and Jen (1979), Admati et al. (1986), Henriksson and Merton (1981), Connor and Korajczyk (1986), and Lee and Rahman (1990) among others—have attempted to separate the micro-forecasting effects of investment managers from macro-forecasting for the market as a whole. Using the Quandt switching regression model and a CAPM framework, Kon and Jen (1979) examined the possibility of changing mutual fund portfolio market-related risk levels over time. They used a maximum likelihood test to separate their data sample into different risk regimes, and then they ran the standard regression equation for each such regime. They found evidence that many mutual funds had discrete changes in the level of market-related risk chosen. This finding agreed with the view that managers of such funds attempted to incorporate market timing into their investment strategies.

Admati et al. (1986) used the portfolio approach and the factor approach to dichotomize between timing ability and the ability to select individual assets. The portfolio approach restricts timing information to returns on a pre-specified set of timing portfolios. This approach excludes selectivity information relating to timing.
portfolio returns, but it includes information about some other asset returns. The factor approach utilizes timing information about the realization of factors that affect the returns of many assets, but it does not restrict this information to pre-specified timing. Selectivity under the factor approach allows for any specific determinants of individual asset returns without restriction.

Admati et al. (1986) developed two intuitive information characterizations: (1) selectivity information statistically independent of returns on timing portfolios, and (2) different types or coordinates of selectivity information applicable to different assets. Merton (1981) proposed an equilibrium theory of value for qualitative forecasts of whether stocks will outperform bonds. Based on Merton (1981), Henriksson and Merton (1981) presented statistical techniques for testing forecasting ability with a particular emphasis on the market-timing ability of investment managers. They presented both parametric and nonparametric tests of market-timing ability. The parametric tests require the assumption of either the CAPM or a multifactor return structure. Based strictly on observable returns, the tests permit identification of the separate contributions from market-timing ability and micro forecasting.

Other studies on timing and selectivity included Fabozzi and Francis (1979), Alexander and Stover (1980), and Lee and Rahman (1990). They all found at least some evidence that mutual fund portfolios do not maintain a constant risk posture over time, and they concluded that fund managers' decision processes might include attempts at market timing.
Testing timing ability for fund managers requires a time-series analysis based on specific performance data of institutional investors. As mentioned before, the test of timing ability includes the alteration of the proportion invested in a portfolio’s risky or safe assets. However, this study mainly focuses on measuring portfolio performance of all institutional investors’ selection ability, based on portfolio simulation. The test of institutional investors’ timing ability lies beyond the scope of this study.

Beta (β) Analysis

Portfolio-β Constant

Most mutual fund performance evaluation research in the 1960s and early 1970s typically employed a one-parameter risk/return benchmark like that developed by Jensen (1968). Black, Jensen, and Scholes (1972), as well as Blume and Friend (1973), refined the analytical system. Such investigations effectively focused on fund managers’ security selection skills, and they assumed constant risk levels through time.

This assumption no longer suffices because mutual funds with generally active management should have a changing level of systematic risk as a result of the buying and selling decisions of the fund managers. For example, a manager who can make better-than-average forecasts of future realizations on market factors will likely adjust to portfolio risk in anticipation of market movements. That manager can shift the overall risk composition of the portfolio in anticipation of broad market price movements. Kon and Jen (1978) regarded the risk level of a managed portfolio as a decision variable resulting from timing activities.
This study assumes that institutional portfolio managers are limited to selecting stocks, not to timing the market. Managers' timing ability relates to beta-constant portfolios. However, the study of portfolio beta-constant lies beyond the scope of this study; this study assumes portfolio simulation at the individual stock's beta level rather than at the portfolio's beta level. From this point on, therefore, this study will discuss only literature concerning beta-constant individual securities.

Individual Stock-β Constant

Research often measures β, which represents systematic risk of an individual stock, by applying ordinary least squares (OLS) regression to a time series of returns of that individual stock paired against the market. This OLS model assumes a constant beta through time in the regression expression. However, much research has attempted to determine whether the systematic risk of an individual firm’s stock remained constant. Much of this research has tested the constancy of common stocks’ betas. Although one study has found a stationary beta, most evidence has indicated nonstationary βs for individual securities. Examples of this work have included Blume (1971, 1975), Fabozzi and Francis (1977, 1978), Sunder (1980), Bey (1983), Lee and Chen (1982), and Ohlson and Rosenberg (1982).

The studies by Blume (1971, 1975) represented the pioneering work that first subjected the concept of a constant beta to close empirical scrutiny. Based on seven-year estimation periods, he found that beta tended to regress toward the grand mean of unity. For example, a portfolio which had an extremely high estimated beta in one
period tended to have a less extreme estimate in the following period. Blume concluded that portfolio betas remained stable over relatively long periods, and that individual stocks had unstable betas.

If a manager disregards non-constant betas in the risk-return relationship, the resulting estimate of beta may provide misleading performance information. Managers, therefore, must pay attention to this beta constant. Previous research has developed several different stochastic parameter models for non-constant beta, particularly a random coefficient model and a first-order autoregressive process. The former model states that each period's beta for a given stock represents a normally distributed random variable with a mean of beta. The latter model tests for a first-order autocorrelation, or whether the error in period t depends on the error in the preceding period. Fabozzi and Francis (1978), Lee and Chen (1980), Alexander and Benson (1982), and Lee (1982) used the random coefficient model. Sunder (1980) and Ohlson and Rosenberg (1982) considered the first-order autoregressive model.

What causes a firm's systematic risk to change? Beaver, Kettler, and Scholes (1970) conducted much of the research in this area. Their research indicated that financial leverage changes, operating leverage, cash dividend yield, the degree of cyclicality of firm revenues, and earnings growth contributed to systematic beta changes. Rosenberg and Guy (1976a, 1976b) indicated that the change of beta may have arisen through the influence of either microeconomic or macroeconomic factors. They cited operational changes in the company or changes in the business environment peculiar to the company as possible microeconomic factors; they suggested the rate of
inflation, general business conditions, and expectations about relevant future events as possible macroeconomic factors.

One study tested the hypothesis of constant beta coefficients. Brenner and Smidt (1977) tested a specific non-constant beta model against a constant beta model. Their study of 726 NYSE-listed securities supported the constant beta hypothesis.

The $\beta$-Return Relationship

Sharpe (1964), Lintner (1965), and Black (1972) developed the mean-variance capital asset pricing model (CAPM). Other investigators have published studies on the relationship between beta risk and average return in the securities markets; however, not many of the studies have demonstrated any significant relation between beta and average returns. Their beta risk represented the slope in the regression of a security's return against the market's return, given the efficient market portfolio viewpoint.

Friend et al. (1970) published the first important study on the beta-return relationship. They studied 103 mutual fund performances based on the measure of risk theoretically most appropriate for investors taking advantage of market diversification opportunities. Their results showed a high positive correlation between mutual funds' beta coefficients and average rates of return. Fama and Macbeth (1973) confirmed these results in a test of the relationship between return and risk for NYSE common stocks. Their study revealed a positive tradeoff between return and risk, as well as a linear relationship between a security's portfolio risk and its expected return.
Using monthly returns in the period 1960-1969, McDonald (1974) studied the risk and return relationship of 123 United States mutual funds. He found that the market-based portfolio fund line sloped more steeply than the market line. He concluded that high-beta funds generally "outperformed" low-beta funds for market-based portfolios of equal systematic risk. Additionally, he found a positive relationship between the market risk beta and average rate of return.

Some previous research has shown that beta risk and average rate of return do not always have positive correlations, especially in a declining market. Shawky (1982) found a negative correlation in the bear market risk-return relationship of mutual funds. His results also showed that the slope of the risk-return relationship strongly depended upon the market during the estimation period. A bull market or upward turn produced a positive slope; conversely, a bear market caused a negative slope.


Badrinath et al. (1989) found a positive relationship between CAPM betas and levels of institutional ownership. Holding a stock with a high beta increased the expected return if the portfolio outperformed the market. The high beta meant stock

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25 Friend, Blume, and Crockett, (1970, 56) found that high-risk funds performed better than lower-risk funds during the period studied. Chan and Lakonishok (1993) subsequently mentioned this finding.
price volatility and that when the market rose, the price of a high-beta stock moved up even faster.

Even though portfolios with high beta stocks bear a "loss" in case of sub-market performance, institutional managers prefer higher beta stocks to lower beta stocks. Despite their preferences for higher betas, institutional investors restrict their investment activities to the stocks of firms with large market values. Those firms have less-risky stocks than do firms with lower market values (Badrinath et al., 1989), and they reduce the potential magnitude of loss in case of sub-market performances.

Sias (1996) presented an opposite theory on the relationship between stock volatility and the institutional investor. Previous academic theory had argued that the higher betas of riskier securities attracted institutional investors. Sias argued that institutional investors played a destabilizing role in financial markets and that increases in institutional holdings resulted in increased volatility.

**Firm Size and Institutional Holdings**

The small-firm effect is a market efficiency-related anomaly. According to Banz (1981), the stocks of small NYSE firms tend to earn higher average risk-adjusted returns than the stocks of large NYSE firms. Banz (1981) found that both total and risk-adjusted rates of return tended to fall with increases in the relative size of the firm. This size effect appears to have persisted for over forty years.

Reinganum (1981), using a sample of both NYSE and AMEX firms, also found that returns on common stocks appeared to correlate negatively with the aggregate
market values of the securities. Later studies—Keim (1983), Reinganum (1983), and Blume and Stambaugh (1983)—showed that this small-firm effect occurred almost entirely in the first two weeks of the year, thereby making it a “small-firm-in-January” effect (Bodie et al., 1996).

Why have small stocks provided higher risk-adjusted returns than large stocks, and why has the superior performance of small stocks occurred in January? Roll (1982) suggested that the small-firm effect might result from improper estimations of security betas. Roll said that standard beta estimates derived from daily data seriously understated the actual risk of a small firm. However, Reinganum’s research (1982) did not support Roll’s conjecture on the firm size effect. He concluded that although the direction of the bias in beta estimation agreed with Roll’s argument, the small-firm effect occurred nevertheless, even after controlling for trading frequency.

Another explanation of the small-firm effect came from liquidity theory as researched by Amihud and Mendelson (1989). They performed a joint test with all the variables—systematic risk (β), residual risk, size, and the bid-ask spread—hypothesized to affect expected returns. Their argument started with the proposition that the expected return increased with the asset’s systematic risk, residual risk, and market value; it decreased with the number of investors who had access to information about it and who invested in it. They found a highly significant bid-ask spread and a negligible size influence. Smaller stocks had larger bid-ask spreads, and the bid-ask spread dominated size in a joint test of the two variables’ relationships to return. Size assumed
importance only because smaller stocks had lower liquidity, and, therefore, larger bid-ask spreads.

Keim (1983, 1986) and Roll (1983) found that roughly half of the size effect occurred in January, and more than half of the excess January returns occurred during the first five trading days of that January. The first trading day of the year showed a high small-firm premium in every year of the period studied. Ritter (1988) attributed this small-firm-in-January effect to income tax-related individual investor behavior. Individuals owned large proportions of small stocks, and, as the end of the year approached, they sold stocks held at a loss in order to receive a tax benefit. They reinvested in January, creating buying pressure that pushed the prices of small stocks upward. The low buy/sell ratio for individual investors in late December and the high buy/sell ratio early in the following January provided evidence of this pattern.

**R&D Expenditure and Institutional Holdings**

As institutional investors increased their percentage ownership of the voting stock of publicly traded companies, they influenced these firms’ operations (Pozen, 1994). Stock analysts have sought to determine whether publicly traded companies’ R&D expenditures have undergone any systematic changes and whether those changes have influenced stock prices. Three mutually exclusive viewpoints evolved concerning the effects of R&D expenditures (Kochhar and David, 1996). The first view (Drucker 1986, Mitroff 1987) treated institutional investors as “myopic” investors looking for short-term gains from their equity investments. The second view considered institutions
as interested in long-term gains from their investments, so these investors sought and invested in more innovative firms. Allen (1993), Jarrell et al. (1985), and Jensen (1988) supported this perspective. The third view (Aoki 1984, Taylor 1990, Useem 1993) considered that the large holdings of these investors provided them with an incentive to monitor firm managers and influence firm actions if necessary. Thus, self-interest motivated institutional investors to use their "voice" to influence managerial decisions, with the goal of increasing firm value.

The view that institutions invested for short-term gains received extensive support during the late 1980s. However, increasing levels of institutional ownership made it difficult for institutions to simply follow an "exit" policy of selling a stock when dissatisfied with its performance. This policy entailed increasingly more expense as institutions had to accept substantial discounts in order to liquidate their significant holdings (Coffee, 1991). The enormous level of assets controlled by institutions made efficient movement in and out of stock positions increasingly difficult (Nussbaum et al., 1987). Those movements would entail commissions when liquidating positions at lower prices and still more commissions when reinvesting the proceeds. Institutional investors, therefore, started involving themselves in corporate strategy. The last two theories—explaining how institutional investors acted as long-term investors—have recently gained more acceptance than the first one, the "myopic theory" (Kochhar and David, 1996; Hansen and Hill, 1991).
Summary

Several theories have appeared in the literature to explain the evaluation of mutual fund performance. EMH, timing and selection ability, beta constant, beta-return relationship, firm size effect, and level of R&D expenditures each have offered insights into the causal factors creating excess returns for institutional investors' portfolios. The next chapter will review previous empirical studies in those areas.
CHAPTER 3

REVIEW OF THE RELATED LITERATURE

Introduction

This chapter reviews relevant empirical studies. Section one examines literature on mutual fund performance. Section two examines the evidence concerning beta effects on portfolio performances. The first part deals with the beta constant relation to the systematic risk of a firm, and the second part deals with the beta-return relationship. Section three reviews evidence concerning the effect of firm size on return analysis. The final section reviews empirical evidence that seeks to explain relationships between levels of institutional holdings and R&D expenditures.

Mutual Funds Performance

As institutional holdings of corporate stocks have increased, a number of researchers have attempted to evaluate the performance of institutional portfolios. No clear consensus has been attained about performance evaluation. Some researchers have concluded that actively managed mutual funds outperformed index funds, while others have judged that index funds outperformed mutual funds. The latter opinion appears to have more acceptance.
Mutual funds tend to perform less efficiently than market indexes because of load fees, management fees, brokerage fees, and unreasonably established benchmarks for comparisons. A summary evaluation of mutual fund performance follows.

Most early researchers—including Treynor (1965), Sharpe (1966), and Jensen (1968, 1969)—utilized a one-parameter risk-adjusted measurement of portfolio manager performance. These researchers presumed that those managers acted as microforecasters, or individual stock pickers. The early investigators searched for evidence of superior mutual fund investment performance in terms of individual stock selection ability. Their common results revealed that mutual funds performed below the benchmark portfolio, or the naive portfolio strategy. Sharpe found a lower (0.34) reward-to-volatility (RVOL) ratio²⁶ for his sample than for the Dow Jones Industrial Index. Jensen found a -.011 average value of alpha, calculated net of expenses. This indicated that the funds earned about 1.1% less per year (compounded continuously) than they should have earned, given their level of systematic risk.

Treynor and Mazuy (1966) introduced a nonlinear version of CAPM to test for market timing ability. In the standard CAPM regression equation, a portfolio’s return has a linear relationship with the market return. However, Treynor and Mazuy argued that a manager who could forecast market returns would hold a greater proportion of the market portfolio in stocks with a high return. Their portfolio return exhibited a convex relationship to the market return. Their study showed no statistical evidence

²⁶RVAR ratio = (average return - 3.0%)/variability. For more detail, see Sharpe (1966, 125).
that investment managers of any of fifty-seven open-end mutual funds successfully outperformed the market.

Soon after publication of the one-parameter measure, Friend, Blume, and Crocket (1970) studied 103 mutual funds for the 1960-1968 period. They applied a risk-class approach to overcome the bias inherent in the one-parameter risk-adjusted approach. Their results also confirmed previous findings. Their random portfolios of NYSE stocks performed better on average than did mutual funds with equal investment in each stock and in the same risk class. Friend et al. (1970) attributed the inferior performance of mutual funds to unreasonably established benchmarks plus the effects of both mutual fund management fees and commissions.

McDonald (1974), Mains (1977), and Kon and Jen (1979) used the one-parameter model with data from the late 1950s and the 1960s in studying the investment performance of mutual fund management. Although some individual funds performed in a superior manner, the mutual fund sample showed neither significantly "superior" nor significantly "inferior" performance. Kim (1977) found a negative relationship

27This approach generated random portfolios of various sizes with equal dollar weights or with market value weights at the beginning of the evaluation period. It held such portfolios to the end of the evaluation period. To evaluate the performance of managed funds, it classified both the random portfolios and managed portfolios by predetermined risk classes.

In each risk class, it compared \( y \) (the mean return on the managed portfolios) to that on the random benchmark portfolios in order to determine which group performed better (Kim, 1978).

28The risk-adjusted benchmark portfolio approach tended to evaluate unfavorably the funds which assumed risk greater than the market portfolio in some periods and the reverse in other periods. This effect occurred because the benchmark portfolios, generated by applying realized return data to the CAPM, tended to produce "unreasonably" high returns for the mutual funds with above-average risk and "unreasonably" low returns for the funds with below-average risk (Friend and Blume [1970] as cited in Kim [1978, 387]). See Friend and Blume (1970) for details.
between risk and return. The reverse fund relationship is attributed to managers who had invested too much in risky growth stocks during the bear market.

Research on mutual funds during the 1980s shifted from evaluating overall performance to understanding the details of superior performance. Many of those studies examined the market-timing performance of mutual fund managers.

Jensen's Alpha Measure (1966, 1968) prepared the foundation for most of the research about mutual fund manager selection skills. Jensen (1968) argued that if a manager successfully predicted market movements and altered portfolio compositions appropriately, the portfolio risk estimate is forced downward and the associated measure of risk-adjusted performance (alpha hat) is forced upward. Grant (1977) reexamined Jensen's contention. He explained how market-timing actions affected selection-ability empirical test results. His research (1977) reversed Jensen's argument that as upwardly biased estimates of least-squares estimators of beta, performance estimates are biased downwardly. By ignoring timing, the previous researcher had biased portfolio alpha estimates downward. Grant traced that timing-related downward bias to a mathematical error in Jensen's report and a conceptual problem involved in Jensen's (1968) work. He showed that market-timing made the portfolio alpha's regression estimate a downward-biased measure of excess returns resulting from micro forecasting ability. Chang and Lewellen (1984), Henriksson (1984), and Lee and Rahman (1990) supported Grant's findings.

Financial researchers, nevertheless, continued to employ Jensen measures. Lehmann and Modest (1987) examined monthly-returns data for 130 mutual funds over
the January 1968 through December 1982 period. They utilized Jensen's measures to
determine the sensitivity of inferences about performance to the benchmark chosen to
measure normal performance. Their study did not determine whether mutual funds
achieved abnormal performance. However, the measures of abnormal mutual fund
performance showed considerable sensitivity to the benchmark chosen to measure
normal performance. Grinblatt and Titman (1989) used Jensen's measures to identify
mutual fund managers who exhibited superior stock selection abilities. They studied
quarterly equity holdings data for a large sample of mutual funds that operated derring
part or all of the 1975-1984 period. Like Lehmann and Modest, they concluded that
abnormal return measurement benchmarks influenced performance evaluations.
Although some fund managers turned out to be superior performers, high operating
expenses offset superior performance. Their actual returns, therefore, did not exhibit
abnormal performance.

Lee and Rahman (1990) employed the Bhattacharya and Pfleiderer model based
upon Jensen measures (1972). They produced no evidence of overall superior micro
fund manager ability, except at the individual fund level.

29However, an early study by Peterson and Rice (1980) says the choice of an index or measure
does not appear to affect the relative rankings of the portfolios. Peterson and Rice calculated quarterly
returns for 15 mutual funds over two five-year observation periods, 1967-1971 and 1972-1976. They
utilized four proxies for the market portfolio: the Dow Jones Industrial Average, the Standard and Poor's 500
Stock Index, and two indices representing an equal-weighted and a value-weighted index of all NYSE-
listed common stocks. Peterson and Rice found that for the Treynor measure, choice of market proxy
made little difference in ranking the performance of the portfolios.
**Beta Constant**

Much past research has tested hypotheses about the instability of common stock's systematic risk, by beta. Many of the tests used ordinary least squares (OLS) regression estimates of individual stock risks over consecutive time segments. In most cases, least-squares beta estimates, which represented individual common stock market risk levels, used either a market model (i.e., an actual) or a revised traditional CAPM (i.e., an expectation) in a standard linear regression model.

The latter model originally represented the expected one-period return of any security or portfolio, given its level of systematic risk beta. Empirical applications of the CAPM required additional assumptions (a statistical generating process) for actual rates of return. Fama (1968) and Jensen (1968) provided a framework for applying the expected single-period model of CAPM to ex post multiperiod returns. This process yielded a result approximately equal to the coefficient beta ($\beta_j$) in the "market model" given by:

$$\bar{r}_j = \alpha_j + \beta_j(\bar{\pi}_j) + \bar{e}_j,$$

$$j = 1, 2, ..., N$$

where the "$\beta_j$" parameter may have varied from security to security, an unobservable "market factor", $\bar{\pi}_j$, (to some extent) affecting returns on all securities, and $N$ representing the total number of securities in the market (Jensen, 1968).
Blume (1971) conducted the first reported study of beta stability. He found a product moment correlation of .63 for single securities for two time periods (July 1926 through June 1933, and July 1933 through June 1940). Levy (1971) used monthly prices and successive seven-year periods to examine the longer-term stability of the beta coefficient. He observed unstable betas of individual stocks, and warned that past betas for individual securities did not provide good estimates of future risk. Fabozzi and Francis (1978), Kon and Jen (1979), Sunder (1980), Ohlson and Rosenberg (1982), Lee and Chen (1982), Kon (1983), Bos and Newbold (1984), Simonds et al. (1986), Collins et al. (1987), and Rahman et al. (1987) researched systematic risk (β) stability for individual securities.

Fabozzi and Francis (1978) used monthly returns of NYSE stocks traded from 1965 to 1971 to examine the beta coefficient stability. They concluded that individual security betas moved randomly, while the OLS\textsuperscript{31} beta acted as an invariant point estimate over the sample period. Bos and Newbold studied stability of systematic risk during the 1970s and found results similar to Fabozzi and Francis; they used monthly return data of NYSE-listed stocks and observed strong random systematic risk.

Kon and Jen studied the beta stability of individual stocks contained in portfolios of 49 mutual funds. They used Quandt's switching regression model and monthly

\footnotesize
\textsuperscript{30}This correlation suggested that assessments for individual securities derived from historical data could explain roughly 36 percent of the variation in the future estimated values leaving about 64 percent unexplained (Blume, 1971).

\textsuperscript{31}By definition, the OLS method estimates the average slope, and also by definition, that average is invariant over the data range.
return data from the 1960-1971 period; they found that 27 of 49 funds showed multiple
regimes and that 6 funds showed 3 regimes. Kon (1983) tested 1960-1976 data for
mutual funds and found the same non-constant beta of individual funds.

Sunder used 1926 to 1975 monthly return rates for NYSE stocks in testing
individual stock market risk. He had mixed results. The beta coefficient followed a
random walk over time, and it followed an autoregressive process. The average non-
constant level varied from high during the 1926 to 1950 period to low during the 1963
to 1975 period. Ohlson and Rosenberg (1982), as well as Sunder (1980), used NYSE-
traded common stocks to test individual stock stability. They discovered a tendency for
betas to converge rather slowly toward a norm (the stationary mean) as well as a
stationary first-order autoregressive process that produced wide divergences about the
mean value. Most of the studies used monthly-based rates of return.

Collins et al. (1987) used NYSE and AMEX weekly return data for 500
individual securities and for several different time intervals within the 1962-81 period.
As previous researchers have proved, they observed stochastic variation in the beta risk
of equity securities. Their findings are quite persuasive for 10-year estimation periods
and persist for estimation periods as short as 5 years.

Brenner and Smidt (1977) found support of the constant beta coefficient
hypothesis. Alternative specific non-stationary beta coefficients implied a constant
absolute amount of risk. Their study consisted of 762 NYSE-listed stocks with CRSP

\[ \text{Their model used the following relation between the beta of a security and the value-V of the underlying asset} \]
data for 120 consecutive months ending in June, 1968. They developed and used four specific comparative CAPM-based market models and applied Chow Test coefficient equality in two time periods. They compared the two null hypotheses: constant relative risk and constant absolute risk. Brenner and Smidt found no dramatic difference between the two hypotheses; the slight difference that they found tended to favor the constant beta coefficient hypothesis. Brenner and Smidt interpreted the difference as meaning that the market models incorrectly specified the data generating process.

**The β-Return and β-Institutional Holding Relationships**

Early CAPM studies supported a positive relationship between beta risk and average rate of return. Recent studies, however, have not supported that relationship. Black, Jensen, and Scholes (BJS, 1972) investigated the relationship between risk and return. They used 1931 through 1965 monthly returns from nearly all NYSE stocks. Their findings supported the traditional form of the CAPM relationship: the higher the portfolio β, the larger the portfolio excess return. The most volatile and least volatile portfolios had 1.56 and .5 betas, respectively; their corresponding portfolios had monthly returns of 2.13 and .91 respectively.

\[ \beta = \frac{B}{V} \]

where B represents the risk of the real asset, and β measures the amount of risk per dollar of value. The quantity of B measures the absolute amount of risk associated with the asset. If the absolute amount of risk associated with the asset remains constant when the value of the asset changes, beta will vary in inverse proportion to variations in the value of the asset (Brenner and Smidt, 1977).
Fama and MacBeth (1973) examined the risk-return relationship of CAPM from 1935 to 1968. They regressed monthly returns for twenty portfolios against the values of explanatory variables. Their study provided evidence of a positive relationship between systematic risk and the rate of return. Fama and MacBeth produced a significant market premium for the entire study period.

Recently, Fama and French (1992) proclaimed beta's death; they could discern no relationship between market beta and average return. Their sample included all nonfinancial firms in the combined NYSE, AMEX, and NASDAQ return files. They merged CRSP and COMPUSTAT annual income-statement and balance-sheet data for the 1963 to 1990 period. They formed ten portfolios based upon the ranked market betas of stocks. They concluded that the highest beta portfolio had the lowest average return, and that the highest average returns occurred in the third beta portfolio.

Kothari, Shanken, and Sloan (1995) sought to determine whether annual beta explained cross-sectional variations in average returns over three different study periods between 1927 and 1990. They presented evidence of substantial ex post compensation for beta risk over the 1941 - 1990 period and even more over the 1927 - 1990 period. Consistent with evidence in Fama and French, they found weak estimated risk premiums for the 1963 - 1990 subperiod; they saw no relationship between beta risk and average return over the relatively short period of time. Although they used monthly return data for average returns, they applied annual estimates of beta to reduce the size effect coming from the small-firm January effect.
Using 1931 - 1965 data, Black, Jensen, and Scholes (1972) observed higher monthly returns for low-risk NYSE stocks than the CAPM would predict. McDonald (1974), however, found that high-beta funds outperformed low-beta funds in a study based on 123 American mutual funds during the 1960 - 1969 study period.

Using a 1977 - 1991 sample of all securities listed on the NYSE, Sias (1996) investigated the relationship between volatility and institutional holdings of corporate stocks. He found that institutional investors played a destabilizing role in financial markets. He concluded that increased institutional holdings of corporate stocks preceded increased individual stock volatility. Sias regressed the natural logarithm of volatility in each year against the change in institutional holdings in the previous year. The coefficient associated with changes in institutional holdings proved positive (and significant at the 5% level) in every year.

**Firm Size and Institutional Holdings**

Most of the fourteen previous studies proved a firm-size effect in one or both of these ways: (1) they found an inverse relationship between average rate of return and corporate market values (Brown et al., 1983), or (2) they found a linear relationship between the two (Banz, 1981). Most of that research showed that the firm-size effect occurred in January.

Banz (1981) studied the empirical relationship between returns and total market values of NYSE common stocks. He used the monthly returns of all NYSE stocks.
from 1926 to 1975. Banz found that smaller firms had higher risk-adjusted returns than medium size portfolio returns or the largest portfolio.

Reinganum (1981) stated that the firm size effect resulted from either misspecified CAPM or inefficient capital markets. Reinganum used quarterly and annual earnings data for 566 NYSE and AMEX stocks traded in 1976 and 1977. He attributed persistent abnormal returns to the misspecified equilibrium pricing model. He traced those abnormal returns to flaws in the capital asset pricing model, rather than to informational inefficiencies.

Roll (1981) argued that part of the observed risk-adjusted excess returns related to size resulted from improper estimations of security betas, rather than to inadequate empirical representation of capital market equilibrium. Reinganum (1982), however, did not support that argument. Reinganum based his research on NYSE and AMEX trading data, and he used average daily returns from the 1964 - 1978 study period. Then he used monthly and quarterly returns to estimate betas. The estimated daily return beta of the small firm portfolio produced a 1.69 coefficient, while it produced 1.47 and 2.0 coefficients, respectively, for quarterly and monthly data. He proved that misestimation of beta could not explain the firm size effect.

Banz, Brown et al. (1983) tested firm size effect using all stocks traded on the NYSE and AMEX from 1976 to 1978. They found a linear size effect between mean returns and firm size.

33For details, see Brown et al. (1983, 40).
A great deal of research has sought to determine potential explanations of stochastic size effects. Keim (1983) used CRSP daily files for all securities traded on the NYSE and AMEX from 1962 to 1978. He discovered that daily abnormal return distributions in January had larger means relative to the remaining eleven months, and he noticed a more pronounced size effect in January than in any other month. He introduced a tax loss selling hypothesis to explain this phenomenon. Lakonishok and Shapiro (1986), Jaffe et al. (1989), Ritter and Chopra (1989), Leong and Zaima (1991), and Elfakhani (1993)—among others—corroborated the January small-firm effect.

No published work on the relationship between institutional holdings of corporate stocks or mutual fund performance and firm size effect was found. However, Tsetsekos and DeFusco (1990) studied portfolio performance in terms of the relationship between managerial ownership and the size effect. They designed their study to see whether portfolios of firms with high managerial ownership outperformed portfolios of firms with low managerial ownership. According to their study, the smallest firm portfolio earned a significant positive abnormal return of .8% per month; the largest value firm portfolio earned a significant negative .2% abnormal return per month. They agreed that the small-firm effect did influence abnormal returns. However, the level of managerial ownership did not appear to have an effect on portfolio returns; portfolios constructed to control for the size effect exhibited risk-adjusted returns unrelated to the degree of managerial ownership.

Most of the financial analysts who tried to isolate superior ability and above-normal rates of return limited the scope of their research to fund managers' stock
selection abilities and market timing abilities. (Stock selection ability consisted of selecting stocks of small firms which outperform the market, selecting stocks with high betas which outperform the market, and other factors.)

R&D Expenditure and Institutional Holdings

Sias (1996) argued that institutional ownership increased stock price volatility, while others (Dobrzynski et al., 1986; Drucker, 1986) suggested that it induced a myopic short-term management orientation. Past institutional investor evaluations generally centered on financial performance measures (Graves and Waddock, 1990). Institutional investment managers, therefore, attempted to influence short-run strategies of companies in their portfolios. Graves (1988) studied institutional investor-R&D spending relationships for twenty-two computer manufacturing companies. He found a negative relationship between R&D expenditures and institutional ownership; high levels of institutional ownership may have suppressed R&D spending in the computer industry. Because of intense pressure to produce short-term earnings, institutional investors likely influenced companies in their portfolios to avoid major long-term investments such as R&D expenditures. They simply considered themselves traders, not investors, and they eagerly sold stocks for quick profits (Dobrzynski, 1986). As the levels of institutional ownership have increased, annual stock turnover rates\(^{34}\) have

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\(^{34}\)Turnover equals the fraction of a firm's capital traded on a given day as measured by the price on day \(t\), multiplied by the volume on day \(t\), and then normalized by dividing by year-end capitalization.
also increased dramatically, from 16% in 1965 to 54% in 1985 (Graves and Waddock, 1990).

Management literature has attributed declining innovation, poor productivity growth, and a loss of international competitiveness (Scherer 1984 and Thurow 1985) to institutional investors' orientation toward short-term profits. Institutional investors now recognize the folly of that orientation and the "exit" policy of dumping a given stock because of dissatisfaction with managerial performance. The cost of such a practice has increased greatly because they have had to accept substantial discounts in order to liquidate their significant holdings (Aoki, 1984). Institutions now own more than 50% of U.S. equities (Mallin, 1995); their investment managers now must concern themselves with both short-term and long-term results.

Recent studies by Hansen and Hill (1991) and Kochhar and David (1996) showed a significant positive relationship between institutional holdings and both long-term investment and R&D expenditures. Hansen and Hill used 129 firms in four research-intensive industries over a ten-year period. Kochhar and David used 1989 financial data for 135 manufacturing firms traded on the NYSE, AMEX, and NASDAQ. The results indicated that institutions did not foster short-term orientation and that they may have influenced firms to increase innovation.

Heiner (1983) posited another reason for the positive relationship between R&D spending and institutional holdings. His theory—referred to as the competence-difficulty gap (the C-D gap)—explained the ability of shareholders to make rational decisions concerning share value. The gap measured the spread between an economic
actor’s competence to make a rational decision and the difficulty of the decision problem. Individual shareholders had a wider gap than did institutions. Hansen and Hill (1991) explained that individual shareholders had a limited ability to make difficult decisions in a complex environment characterized by substantial noise. This gap theory suggested that the wider C-D gap may have led to buy and sell decisions on the basis of short-term earnings. Since institutions systematically processed information better than individuals, the decisions of institutional investors probably led to more nearly rational decisions oriented toward long-term investments.

**Summary**

Sharpe’s measure, still frequently used by financial researchers, will be applied to test the selection ability of institutional investors. Then, as factors affecting the selection ability of institutional investors, the CAPM based β-return relationship, the firm-size effect, and R&D expenditures will be studied to ascertain whether they exhibit any relationship with institutional investors’ excess returns. The CAPM based beta-return relationship is one of the top issues currently being discussed by financial analysts. The relationship between beta and rate of return will be tested in this study.

The next chapter discusses the five hypotheses addressed in this study. Previous empirical research has not specifically analyzed these formal hypotheses.
CHAPTER 4

HYPOTHESES

Introduction

Since the 1930s institutional investors, such as banks, insurance companies, and investment counselors, have acquired increased concentrations of publicly traded stocks. Even though investors could have done better by buying index funds, the size of institutional investors has continued to grow each year.

Gruber (1996) developed a clientele behavior classification system to explain this phenomenon. He classified one group as "sophisticated" clientele and the other as "disadvantaged" clientele. The sophisticated group directs its money to funds based on performance. He divided disadvantaged clientele into three sub-groups: (1) unsophisticated investors, (2) institutionally disadvantaged investors, and (3) tax disadvantaged investors. Gruber concluded that unsophisticated investors directed their money to funds based at least in part on other influences, such as advertising and advice from brokers. Disadvantages institutional investors consisted of pension accounts which contained assets that underperformed. Tax disadvantaged investors held funds until capital gains taxes made liquidation infeasible. This group could have acted as sophisticated investors in placing new money.

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As yet, no one has analyzed the ability of institutional investors to collectively earn abnormal returns. Investors need to know whether a stock portfolio with a high level of institutional investor ownership will show a greater return than one with a lower level of institutional investor ownership. They also need to know whether the small-firm effect theory still applies to the evaluation of institutional investors.

Following are five hypotheses relating to return characteristics for institutional investors. The investigation includes cross-sectional analysis of institutional investment portfolio equity returns.

**Hypothesis 1**

These tests will examine gross returns that have no transaction costs, fees, or other expenses. Different institutional investors have different transaction costs or fees, and this test utilizes portfolios formed by several criteria that make it difficult to trace stock ownership to institutional investors.

\[ H_{11}: \text{Mean risk-adjusted excess returns of stock portfolios do not correlate positively with institutional investor concentration percentages.} \]

\[ H_{12}: \text{Mean risk-adjusted excess returns of stock portfolios have a positive correlation with institutional investor concentration percentages.} \]

Hypothesis 1 addresses the first purpose of this study. It attempts to determine whether portfolios with higher concentrations of institutional investors exhibit greater return rates than those with lower holdings. It also attempts to ascertain whether they systematically produce returns above those estimated by the CAPM.
Rejection of null Hypothesis 1 will imply that stock portfolios with high concentrations of institutional investors exhibited different risk-adjusted rates of return than those with low holdings by institutional investors. Higher risk-adjusted rates of return may indicate that the institutional investors had superior selection ability. Failure to reject the null hypothesis will indicate that institutional investors collectively did not evaluate investments any better than other investors. Some institutional investors may have done better while others did worse.

**Hypothesis 2 (Related to β Risk)**

$H_0^2$: Stock portfolios with higher β risk do not exhibit greater risk-adjusted abnormal rates of return than those with lower β risk for market-based portfolios of equal systematic risk.

$H_2^2$: Stock portfolios with higher β risk exhibit greater risk-adjusted abnormal rates of return than those with lower beta risk for market-based portfolios of equal systematic risk.

Hypothesis 2 (null and alternative) addresses the second purpose of this study. It attempts to determine whether stock portfolios with higher market risks, represented by higher βs, produced higher rates of return than those with lower β risks as implied by the CAPM. Testing this hypothesis will indicate whether the compensation for systematic risk equaled or exceeded the market rate of return less the risk-free rate $(r_m - r_f)$, as stated by the CAPM. This excess returns test will determine whether high-β stock portfolios systematically earned more than the required return estimated by the CAPM. It examines the relationship between β and mean excess return. Ultimately,
the test of this hypothesis will determine the appropriateness of the stock risk measure, \( \beta \).

Rejection of null Hypothesis 2 will lead to the conclusion that institutional investors manifested their superior ability by selecting stocks with a higher \( \beta \). It could mean that institutional investors required a higher return for holding a stock with a larger \( \beta \), which would suggest that institutional investors considered the \( \beta \) factor a useful tool in forecasting security risks. It could also mean that \( \beta \) played an important role in stock pricing.

**Hypothesis 3 (Related to Volatility)**

- **H\(_{03}\)**: Stock portfolios with higher volatility do not exhibit greater or less rates of return than those with lower volatility.

- **H\(_{A3}\)**: Stock portfolios with higher volatility exhibit greater or less rates of return than those with lower volatility.

Hypothesis 3 (null and alternative) addresses the third purpose of this study. It attempts to ascertain whether stock portfolios with higher volatility produced higher rates of return than those with lower volatility.

The CAPM implies that in a well-diversified portfolio, portfolio returns relate to systematic risk only. The market compensates only systematic risk (\( \beta \)). With an exactly true CAPM, unsystematic risk will make a zero contribution to portfolio returns. The relationship between return and risk based on the CAPM is not always consistent with the CAPM's prediction. Miller and Scholes (1972) found an apparent association between high unsystematic risk and higher realized returns.
Testing this hypothesis will measure the validity of the compensation for β risk implied by the CAPM. Second, this hypothesis will indicate the relative investment behavior aggressiveness or conservatism of institutional portfolio managers.

Rejection of Hypothesis 3 will lead to the conclusion that institutional investors manifested their superior ability by selecting stocks with a higher volatility, and requiring a higher return. It could suggest that institutional investors considered the volatility factor as a useful tool in forecasting risk of securities, and that volatility played an important role in stock pricing.

**Hypothesis 4 (Related to Firm Size Effect)**

H0₄: Stock portfolios composed of small firms' stocks do not exhibit greater risk-adjusted rates of return than those composed of large firms’ stocks, ceteris paribus.

H₄: Stock portfolios composed of small firms' stocks exhibit greater risk-adjusted rates of return than those composed of large firms’ stocks, ceteris paribus.

Hypothesis 4 addresses the fourth purpose of this study, determining the correlation between stock portfolios composed of small-firm stocks and risk-adjusted abnormal rates of return.

This phase of the study will test whether institutional investments in stocks of small firms earned abnormal returns. Earlier empirical studies had found that small firms yielded higher average returns than large firms of equal risk. In other words, average rates of return and firm size are related inversely and linearly. This study will
use total asset as the measure of firm size. Tests of these hypotheses will include an exploration of the January firm size effect.

Failure to reject Null Hypothesis 4 will lead to the conclusion that institutional investors benefitted by cautiously including small firm stocks in their portfolios. This will imply a measure of the small-firm effect in institutional investment.

**Hypothesis 5-A (Related to R&D Expenditures)**

$H_{5a}$: Firms' R&D expenditures and institutional stock ownership percentages do not correlate.

$H_{5a}$: Firms' R&D expenditures and institutional stock ownership percentages have a positive correlation.

**Hypothesis 5-B (Related to R&D Expenditures)**

$H_{5b}$: Stock portfolios with higher R&D expenditures and higher concentrations of institutional investors do not exhibit greater risk-adjusted rates of return than those with less R&D expenditures and lower concentrations of institutional investors, ceteris paribus.

$H_{5b}$: Stock portfolios with higher R&D expenditures and higher concentrations of institutional investors exhibit greater risk-adjusted rates of return than those with less R&D expenditures and lower concentrations of institutional investors, ceteris paribus.

Hypotheses 5-a and 5-b address the final purpose of this study, determining the correlation between firms' R&D spending and increasing institutional stock holdings.

This study will test whether the different levels of institutional shareholdings are related to a firm's R&D expenditure. There are two possible reasons that institutional investors choose those firms with higher R&D. First, firms with higher

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R&D had greater returns; or institutional investors influenced managerial decisions that increased firm value.

Failure to reject both null Hypotheses 5-A and 5-B would lead to the conclusion that institutional investors had a long-term innovation-oriented motivation, rather than a short-term-profit-oriented one. The acceptance of both null hypotheses would preclude a definitive conclusion, and it would necessitate other experiments to explain the different relationship. Failure to reject Hypothesis 5-A, coupled with rejection of Hypothesis 5-B, would indicate that institutional investors had strong incentives to monitor firm activities and continuously influence managers so as to increase firm values.

**Institutional Portfolio Performance Joint Effect Test**

Finally, this study will test the effect of those five variables, as a whole, on the portfolio performance. This is done to develop a decision model for institutional investors’ extra return in order to discover if there is a significant relationship between portfolio returns and the five variables used in this study. The dependent variable is the monthly mean return, based on the institutional ownership information. The independent variables are these explanatory variables: institutional ownership, beta, volatility, total assets, and R&D expenditures.

If the multiple regression model is statistically significant, it gives rise to a decision model for institutional investors’ portfolio selection. With joint tests, it is also
possible to see which variables are positively or negatively related to institutional portfolio return.
CHAPTER 5

SAMPLE AND METHODOLOGY

Introduction

Ownership and control of U.S. corporations has increasingly shifted from individuals to various intermediary institutional investors acting on behalf of their constituents. Pension funds, mutual funds, insurance companies, and commercial banks, have assumed an important role among these growing intermediaries.

Increased levels of corporate stock holdings by these intermediaries have created the opportunity for research on the behavior of institutional investor portfolio managers. Much previous research has focused on mutual fund portfolio performances in terms of managers' timing and selection abilities. However, that research has not determined what constituted those superior selection and timing abilities. This research has attempted to ascertain whether institutional investment portfolio managers possessed a superior stock selection ability.

Based on selection ability, this research evaluates performance attributes of institutional portfolio managers. The role of the five following attributes related to institutional investors are investigated. These are the small stock firm, January, beta, volatility, and R&D expenditures effects. An investment strategy based on any or all of
these attributes are related to portfolio rates of return. This chapter describes the sample selection criteria and the methodology employed in testing the various hypotheses.

The Study Group

The study group is selected from firms listed on the Compact Disclosure database\(^\text{35}\) during the 1989-1996 period.\(^\text{36}\) The Compact Disclosure monthly database included all securities registered with the SEC and traded in American stock markets, such as the NYSE, the AMEX, NASDAQ, and other regional stock markets. The database included financial statement information, ownership characteristics, trading histories, monthly average stock prices, and current dividend information for approximately 9,000 publicly traded firms.\(^\text{37}\) Only those firms traded in the NASDAQ national market system have sufficient information about the number of stocks owned by institutional investors to warrant inclusion in the study group. Stocks traded on the other regional markets in the non-national market system generally do not have sufficient data for a meaningful analysis.

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\(^{35}\)The Compact Disclosure database contains corporate information on public companies filing with the U.S. Securities and Exchange Commission (SEC).

\(^{36}\)However, the sample excluded January 1989 and February 1990. Therefore, the study used 94 sets of monthly returns.

\(^{37}\)The number of firms varied each year due to new listings and delistings of firms. The available numbers of firms ranged from 4,000 to 6000 every year 1989 through 1996.
Methodology

This section describes statistical methodologies designed to test the research hypotheses, assumptions, and verifications required for each model. The main model for testing the research hypotheses, Jobson and Korkie's statistics, is used for significance tests of portfolio performance based on the traditional Sharpe measure. The traditional CAPM and the market model had suffered problems because beta measurement required an ex ante expected return generating model. Usually the estimate is prepared with data from prior to the test period (Jobson and Korkie, 1981).

Sharpe's measure (1966) represented the excess return per unit of risk, usually represented by the standard deviation, for the market in a well-diversified portfolio.

Sharpe stated his original measure as

\[ SH_i = \frac{\mu_i}{\sigma_i} \]  \hspace{1cm} (5-1)

where

- \( \mu_i \) represented risk premium, actual portfolio i's average holding period return minus average risk-free rate over the same period.
- \( \sigma_i \) represented the standard deviation of portfolio i.

This Sharpe measure yields an excess return per unit of risk, but it is not used for testing portfolio performance utilizing the Sharpe measure. This Z-statistic made it possible to test statistical significance for excess returns comparing one portfolio's performance to another. This method avoided the beta measurement problem.
If risk premiums\textsuperscript{38} followed a multivariate normal distribution,\textsuperscript{39} they would produce the following transformed difference for the Sharpe measure.\textsuperscript{40}

$$SH_{im,t} = \sigma_{it} \bar{r}_{it} - \sigma_{mt} \bar{r}_{mt}$$

(5-2)

where

\[SH_{im,t}\] = transformed Sharpe performance measured difference between portfolios \(i\) and \(m\) for overall period \(t\), where \(i\) represented a sample portfolio and \(m\) denoted the market proxy portfolio;

\[\bar{r}_{i,t}, \bar{r}_{m,t}\] = portfolio (\(i\) or \(m\)) average means return premiums for overall period \(t\);

\[\sigma_{i,t}\] = standard deviation of portfolio \(i\) return premiums for overall period \(t\); and

\textsuperscript{38} Risk premium represented actual return minus risk free rate.

\textsuperscript{39} A violation of this assumption may lead to some differences between the actual distribution and the sampling distribution of test statistics. This in turn causes misspecification that may result in biased statistical tests and misleading inferences. Skewness, Kurtosis and Shapiro's Wilk (W statistic) tests of normality reinforce the notion that return premiums are distributed in a fashion close to multivariate normal (Elfakhani, 93).

\textsuperscript{40} Jobson and Korkie's transformed difference for the Sharpe measure is made possible by generating asymptotic approximations to the distributions and the moments of the performance estimators. They applied Taylor series expansion to get the asymptotic approximations for the expectation and variance of an estimator. Taylor series approximations, to the first order term \(O(1/T)\), of the expectations of the transformed differences \(E(SH_{im,t}) = (\sigma_{i,t} - \sigma_{m,t})(1 - \frac{1}{T})\). Thus, the bias to the first order of the transformed Sharpe difference is \(\frac{1}{T}\). However, this bias becomes small if the sample is large. If \(T\) is greater than 36, the bias becomes almost zero (Jobson and Korkie, 1981).

The asymptotic distributions of the Sharpe performance measures are obtained by observing that they are estimators which are functions of the element of \(\bar{r}\) and \(S\), where returns are assumed multivariate normal. Under these conditions the asymptotic distributions may be derived as

\[
\begin{bmatrix}
\bar{r}_i \\
\bar{r}_m \\
\bar{S}_i \\
\bar{S}_m \\
1 \\
\frac{1}{T} \\
\frac{1}{2T^2}
\end{bmatrix} \cdot \left[
\begin{array}{cccc}
\sigma_{i,t} & \frac{\sigma_{i,t}^2}{2T^2} & \frac{\sigma_{i,t}^3}{3T^3} \\
\sigma_{m,t} & \frac{\sigma_{m,t}^2}{2T^2} & \frac{\sigma_{m,t}^3}{3T^3} \\
\end{array}
\right] \cdot \left[
\begin{bmatrix}
\bar{r}_i \\
\bar{r}_m \\
\bar{S}_i \\
\bar{S}_m \\
1 \\
\frac{1}{T} \\
\frac{1}{2T^2}
\end{bmatrix}
\right]
\]

where the variances are equivalent to the \(O(1/T)\) Taylor series approximations, to the true variances of the sampling distributions. For greater detail see Jobson and Korkie (1981).
\[ \sigma_{at} = \text{standard deviations of portfolio } m \text{ return premiums for overall period } t. \]

A statistical significance test could have resulted from calculating the following Z-score:

\[ Z_{SH_{im}} = \frac{SH_{im} - 5}{\sqrt{\theta}} \quad (5-3) \]

where \( \theta \) represented variance of Sharpe measure, with the variance calculated as follows:

\[ \theta = \frac{1}{T} \left| 2 \sigma^2_i \sigma^2_m - 2 \sigma_i \sigma_m \sigma_{im} + \frac{1}{2} \mu_i^2 \sigma^2_m + \frac{1}{2} \mu_m^2 \sigma^2_i - \frac{\mu_i \mu_m}{2 \sigma_i \sigma_m} \left( \sigma^2_{im} + \sigma^2_i \sigma^2_m \right) \right| \]

where \( \sigma_{im} \) represented covariance between mean return premiums of portfolios \( i \) and \( m \) for the study period.

\( T \) represented number of observations.

For any pair of portfolios, the appropriate test required determining whether the difference in the transformed Sharpe measures, \( SH_{im} \), equaled zero. Jobson and Korkie's transformed difference for the Sharpe measure served to compare a portfolio's performance in some time period relative to another period or to compare different portfolios in the same period. Jobson and Korkie's Z-score made it possible to compare portfolios and determine whether one differed from the other. A Z-score of less than a table value (for example, 1.96 for .025 significance level for two-tailed test) precluded
rejection of the null hypothesis. Elfakhani (1993) employed this methodology to test Canadian stock returns.

Jensen's alpha measure (1968, 1969) served as a second method in this study. This model used pooled time series and cross sectional data. Equation 2-5 tested for a positive alpha, resulting from an institution's superior selection ability. Jensen's alpha measure performed two functions: confirming the result of Jobson and Korkie's Z-score and determining the magnitude of Jensen's Alpha as a superior stock selector for professional portfolio managers.

\[
\bar{R}_t - R_p = \alpha_j + \beta_j (\bar{R}_m - R_p) + \mu_t
\]  

(5-4)

where \( R_m \) represents equally weighted index of NYSE, AMEX, and NASDAQ markets. The other variables are defined in Chapter 2.

Finally, the multiple regression tested the joint effect of the five factors (firm size, beta, volatility, R&D, and level of institutional ownership) on portfolio returns of institutional investors. The results yielded a prediction model for stock anomalies in the context of institutional stock ownership.

Assumptions

1. Transaction costs: this study evaluated portfolio performance using the monthly percentage total portfolio return on a gross return basis; it measured returns before any deductions for transaction costs, fees, taxes, or operating expenses. This does not mean that all institutional trades in the securities market had no transaction costs. Institutional investors had different transaction costs or fees. This test utilized portfolios formed by several criteria and ignored transaction costs and other fees to
assure comparability among institutions. The reader can use the findings to estimate the effects of varying levels of cost on the reported results.

2. **Monthly gross return:** this test used monthly stock returns as in the following return equation:

   \[ r_{it} = \frac{(p_{it} - p_{it-1} + d_{it})}{p_{it-1}} \]  
   \[ (5-5) \]

   where

   - \( r_{it} \) = mean return of security \( i \) during time \( t \),
   - \( p_{it} \) = average monthly stock price of security \( i \) during time \( t \),
   - \( p_{it-1} \) = average monthly stock price of security \( i \) during time period \( t-1 \), and
   - \( d_{it} \) = dividend for security \( i \) paid during time period \( t \).\(^\dagger\)

   All these monthly gross returns data came from the Compact Disclosure monthly database.

3. **Ownership, asset, and R&D expenditures data:** All data for ownership, assets, and R&D expenditures came from the October Compact Disclosure database in each year 1989-1996.

4. **The risk-free rate surrogate is the one-month returns:** U.S. Government Treasury Bills with approximately 30 days left to maturity came from The Wall Street Journal. This one-month risk-free rate proxy applied to both sample portfolio returns and market index returns.

5. **Equally weighted average rate of return:** Equally weighted index for each calendar year of all New York and American Stock Exchange, and NASDAQ stocks are used to proxy market index returns.

\(^\dagger\) However, this study excluded the dividend portion. The stock with sticker TDK in Compact Disclosure had dividend payments of $21 for January through May, 1991 and $25 for June through December for the same year. Although this firm paid only twice for the year, the Compact Disclosure database contained the previous dividend payment information for every month under the current dividend section; Compact Disclosure carried the most recent dividend payment information all the way until a new dividend payment occurred. This information, if included, would have created false information on gross stock returns.
6. The study did not use the month's data for stocks with a price of less than $5 at any month end, in order to avoid returns with little economic significance. This applied to both the sample portfolio and the market index portfolio.42

7. The study did not use data for stocks with a monthly return greater than 100%. While some stocks may legitimately rise spectacularly within one month, these outliers might cloud the significance of the great majority of institutional investing. This exclusion of stocks rising 100% or more in a month applied to both the sample portfolio and the market index portfolio.

8. Construction of market index portfolio (control groups). The control groups are utilized only for Jobson and Korkie's test. The control groups use the following three criteria.

Ownership portfolio. The control group for the ownership portfolio is a market index portfolio consisting of all common stocks traded on the New York Exchange, American Stock Exchange, and NASDAQ. This control group is used because the subject of interest is how institutional investors perform compared to the market.

Beta, volatility, small firm portfolios. The same classification rules for these variables are applied for forming both the control groups and the sample groups. The classification criteria are explained in detail under each section of those variables.

R&D portfolio. The R&D sample portfolio is formed using a two-step procedure as mentioned in Chapter 2. First, all sample firms are divided into three groups based upon the percentage of institutional ownership. Then, each of those three groups is subdivided into three groups based upon the amount of R&D expenditures. On the other hand, the control group for the R&D portfolio consists of the universe of stocks

42 This procedure eliminated annually approximately 1,100 stocks from the total sample, resulting in changing the mean share price from $18.93 per stock to $23.48. Only 380 stocks are removed from the NYSE or AMEX with this price restriction; most stocks removed were NASDAQ stocks.

<table>
<thead>
<tr>
<th>Before Price Restriction</th>
<th>After Price Restriction</th>
</tr>
</thead>
<tbody>
<tr>
<td>sample size</td>
<td>mean stock price</td>
</tr>
<tr>
<td>NYSE and AMEX only</td>
<td>2,180</td>
</tr>
<tr>
<td>All Markets</td>
<td>4,800</td>
</tr>
</tbody>
</table>

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divided into low, medium, and high levels of R&D expenditure, without having first been divided based on any other criterion.

**Hypothesis 1: Institutions' Superior Selection Ability Test**

Research Hypothesis 1 examined whether institutions possessed a superior stock selection ability. Professional portfolio managers may have had better information than individual investors. They also employed economies of scale with pooled assets. Therefore, as the concentration of institutional ownership increased, the portfolio return from increased institutional ownership also may have increased. The first hypothesis anticipated greater portfolio returns from higher levels of institutional ownership than for the market or lower levels of institutional ownership.

The statistical model for Hypothesis 1 examined data through Jobson and Korkie's transformed Sharpe measure and Jensen's alpha measure. First, the Sharpe measure is calculated. Second, the transformed differences for the Sharpe measure are calculated and tested for statistical significance by measuring Z-scores. The risk premiums for sample returns is regressed on the market risk premium multiplied by the portfolio beta to find any positive alphas. A significant positive value from the regression would have indicated that institutional portfolio managers possessed a superior selection ability.

This procedure required a division of institutional ownership into five categories. The application of quinine percentages resulted in the formation of five stock portfolios based upon what percentage of the company all institutions collectively own, is as follows:
• 1st ownership portfolio: less than 20% of each company is owned by all institutions taken collectively.

• 2nd ownership portfolio: more than 20% but less than 40% of each company is owned by all institutions taken collectively.

• 3rd ownership portfolio: more than 40% but less than 60% of each company is owned by all institutions taken collectively.

• 4th ownership portfolio: more than 60% but less than 80% of each company is owned by all institutions taken collectively.

• 5th ownership portfolio: more than 80% of each company is owned by institutions.

Models 5-1 and 5-3, respectively, measured Sharpe and Jobson and Korkie's Z-score.

Next, portfolios with different institutional ownership are compared to the market index portfolio in terms of portfolio return through Sharpe and transformed Sharpe measures. Jensen's alpha is used measure to confirm the results. Consistency between the data and the CAPM indicated that the researcher could not distinguish subsequent time series from zero (equation 5-4). The mean risk-adjusted excess returns for all portfolios should have equaled zero under the null hypothesis. On the other hand, a non-zero value of alpha would have attributed market anomalies to some variables. With portfolios grouped on the basis of ownership percentage, any systematic departures from zero would indicate an ownership-level effect.

Portfolio betas($\beta_p$), which represent systematic risk of the portfolio, are simply an average of the individual security betas, weighted by the proportion of each security in the portfolio as in following equation:
where \( z_j \) = the proportion of portfolio market value represented by security \( j \),

\[ N = \text{the number of securities, and} \]

\[ \beta_i = \text{beta of security } j. \]

The time series OLS regression is constructed with one-month T-Bill rates; monthly portfolio returns are calculated by equation 5-5; and portfolio betas are estimated by equation 5-6. Equation 5-4 measured Jensen's alpha.

**Hypothesis 2: Beta Attribute Test**

Tests of Hypothesis 1 determine if different levels of institutional ownership consistently experienced any significantly superior performance in picking undervalued stocks. Hypotheses 2 through 5 determine superior performance attributes of institutional investors who consistently performed in a significantly superior manner. Assuming rejection of null Hypothesis 1, tests of Hypothesis 2 determine whether institutional investors exploited higher-beta stocks. McDonald (1974) found that high-beta funds generally outperformed low-beta funds with reference to market-based portfolios of equal systematic risk. Hypothesis 2 compares the significance of mean monthly excess returns for higher-beta portfolios with that of the market portfolio. Estimates of systematic risk, \( \beta_i \), are developed for each of about 8,000 firms operating over the entire 1989-1996 period. It did so by regressing stocks' monthly returns against market monthly returns:
$r_{it} = \alpha_i + \beta_i r_{mt} + \epsilon_{it}$

(5-7)

where $\alpha_i$ and $\beta_i$ represent regression intercept and slope statistics, respectively; and $r_{it}$ represents the regression model's unexplained residual return in period $t$.

The study group for Hypothesis 2 included only stocks owned partly or exclusively by institutional investors. The model utilized the following beta categories for forming test portfolios. This division has been made to equally divide the sample:

1st beta portfolio; less than .50,

2nd beta portfolio; > .50 and ≤ 1.0,

3rd beta portfolio; > 1.0 and ≤ 1.5,

4th beta portfolio; > 1.5 and ≤ 2.0, and

5th beta portfolio; greater than 2.0.

Each of those portfolios is compared with different values of beta to market index portfolio in terms of portfolio return through Sharpe and the transformed Sharpe measures.

Jensen's alpha measure serves to confirm the results of the Sharpe measures. A 5% significance level (one tail test) for the comparison between any of the sample portfolios and the market index portfolio would reject the null hypothesis. This would suggest that high-beta funds outperformed low-beta funds for market based-portfolios of equal systematic risk. Jensen's alpha distance, also, significantly differs from zero.
Hypothesis 3: Volatility Attribute Test

Hypothesis 3 (assumed rejection of null Hypothesis 1) examines whether institutional investors exploited the stock volatility. The variance measured total risk over the 96 months for an individual security or portfolio.

Badrinath et al. (1989) found institutional ownership inversely related to stock volatility. CAPM also suggested that the market did not compensate for unsystematic risk. It inferred that institutional investors required relatively higher returns for holding high risk stocks. Hypothesis 3 sought to determine how much higher compensation institutional investors required for holding higher volatility stocks in their portfolio.

The study group for Hypothesis 3 included only stocks owned partly or exclusively by institutional investors; it established the following standard deviation categories for forming test portfolios. The classification has been made to equally divide the sample size:

1st volatility portfolio; less than .10,
2nd volatility portfolio; > .10 and ≤ .13,
3rd volatility portfolio; > .13 and ≤ .16,
4th volatility portfolio; > .16 and ≤ .20, and
5th volatility portfolio; greater than .20.

Each portfolio with different volatility values is compared to the market index portfolio in terms of returns through Sharpe and the transformed Sharpe measures. Jensen's alpha measure confirms the result of Jobson and Korkie's statistic. Jensen's alpha indicated whether monthly excess returns increased or decreased as volatility
changed. Any statistically significant relationship between monthly excess returns and levels of volatility would have indicated volatility exploitation by institutions.

**Hypothesis 4: Small Firm Effect Test**

Tests of Hypothesis 4 investigated whether institutional investors made use of the well-known small firm effect in their investment portfolios. Assuming the rejection of null Hypothesis 1, institutional investors' superior selection power might result from purchasing small stocks. Previous research has indicated that small stocks usually provided higher returns. Badrinath et al. (1989) found that institutional investors prefer larger, more liquid firms; however, they did not study whether those larger firms actually generated greater returns in the context of institutional ownership. Small firms have had more difficulties than larger firms in generating needed funds. Therefore, they have needed to pay higher incentives for potential fund providers. Hypothesis 4 addressed these theories. It anticipated that as the size of assets increases, the risk-adjusted excess returns measured by monthly stock returns would decrease.

Many previous studies found that the month of January has a unusual price behavior (Ritter, 1988). It is of interest to investigate January separately from other months. To address this issue for this study, it expands the equation (2-5 or 5-4) described in Chapter 2, by introducing dummy variables for January and non-January months. Following is the basic model:
where Model 5-8 is just a modification of Equation (2-5) with a dummy variable, which takes the value of one in the month of January and zero otherwise. The other variables are defined as in Equation (2-5).

In testing for the small firm effect, stocks owned partly or exclusively by institutional investors are divided into the following five categories:

1st asset portfolio; less than $40,000,

2nd asset portfolio; > $40,000 and ≤ $120,000,

3rd asset portfolio; > $120,000 and ≤ $340,000,

4th asset portfolio; > $340,000 and ≤ $1,460,000, and

5th asset portfolio; greater than $1,460,000.\(^{43}\)

The division gave an approximately equal sample to each category. Five portfolios formed the basis for testing small firms' high return attribute in institutional portfolio performance. Sharpe and the transformed Sharpe measures are used to compare different portfolio returns to the market index portfolio. Then they applied Jensen's alpha measure to confirm the result of Jobson and Korkie's statistic. Jensen's alpha made it possible to test whether monthly excess returns increased or decreased as asset amounts changed. A negative association between asset amounts and excess returns would have shown that institutional investors preferred small firms.

\(^{43}\) Thousand dollars omitted.
Hypothesis 5: R&D Expenditures and Institutional Ownership Relationship Test

Tests of Hypothesis 5 examine how institutional ownership relates to R&D expenditures and how higher R&D expenditures relate to monthly stock portfolios returns. These tests could have produced a negative, positive, or no correlation at all between R&D expenditures and the levels of institutional ownership.

The following regression model tested the first relationship:

\[ R&D_{it} = a_i + b_i \text{(Own}_{it}) + \varepsilon_{it} \]  

(5-9)

where R&D, the dependent variable, represented the natural log of total R&D expenditures for firm i during time t; Own, the independent variable, represented the actual percentage of institutional ownership for firm i during time t; and \( \varepsilon_{it} \) represented error term. Equation 5-9 used ANOVA to estimate the relationship between a dependent measure of R&D expenditure and an independent measure of institutional ownership percentage. Badrinath et al. (1989) found that larger firms, on average, had higher levels of institutional ownership. Larger firms, on average, also have higher levels of R&D expenditures. These facts led to an expectation of a positive relationship between institutional ownership and R&D expenditures. However, this would not necessarily indicate a positive relationship between portfolio excess returns and higher R&D for firms with higher institutional ownership.

In testing the second part of Hypothesis 5, firms are ranked by percentage of institutional holdings as of October of each year and placed in one of three groups. Group 1 contained stocks with the smallest percentage of ownership by institutions, while groups
2 and 3 contained an approximately equal number of firms with equally increasing percentages of institutional ownership.

First, the study groups for R&D expenditures are divided according to the following ownership criteria:

1st ownership group; less than 30%,
2nd ownership group; > 30% and ≤ 60%, and
3rd ownership group; greater than 60%.

Second, each ownership group is rearranged from high to low R&D expenditures to form another three equal-sized data sets. Then, it divided each subset portfolio into three portfolios by amounts of R&D expenditures, using the following criteria:

1st R&D category; less than $10,000,
2nd R&D category; > $10,000 and ≤$100,000,
and 3rd R&D category; greater than $100,000.44

This resulted in 9 portfolio groups. Each of those portfolios (with different level of ownership and different amount of R&D expenditures) are compared to the market index portfolio in terms of portfolio return through Sharpe and the transformed Sharpe measures. Jensen’s alpha measure is used to confirm the result of Jobson and Korkie’s statistic. Jensen’s alpha made it possible to see how monthly excess returns related to the various institutional ownership and R&D expenditure levels. It was anticipated that results might have explained the interests or orientations of institutional investors. Did

44 All units are thousand dollars omitted.
they act as myopic investors, or as hyperopic investors? Did they act in a manner hyperopic because higher R&D spends generated greater excess returns, or because higher R&D expenditures had income production potential?

**Institutional Portfolio Performance Joint Effect Tests**

Finally, the sign of the relationship between institutional portfolio performance and five explanatory variables (institutional ownership, beta, volatility, firm size and R&D expenditures) is estimated. This is in order to determine whether an institution's portfolio choices based on one or more of those five variables might affect its future performance. The following multiple regression equation analyzed the cross-sectional predictability of institutional portfolios:

\[
R_j = b_0 + b_1OWN_j + b_2BETA_j + b_3VOL_j + b_4FS_j + b_5R&D_j + e_j
\]  

(5-10)

where

- \( R_j \) = Mean return of stock \( j \) in the institutional portfolio for the entire study period. In this case, \( R_j \) is just gross stock return, but not a excess return.
- \( b_0 \) = Intercept term.
- \( b_1 \) through \( b_5 \) = Parameters for \( OWN, BETA, VOL, FS, \) and \( R&D, \) respectively.
- \( OWN_j \) = Mean percentage of institutional ownership for stock \( j \) for the entire study period.
- \( BETA_j \) = Beta of stock \( j \) in the institutional portfolio for the entire study period.
- \( VOL_j \) = Return volatility of stock \( j \) in the institutional portfolio for the entire study period.
$F_{S_j} = $ Mean value of assets of company $j$ in the institutional portfolio for the entire study period.

$R&D_{j} = $ Mean value of coincident (not lagged) R&D expenditures of company $j$ in the institutional portfolio for the entire study period.

e$_{j} = $ Error term for stock $j$ during the entire study period, distributed as $N(0, \sigma^2)$.

* $F$ and $R&D$ are represented by natural log.

An observation consisted of a stock that had all information for the dependent and five independent variables. Institutional ownership, firm size, and R&D expenditures for each firm are annual, changing during each of the eight years of the study period. Annual data for firm assets and total R&D expenditures changed each year during the eight years of the study period, but did not change monthly within each year. Firm assets tend to change only slowly, and R&D expenditures may bear a lagged relationship to sales. Beta was based on monthly return data, computed by applying the market model to the entire study period (not to a preceding estimation period). Stock-price variability was based on the entire set of observations used in computing beta.

This procedure resulted in approximately 8,000 observations for each of the variables except R&D expenditures. Because not all firms reported R&D expenditures, the actual sample size was reduced to approximately 2,300 observations.

This procedure automatically removed firms without institutional investors, so the sample, taken as a whole, may be said to represent a collective institutional portfolio.

In a multiple regression model, when two or more independent variables are highly correlated with each other, the model is said to have a problem with
multicollinearity. Volatility and beta are expected to be correlated with each other in this empirical test. The amount of R&D expenditures and the total assets are also expected to be positively related to each other. Therefore, these two pairs are expected to exhibit multicollinearity. The existence of multicollinearity tends to inflate the variances of predicted values, that is, predictions of the response variables for sets of x values, especially when these values are not in the sample. Moreover, multicollinearity tends to inflate the variances of the parameter estimates.

To detect the multicollinearity, a correlation matrix\textsuperscript{45}, the VIF statistics (variance inflation factors), and condition number (or index) were applied in this test. The variance inflation factors are useful in determining which variables may be involved in the multicollinearities. There are no formal rules for deciding the magnitude of variance inflation factors that cause poorly estimated coefficients. According to the \textit{SAS System for Regression} (1996), values exceeding 10 may indicate multicollinearity, but this is arbitrary.

The other method, the condition number, is the square root of the ratio of the largest to smallest eigenvalue, which provides a single statistic for indicating the severity of multicollinearity. As in the VIF statistics, criteria for a condition number to signify serious multicollinearity are arbitrary, with the value 30 often given (SAS System for Regression 1996).

\textsuperscript{45} A high correlation coefficient of 70 or 80 over indicates that there is correlation between the two independent variables, causing multicollinearity.
CHAPTER 6

RESULTS

Introduction

Chapters 2 and 3 presented a review of literature relevant to this study, and Chapter 4 stated the five hypotheses. Chapter 5 described the data and the statistical methodology. This chapter presents the empirical test results for all five hypotheses and the joint effect of five variables (ownership level, beta, volatility, firm size, and R&D expenditures) on portfolio performance.

The first section of this chapter presents and analyzes Hypothesis 1 results; those tests determine whether institutional investors possessed a superior selection ability. The second section presents and analyzes results for Hypothesis 2 through Hypothesis 5; which dealt with attributes of portfolio performance. The third section presents and discusses the multiple regression analysis results for the joint effects of five variables on institutional portfolio performance.

**Hypothesis 1: Institutions' Superior Selection Ability Test**

Hypothesis 1 examines whether institutional investors exhibited superior stock selection power. Tables 1-1, 2-1A, 2-1B, and 4-1 summarize the results of ownership
analysis. Table 1-1, which reports the results of Model 5-1, indicates that some ownership portfolios exhibited greater Sharpe measures than the market portfolio. Middle-range ownership portfolios had Sharpe measures below those of the market, whereas both lower and higher ownership portfolios exceeded the market average. Monthly mean risk-adjusted excess returns (actual return minus the risk free rate)\(^4\) gradually increased as the level of ownership increased. At the same time, portfolio risk, represented by the standard deviation for ownership portfolio returns, also rose as the concentration of ownership increased. There is an association between higher risk premium and greater risk-taking. The highest Sharpe measure--80% or more--coincided with the highest ownership quinine. The next highest Sharpe measure coincided with the lowest quinine.

The Sharpe measure of the ownership portfolio as a whole was not significantly different from that of the market index portfolio. This implies that the performance of institutional investors, taken as a whole, matched the performance of the overall market. Thus, collectively, institutional investors would have earned their management fees, but no more, in a market without transaction costs. Given that the market has transaction costs, institutional investors collectively failed to match the market. Obviously, performance of particular institutional investors differed from that of the average institutional investor.

\(^{46}\) In the context of the CAPM, excess return refers to the actual return of a stock over its expected equilibrium return (see the positive intercepts in Models 2-5 or 5-4). In this case the term "excess return" represented a mean return in excess of the monthly risk-free rate.
Table 2-1A reports the results of Jobson and Korkie's test in Model 5-2. Jobson and Korkie's transformed difference test for the Sharpe measures provided a statistical decision criterion. That criterion applied to performance differences between Sharpe measures for ownership portfolios and the Sharpe measure for the market index portfolio. Only one ownership portfolio—the fifth quinine, representing between 80% and 99% ownership—showed mean risk-adjusted excess returns that differ from the market index portfolio, at the 5% level. However, for the first and second ownership portfolios, the positive transformed Sharpe measures, shown under column \( \text{SH}_{im} \) in Table 2-1A, showed no statistical significance. Sharpe measures for the first and second sample portfolios did not differ significantly from the market average. According to the Z-score on Table 2-1A, institutional investors with the highest ownership percentages earned a significantly positive risk-adjusted excess return. That return exceeds the market portfolio average.

Table 2-1A indicates that risk adjusted return produced negative Jobson and Korkie's Z-scores for the third and fourth portfolios; the market portfolio outperformed these portfolios. Institutional investors' selection ability did not exist at lower and middle ownership levels. Indications of stock selection ability occurred only among higher level institutional ownership portfolios.\(^47\) However, table 2-1A reports that the overall performance of institutional investors does not exceed the market index. Ownership portfolio analysis implies that although a significant mean excess return difference between ownership and market portfolio is found at one certain level of ownership

\(^{47}\) However, this finding might have differed if the study had employed several different control groups to compare sample output, instead of only one.
portfolio, institutional investors as a whole could not outperform the market index returns.

The same result has been found in the Jensen's alpha test reported below.

Table 2-1B reports the results of the tests for significant differences between pairs of ownership portfolios. Table 2-1B indicates statistically significant performance differences at the 0.025 level between the fifth and fourth quintiles and also between the fifth and third quintiles. Stocks held in greater percentage of institutional investors' portfolios exhibited higher risk-adjusted rates of return, which confirmed expectations of this study.

Table 4-1 summarizes the results of Jensen's alpha measure regressed by Model 5-4, which led to the same conclusion as the Jobson and Korkie's Z-statistic. Like traditional Sharpe measures, Jensen's alpha measures required pre-computed portfolio betas and showed positive intercepts for the first, second, and fifth ownership portfolios. Those betas resulted from weighting the beta averages of the underlying securities, as in Model 5-6.

Table 3-1 indicates that portfolio betas increased as ownership concentration increased. The first quinine (below 20%) had a Jensen's alpha value of .055%, the second quinine (between 20% and 40%) had a value of .022%, and the third quinine (between 40% and 60%) had a value of -.028%. The fourth quinine (between 60% and 80%) had a value of -.01%, and the fifth quinine (more than 80%) had a value of .46%. As in Jobson and Korkie's analysis, the highest Jensen's alpha measure came from the fifth ownership portfolio. However, Jensen's alphas for the remaining ownership portfolios
indicated no mean return differences between the sample ownership portfolio and the market average portfolio at the 5% level of significance.48

The highest ownership portfolio (consisting of stocks with greater than 80% institutional ownership) provided the highest mean risk-adjusted excess return. The lowest ownership level, consisting of companies whose stocks were less than 20% owned by institutions, created the next largest excess return. Jensen's alphas led to the same conclusion as the Sharpe measures. The two largest alphas, .46% and .055%, come from the fifth and first quintile categories, respectively. The remaining quintile portfolios produced insignificant results in this Jensen's alpha test.

The overall performance by institutional investors does not exceed the market mean index. The intercept term for the overall model in the table 4-1, while nominally positive, does not achieve statistical significance. This result is the same as in the Jobson and Korkie's test.

The results of the tests of Hypothesis 1 suggest that as ownership levels increased, risk premium, portfolio betas, and portfolio risk also increased. Mean excess returns of the sample and control groups did not differ significantly, except in the last ownership portfolio, because of the association between higher returns and higher risks. This implies that institutional investors did not always succeed in purchasing stocks that could bring higher returns. As the "safety-net" theory would imply, continual scrutiny of institutional portfolio managers' performance and investment choices tended to insure intrinsically

48 The T statistic had a value of 2.026, and probability had a value of .0457 for the highest ownership portfolio (between 80% and 99% ownership portfolio).
sound, well-informed, and prudent investment decisions. Institutional investors concentrated their activity on sound and stable stocks rather than on stocks with higher rates of return.

The highest ownership portfolio showed the greatest risk-adjusted excess return. This ownership category also had the greatest portfolio risk and portfolio beta for its actual returns; the reward for the higher risk far exceeded the increasing risk. The results of Jobson and Korkie’s transformed Sharpe difference and Z-score supported this relationship.

These results and analyses supported rejection of null Hypothesis 1, leading to the interpretation that monthly mean risk-adjusted excess returns of stock ownership portfolios correlated positively with institutional investors’ ownership concentration. At the highest level of ownership portfolio, the study found a significant difference between sample portfolio excess returns and the market index portfolio return.

However, overall, there is no evidence that institutional investors, on average, outperform investors who purchase index funds. This implies that the market is very efficient. However, as reported in earlier studies, a small number of portfolios can consistently achieve a superior stock selection. There are also significant return differences between a low institutional ownership group and a high institutional ownership group. This means that, for the sample period, stock portfolios held in greater percentage by institutional investors exhibit higher risk-adjusted rates of return. This study concludes that not all the institutional markets are perfectly efficient. This study found that institutional investors earned consistently higher return than that of the market
index portfolio when they hold stocks mostly owned by themselves and other institutional investors. Perhaps these stocks are obvious “winners” and investors continue to bid up prices.

Hypothesis 2: Beta Attribute Test

Tests of Hypothesis 1 found that portfolios held mostly by institutional owners exhibited superior returns, inferring superior stock picking ability. Based on those results, Hypotheses 2 through 5 addressed the identification of institutional investor attributes which led to that superior selection ability. Hypotheses 2, the first step in identifying those attributes, examined whether institutional investors benefitted from portfolios of different betas. Each sample beta portfolio and each control group beta portfolio were compared. Models 5-1, 5-2, and 5-4 tested the beta effect on institutional portfolio performance. Tables 1-2, 2-2A, 2-2B, and 4-2 summarize the results of the beta analysis. Table 1-2 reports results of Sharpe measures.

As reported in Table 1-2, the Sharpe measure for the low-beta portfolio was lower in the institutional ownership portfolio than in the control portfolio; equal in the second portfolio to that of the control portfolio; and higher in the remaining three portfolios than in the control groups. As the value of beta increased, so did the risk premiums and portfolio standard deviations. The increasing rate of return in the sample beta portfolio return did not outpace the increasing rate of return in the control group as the value of beta increased. As Table 1-2 indicates, the highest beta portfolio (stock portfolios consisting of betas greater than 2.0) had a slightly higher mean risk-adjusted rate of return.
than that of the counterpart in the control groups. Conversely, the lowest beta portfolio had a lower return than that of the counterpart in the control groups.

Table 2-2A reports the result of Jobson and Korkie's test. This table reports differences of monthly mean risk-adjusted excess returns between sample beta and market index portfolios. According to Table 2-2A, only the third level (between 1.0 and 1.5) beta portfolio had a performance that differed from the market index portfolio at the .05 level. The tests determined whether a portfolio of large beta stocks outperformed a portfolio of small beta stocks, and it compared both with market index portfolios.

Table 2-2A indicates that—except for the third level beta portfolio—jobson and Korkie's Z-test did not support higher Sharpe measures for the higher beta categories. As the value of beta increased, the monthly mean risk-adjusted excess return also rose; however, those increases did not outpace the risk increase. Tests of Jobson and Korkie's statistic implied that compensation for beta risk almost equaled the CAPM market risk premium. Performances measured by monthly mean risk-adjusted excess returns at both lower and higher levels of beta portfolios did not significantly differ from that of the market index portfolio. Only in the middle range beta portfolio did the performance surpass the market index performance. Table 2-2B shows no significant differential performance between any two portfolios.

Table 4-2 reports Jensen's alpha measures in Model 5-4, which also support the Jobson and Korkie's Z-test result. The initial step in calculating Jensen's alpha is the calculation of portfolio betas by Model 5-6. Table 3-2 reports that as the value of beta increased, portfolio betas also increased. Jensen's alphas, which indicated superior
performance, turned negative at the middle level of beta stock portfolios, but positive at both higher levels and lower levels of beta stock portfolios. However, there are no significant alphas. This implies that institutional investors used a stock portfolio selection process which can be reasonably approximated by CAPM, and which approximated the market performance before taking costs into account. The relationship between the portfolio betas and their respective monthly mean excess return is tested by the market-based portfolio OLS regression.

\[ MR = .001849 + .005311 \beta + u, \quad R^2 = .0325 \]

\[ (.0003) \quad (.0001) \]

\[ n = 8,396 \]

* Numbers in parentheses represent t-value significance level.

where MR represented monthly mean excess return for the market-based portfolio.

Figure 1 depicts these relationships.

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49 However, this is completely opposite to the Jobson and Korkie's test. Maybe this is due to the different market index applications between the Jobson and Korkie's test and Jensen's test.

50 This regression was made by regressing a stock's excess return on its beta in the market index portfolio.

51 This very small R-square represented a cross-sectional time-pooled regression. The F statistic had a value of 83 and probability had a value of .0001.
Market-Based Portfolio
(.00185 + .005311 beta)

Figure 1. SYSTEMATIC RISKS AND EXCESS RETURNS

Dots in the graph represent the combinations of the following beta portfolio excess returns and their respective portfolio beta of the beta portfolio.

<table>
<thead>
<tr>
<th>PER*</th>
<th>β portfolio 1</th>
<th>β portfolio 2</th>
<th>β portfolio 3</th>
<th>β portfolio 4</th>
<th>β portfolio 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>.0017</td>
<td>.0043</td>
<td>.0066</td>
<td>.0096</td>
<td>.0144</td>
<td></td>
</tr>
<tr>
<td>portfolio βs</td>
<td>.34</td>
<td>.75</td>
<td>1.2</td>
<td>1.7</td>
<td>2.8</td>
</tr>
</tbody>
</table>

* PER represents portfolio monthly mean excess returns.
The study found no substantial dispersion of monthly mean excess returns of beta portfolios from that of the market-based portfolio.

The attribute test implied that higher betas did not contribute significantly to superior institutional investor selection. The Sharpe measures indicated no significant transformed difference between sample and control groups. This finding contradicted McDonald's (1974) theory. As CAPM would imply, the systematic risk and monthly mean risk-adjusted excess return are positively related. Higher and lower betas received the compensation stated by CAPM, so other selection criteria, filters, or screens which may have been applied by portfolio managers do not appear to have added to institutional portfolio returns. Although middle range beta groups showed significance with Jobson and Korkie's test only, they had very small Sharpe and Jensen measures.

All beta attributes tests, including the graph explaining the relationship between systematic risk and excess return, resulted in failure to reject null Hypothesis 2. In fact, the performance of the medium size (third) beta portfolio outperformed the market index portfolio. On the other hand, the overall beta test results coincided with the CAPM prediction. There is a positive relationship between systematic risk and monthly excess return based upon Jensen's measure. However, this hardly suggested that the beta effect made a major contribution to the institutional investors' superior stock selection ability. It implied only that the higher beta group did not outperform the counterpart of the market index in the control groups. Finally, if beta had an effect on institutional portfolio performance, that effect might have come from the middle range of beta categories.
**Hypothesis 3: Volatility Attribute Test**

As the second step in identifying elements of institutional investors' extra selection ability, tests of Hypothesis 3 examined whether institutional investors considered total variability (represented by standard deviation) of individual stocks. The tests compared each of the volatility portfolios to its counterpart in the market index portfolios.

Tables 1-3, 2-3A, 2-3B, and 4-3 summarize the results of the volatility analysis. Table 1-3 reports results of Sharpe measures. As this table indicates, risk premium, portfolio standard deviation, and Sharpe measures in the sample groups increased as the value of the standard deviation grew larger. At the same time, risk premium, portfolio risk, and Sharpe measures in the control groups rose as the level of volatility increased. According to this table, all except the first of the volatility categories had higher Sharpe measures than those of market index portfolios.

Table 2-3A presents the result of Jobson and Korkie's Z-test. The table data indicate that mean excess returns from the volatility portfolios did not differ from those of market index portfolio, and that this result holds true. Institutional investors required higher compensation for holding riskier securities in their portfolio. However, those riskier stocks did not provide institutional portfolio managers with extra returns; they only compensated for their risks compared to their counterparts in the market index portfolios.

Table 2-3B reports differential performances between portfolios within the volatility groups. According to this table, higher volatility groups produced greater
performance, thus supporting Hypothesis 3. This contradicted the traditional expectation of CAPM that the market would reward only systematic risk. Volatility could not have contributed to institutional investors' extra selection ability because their paired comparison with those of market proxy returns did not differ.

The Jensen's alpha results measure, shown in Table 4-3, did not confirm the results of Jobson and Korkie's test. Rather, they indicated that at lower and middle ranges of volatility, portfolios performances did not consistently provide significant differences from that of the market index portfolio. Neither the negative Model 5-4 intercept terms for the first and second volatility portfolios nor the positive terms for the third portfolio in Table 4-3 was significant. However, the positive intercepts and their t-values appeared significant at the 0.16 significance level for the fourth volatility portfolio and at the .01 significance level for the fifth volatility portfolio. The different output of Jensen's measure related to Jobson and Korkie's Z-score resulted from a different market index application. When compared to the market index portfolio, stocks with higher levels of volatility apparently helped institutional investors generate extra portfolio returns.

Volatility tests gave mixed results, leading to interpretations. According to the Jobson and Korkie's test, volatility did not significantly contribute toward extra portfolio returns. However, Jensen's measure gave contradictory results, because institutional investors

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53 This study created five different market indices that had the sample categorization rules as applied to the sample categorization. Jensen's measure had just one market index return, which came from the characteristic of CAPM. CAPM had a market rate of return as one of its components. However, based upon the assumption that the market index had been divided into five categories as in the sample, the actual results have ended up with the same as the Jobson and Korkie's results. At all levels, the test of volatility did not appear to significantly contribute to institutional investors' portfolio extra return.
investors with higher levels of portfolio volatility generated extra returns. The different results imply that when compared to the market, the volatility portfolio generates excess returns. In the control groups, the volatility portfolio does not generate excess returns.\textsuperscript{54}

Null Hypothesis 3 is rejected, but results are mixed on whether high portfolio volatility caused additional portfolio returns. Contrary to the CAPM expectation, the market provides investors with higher returns that compensated for higher risk. Investors required higher rewards for holding riskier stocks. However, riskier stocks produced higher returns than the market portfolios. The portfolio volatility analysis results of Hypothesis 3 depended upon the methodology chosen for the test. At lower volatility levels, both methodologies indicated there was no contribution of volatility to institutional investors’ superior selection ability. Jobson and Korkie’s test implied that higher volatility could not contribute to institutional investors’ superior stock selection ability. However, the Jensen’s alpha measure result is opposite that of the Josbson and Korkie test; volatility is found to contribute to institutional investors’ extra returns.

**Hypothesis 4: Firm Size Effect Test**

As the third step in searching for components of institutional investors’ extra selection ability, Hypothesis 4 tests whether institutional investors sought any small firm effect. Tables 1-4, 2-4A, 2-4B, and 4-4 summarize the results of this.

\textsuperscript{54} This means that the return of the stock market as a whole is less than that of the segmented market index (as in the control groups) for Jobson and Korkie’s test.
First, Table 1-4 reports the results of Sharpe measures in Model 5-1. All Sharpe measures in the sample groups outperformed the market index portfolios. The first and the second paired groups showed the two biggest Sharpe measure differences. This analysis indicates a negative relationship between asset portfolio risk and firm size. Monthly mean excess returns are also related negatively to firm size. As in earlier studies, firm size (represented by total assets) is related inversely to portfolio returns. Over the entire study period, the portfolio with the highest asset value earned the lowest Sharpe measure (.0881); the group with the lowest asset value earned the highest, .265.

Of the five variables tested, size revealed the smallest portfolio risk difference (1.496%) between firms in the lowest category (3.518%) and firms in the highest category (5.014%), while Sharpe measures produced the greatest difference (.1774) between firms in the lowest category (.088) and those in the highest (.2654). This implies that institutional investors, by having small firm stocks with relatively smaller risk in their portfolios, might have increased their portfolio extra returns.

The fifth asset group ($1.46 billion assets and more) showed the lowest Sharpe measure, .088. This implied that although larger firms had high trading liquidity, they hardly contributed to institutional investors' investment maximization goal.

Table 2-4A reports the results of Jobson and Korkie's Z-test in Models 5-2 and 5-3. It indicates that the smallest firm group showed a significantly high Jobson and Korkie's transformed difference measure of .93, with 2.05 Z-score. The Z-statistic

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55 The second asset portfolio had the next largest transformed measure of .54, with 1.82 Z-score.
indicated consistent statistical significance at the .02 level for the transformed Sharpe difference in mean risk-adjusted return between the smallest sample asset group and the counterpart in the control group. This transformed difference decreased as firm size increased (see values under column SHim in Table 2-1A). Table 2-4B also indicates that a group of smaller firms (e.g., portfolio 1) performed better than a group of larger firms (e.g., portfolio 2, 3, 4, and 5). This inverse relationship between firm size and return confirmed the results of the Sharpe measure.

Table 4-4 reports the Jensen's test which confirmed the results of Jobson and Korkie's test. The alpha measure for the smallest group (.62%) represented the intercept in Model 5-4. This alpha denoted the vertical distance between a portfolio's actual return and its "equilibrium" level of expected return suggested by the CAPM. This positive distance implied an undervaluation of some of the securities in the small asset portfolio. Institutional investors may have increased portfolio extra returns by including as many of those stocks as they could in constructing their investment portfolios.

The third and fourth larger asset portfolios did not have alpha measures as high as the first or the second portfolios. This implied that larger firms, in general, gave nothing but liquidity to institutional investors.

**January Test:** Table 5-1 reports the results of Model 5-8. The January regression intercepts were not statistically significant, nor were they significantly different from the index fund. The results indicated no relationship between Jensen's alpha and firm size in the small firm-January effect test. These results were not consistent with previous hypothesis testing, but caution should be exercised when interpreting the results. This
study covered only an eight-year period of monthly return data. Previous studies—such as Jaffe, Keim, and Westerfield (1989)—utilized much longer time periods. Eight observations per portfolio might not have produced a sufficient basis for the January spot test.\(^5\)\(^6\)

Hypothesis 4 implied that institutional investors considered small firm effects in their portfolio construction. As in earlier studies, firm size related inversely to institutional portfolio returns, which gave institutional portfolio managers a chance to create extra returns. The results dictated rejection of null Hypothesis 4.

**Hypothesis 5: Test of Relationship Between R&D Expenditures and Institutional Ownership**

As the last step of analysis of extra institutional portfolio returns, Hypothesis 5 measured relationships between levels of institutional ownership and R&D expenditures. Those tests used F-statistic and p-values to examine the relationship between R&D expenditures and institutional ownership. Tests of Hypothesis 5-B then determines whether that relationship contributed to institutional investors' superior stock selection ability.

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\(^{56}\) Inappropriate data application for this test may have precluded detection of a significant January effect. In previous studies, more than half of the excess January returns occurred during the first five trading days of that month (Roll, 1983). However, this study used stock price information contained in the Compact Disclosure database, which contained monthly average stock prices.
Tests of Hypothesis 5-A

Table 6 presents F-values, R-squares, significance levels, coefficient estimates, and p-values of the Model 5-9 regression. Table 6 gives the value of the F statistic (F=3596) and the probability value (.0001). The results indicate a positive relationship at the .01 significance level between R&D expenditures and each level of institutional ownership.57

The t-statistic (t=60) of the independent variable (institutional ownership percentage) also confirmed a linear relationship between the natural logarithm of R&D expenditures and institutional ownership percentages at the .01 significance level. Ownership proved significant with a .042214 coefficient. Firms with higher levels of institutional ownership exhibited higher R&D expenditures. The results aligned with previous studies such as Kochhar and David (1996) and Hansen and Hill (1991).

With respect to R&D expenditures, institutional investors behaved in a hyperopic manner. These findings dictated rejection of null Hypothesis 5-A.

Test of Hypothesis 5-B

Hypothesis 5-A proved a significant positive relationship between institutional stock ownership levels and R&D expenditures. Hypothesis 5-B examined whether that relationship contributed to institutional investors' superior stock selection ability. Tables

57 When added with firms' total assets to Model 5-9, R-square increased to 63% from 27%, while the overall significance level remained as low as the .0001 in the original model. Moreover, more importantly, contrary to Demsetz and Lehn (1985), institutional ownership is positively related to firm size measured by total assets. The t-statistic of the asset variable is significant at the .0001 level. This finding is consistent with the Badrinath et al. argument. For more details, see Table 6-2.
1-5, 2-5A, 2-5B and 4-5 summarize R&D expenditure contributions to institutional portfolio performances.

Table 1-5 presents results of Sharpe measures through Model 5-1. As the size of R&D expenditures increased, Sharpe measures at all ownership levels decreased, in contrast to expectations. Regardless of the level of institutional ownership, smaller R&D portfolios outperformed larger R&D portfolios. The R&D portfolios with higher institutional ownership outperformed the same levels of R&D portfolios with lower institutional ownership. The LM portfolio (L for low institutional ownership, M for medium R&D expenditures) failed to equal the market portfolio's performance; all other R&D portfolios performed better than the control groups.

Table 2-5 reports the results of Jobson and Korkie's transformed differences and Z-scores for R&D portfolios in Model 5-2 and 5-3. The table indicates that none of the nine R&D portfolios showed any different performance at the 5% significance level, compared to the matched sample of similar market index portfolios. However, R&D portfolios in the highest ownership group dominated other R&D portfolio groups in the different ownership groups. The lowest R&D portfolio with the highest ownership group showed the biggest transformed Sharpe measure (1.36). However, higher significance test results did not support that high transformed difference because of the increased level of portfolio risk. In general, the contribution of the R&D factor to institutional portfolio performance related inversely to amounts of R&D spending and positively to levels of institutional ownership. The results of Jobson and Korkie's test supported the results of the traditional Sharpe measure.
Table 4-5 represents the results of Jensen's alpha measures in Model 5-4. All the intercepts for the largest R&D expenditures in the Jensen's alpha test proved negative, but are not significant. Among them the largest R&D portfolio with the highest institutional ownership portfolio produced the greatest intercepts. Within the same institutional ownership group, R&D expenditures related inversely to the Jensen's alpha measure. This meant that higher level of R&D expenditures did not contribute to institutional investors' selection ability. This precluded rejection of null Hypothesis 5-B.

Institutional investors exhibited great concern with research and development costs; however, those expenditures did not have a positive correlation with portfolio performance. In theory, bigger firms had higher levels of institutional ownership (Mason, 1995) and a strong positive correlation with R&D expenditures. This study found an inverse correlation between firm size and stock returns; however, higher levels of ownership positively related to stock returns.

These results could lead to several conclusions. First, excess returns from higher institutional ownership did not overcome the inferior returns from larger firms. Second,

58 The impact of R&D on firms’ profit usually occurs with a lag, not coincidentally. This study tested the relationship between the amount of R&D expenditure and its effect on the firms’ profit, assuming coincidence. An assumption of coincidence implies that investors and firm managers can all arrive at an expected present value of the results of R&D. If this is not the case, a new model might be needed to lag the effects of R&D, thereby alleviating the problem of when to expect to receive benefits from the expenditure.

59 However, this is contrary to Demsetz and Lehn's (1985) argument.

60 Regression tests between firm size and R&D expenditures created an $R^2$ of 66%, with a .0001 significance level. For more details, see Appendix Table 6-3.
institutional investors prefer firms with relatively higher R&D expenditure, despite the possible diminution of current return, because of the potential long-run benefits.

**Institutional Portfolio Performance Joint Effect Test**

Finally, this study develops a forecasting model for institutional portfolio performance, based on all variables employed in this test. Table 7 reports the results of model 5-10. Limited multicollinearity problems occurred with all the independent variables. For example, output Table 7-1 lists a rather low (.06) regression $R^2$. Since $1/(1-R^2)=1.06$, variables associated with VIF values exceeding 1.06 related more closely to the other independent variables than to the dependent variable.

The Condition Number is used for detecting multicollinearity is the square roots of the ratios of the largest eigenvalue to each of the other eigenvalues. The number of large values in this column also indicates near linear variable dependencies. Multicollinearity problems may exist when eigenvalues have condition numbers greater than 30. In output Table 7-2, all eigenvalues had condition numbers less than 3.5.

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61 Statistical literature and prior research have established no formal criteria for determining the magnitude of variance inflation factors that cause poorly estimated coefficients. Usually, values exceeding 10 have caused concern, but page 97 of the 1996 SAS Regression Manual treats this value as arbitrary. However, “for models with low coefficients of determination for the regression, estimates of coefficients that exhibit relatively small variance inflation factors may still be unstable . . .” (SAS Regression Manual 1996, 97).

62 The variance inflation factor equaled $1/(1-R_i^2)$, where $R_i^2$ represented the coefficient of determination for the “regression” of the $i$th independent variable on all other independent variables.

63 This is also arbitrary, not a formal criterion.
The correlation matrix in Table 7-1 also indicates some multicollinearities between R&D and assets between volatility and beta, and between R&D and institutional ownership. However, removing one of those variables which caused multicollinearity problems at a time, produced no significant changes in the variances or values of the parameter estimates. The interpretation of regression output in model 5-10 assumes some multicollinearity.

Model 5-10 was significant at 0.01, with small (5.9%) variability. The F value was 28.7. See Table 7-2.

\[ R_j = -0.03637 + 0.0002 \text{Own} + 0.002 \text{BETA} + 0.0675 \text{VOL} + 0.004 \text{FS} - 0.0025 \text{R&D} \]
\[ (0.0001) \quad (0.0001) \quad (0.006) \quad (0.0001) \quad (0.0001) \]

* The numbers in parentheses represent the significance level of t-statistics.

In Table 7-2, all explanatory variables are significantly related to institutional portfolio performance. Beta is significant at the .0006 level. The signs of coefficients for each of the variables are positive, except for that of R&D.

All the signs except that for the asset variable are as hypothesized. The asset variable related negatively to the portfolio return in the attribute test. Holding constant all other variables, the model indicates an increase of 0.002 in monthly mean portfolio return with each percentage increase in institutional ownership; and the model predicts an increase of \(0.004 \times (1/33,000,000)\) in monthly mean portfolio return for each unit of
increase in assets. This finding disagreed with results of the small firm attribute test. Holding constant everything else, with one unit increase in R&D expenditures, the model predicts a decrease of \(0.00253 \times (1/132,000)\) in monthly mean portfolio return.

The final chapter presents the overall conclusions from testing and analysis. More detailed implications, limitations, and suggestions for future research are presented.

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64 In a semi-linear-log form of regression, the slope of this form depends upon the value of independent value of asset, the value of dependent value of portfolio return, or both. As a non-constant, it depends upon where along the function the expression is evaluated. In this case, the portfolio has a mean average asset value of $33,000,000. If this mean value of assets were to change, then the slope of this expression might change, too. Therefore, this slope has validity only with a mean value asset of $33,000,000.

65 Mean value of R&D expenditures. The same theory applies to the R&D variable as asset variable.
CHAPTER 7

SUMMARY AND CONCLUSIONS

This study examines the recent dramatic increases of institutional holdings of corporate stock. It also measures the success of portfolio managers' returns on investment. Did these managers possess a superior stock selection ability? If they did, where did the stock selection power come from? Did it come from beta, stock volatility, small firm effect, R&D expenditures, or some combination of these? If they possessed a real superior stock selection ability, could a description of that ability form a prediction model for future investors?

This study utilized data for stocks traded on the NYSE, AMEX, and NASDAQ. It tested five potential explanatory hypotheses using Sharpe's measure, Jobson and Korkie's Z-test, and Jensen's alpha measure. For Sharpe's and Jobson and Korkie's tests, several different market index portfolios were constructed by the same classification rules as those applied to sample groups. For Jensen's model, a modified CAPM model was employed.
Institutional Ownership

Analysis of ownership portfolios indicated that institutional investors are somewhat successful in choosing undervalued stocks. Institutional investors as a whole do not show superior selection ability performance when compared to a market index portfolio. However, when the ownership portfolios are divided into groups based on different levels of ownership concentration, some of these exhibited a significant difference in mean excess returns, relative to the market. Stocks with more than 80% or less than 40% institutional ownership produced the highest extra returns. The selection power of institutional investors proved very weak at the middle range of institutional ownership. This implied behavior is consistent with the safety net theory. Portfolio managers selected solid, safe, and prudent stocks, with secondary emphasis on returns.

Gross returns analysis excluded transaction costs. Had these costs been included, the mean return differences between the ownership and market index groups might have equaled, or even fallen below, that of the stock market as a whole.

The monthly mean return for companies owned by institutions did not significantly exceed returns for the market except for the portfolio in which stocks represented companies at least 80% owned by institutions. Although stock portfolios owned significantly by institutions showed a relatively high portfolio risk, the return outpaced the risk-to-return ratio. Risk-adjusted rates of return of highly condensed ownership portfolios outperformed lower ownership concentration portfolios.

Although the institutional ownership sample as a whole showed neither significantly superior nor inferior performance, individual portfolios performed in a
superior manner. This is consistent with results of mutual fund studies such as McDonald (1974), Mains (1977), and Kon and Jen (1979). This finding is consistent to the “sophisticated” clientele group (Gruber, 1996) in which money is directed to funds based on performance.

**Beta Effect**

The second hypothesis addressed the beta effect on institutional portfolio performance. Portfolio excess returns are examined within several different beta portfolio levels. Jensen's alpha measures computed by the modified CAPM (Model 5-4) showed that the intercept did not significantly differ from zero and did not support the traditional high beta performance theory. Although middle range beta portfolios generally outperformed the market, the higher beta effect did not contribute to institutional investors’s superior portfolio performance. In this case, sample portfolio compensation equaled its systematic risk.

**Volatility Effect**

Volatility analysis presented mixed results, depending upon the methodology applied; and at higher levels of volatility, Jobson and Korkie's test implied that institutions generated no abnormal return from stock volatility. To the contrary, Jensen's alpha measure indicated that institutions benefitted from stock volatility, which might provide useful information for institutions seeking to generate extra portfolio returns. Contrary to the traditional view on volatility, the markets compensated for total risk. As
volatility increased, the rate of return also increased commensurately with the market index, as shown in Table 1-3.

**Firm Size and January Effect**

The small firm effect resulted in the greatest contribution to institutions' superior selection power. In general, the smaller firms generated higher monthly mean excess risk-adjusted rates of return.

The expected January effect was not funded. However, the data used for testing the January effect may not have properly served this purpose. Previous studies showed that the January effect occurred in the first few trading days of the year, but this study employed monthly return data.

**R&D Expenditures**

The test of R&D expenditures using simple and multiple regression indicated a positive, but weak relationship between R&D expenditures and both institutional holdings and institutions' abnormal returns. In the context of R&D expenditures, institutional investors acted hyperopically.

The next test investigated whether the positive relationship between R&D expenditures and institutional ownership contributed to portfolio performance. In general, the level of R&D expenditures and monthly mean excess risk-adjusted rate of returns were inversely related. R&D expenditures portfolios with higher institutional ownership showed greater rates of return. Although the results did not prove significant, the
relationship occurred across institutional ownership levels and with all test methodologies.

Institutions were found to prefer firms with larger R&D expenditures, but these did not generate extra returns. Institutional managers may have preferred larger R&D expenditures because of a high correlation between R&D and innovation.

**Joint Effects Test**

This study presents a limited decision model based upon several explanatory variables. The multiple regression model produced significant results at the .01 level with an F statistic of 28.7. The output of Model 5-10 indicates a significant relationship between portfolio returns and four variables (volatility, beta, asset, and institutional ownership).

Contrary to expectations, the R&D variable related inversely to the portfolio return. This supported the results of the of R&D expenditures attribute test. The asset variable contributes positively to institutional portfolio returns. This is contrary to the results of the total assets attribute test. Each of the parameters was significant, and the regression model explained 5.9% of the total variation.

**Contributions**

This study evaluated the portfolio selectionability performance of institutional investors. Most previous work focused on only one segment (mutual funds) which does not represent the performance of all institutional investors.
Additionally, this study determined some characteristics of institutional investors by examining relationships between their stock selection ability and their attributes. Previously, most academic work on institutional investors focused on identifying superior time forecasters and superior stock selectors. The previous literature lacked behavioral facts such as the "whys and hows" of superior investment selection. Institutional performance is related to firm quality attributes such as beta, volatility, firm size, and R&D expenditures.

In conclusion, institutional investors as a whole are not superior stock selectors; however, specific portfolios performed in a superior manner. The institutions' superior selection ability is partly based on such firm quality attributes as firm size and returns volatility effects.

**Limitations**

One of the limitations of this study is that it used monthly return data that did not completely satisfy the purpose of the research. The test of the January small firm effect was likely not significant due to the use of monthly return data.

**Directions for Future Research**

This study tested the effects of selected variables—beta, stock volatility, firm size effect, R&D expenditures—on financial institutions’ stock portfolio returns. Other proven anomalies such as cash flow, E/P ratio, past performance, liquidity ratio, book to market ratio, working capital, and earnings might also have affect institutional portfolio returns.
To develop a more accurate relationship between superior institutional performance and its attributes, a research study design should include institutional micro and macro forecasting such as timing of beta manipulation. Furthermore, a future study, based on individual institutional investors rather than upon investors as a whole, would give insight for evaluating institutional investment behavior. Future research should incorporate both cross-sectional and time-series data.
<table>
<thead>
<tr>
<th>AUTHOR, JOURNAL</th>
<th>SAMPLE, PERIOD</th>
<th>ISSUES &amp; RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black, Jensen, and Scholes, 1972</td>
<td>Monthly returns of NYSE stocks, 1931-1965</td>
<td>Low-risk stocks had higher returns than the CAPM would predict. High-risk stocks had lower returns than the model would predict.</td>
</tr>
<tr>
<td>Fama and French, 1992 J of Finance</td>
<td>NYSE, AMEX and NASDAQ return files from the CRSP, 1941-90 &amp; 1963-90</td>
<td>A relation between average stock returns and beta during the longer period, but no relation over the shorter period.</td>
</tr>
<tr>
<td>Chan and Lakonishok, 1993, J of Portfolio Management</td>
<td>Monthly returns files from CRSP, 1926-1991</td>
<td>A strong positive relation between beta and risk up to 1982, but no relation thereafter because of noise in the data.</td>
</tr>
<tr>
<td>Kothari, Shanken, and Sloan, 1995 J of Finance</td>
<td>Monthly portfolio returns of NYSE and AMEX stocks from CRSP, 1927-90, 1940 -1990, and 1963-90</td>
<td>No relation between beta and average return over the relatively shorter period; however, a positive relation between average returns and beta risk over the longer period, provided that the study measured betas at the annual interval.</td>
</tr>
</tbody>
</table>
### RISK-INSTITUTIONAL HOLDINGS RELATIONSHIP

<table>
<thead>
<tr>
<th>AUTHOR, JOURNAL</th>
<th>SAMPLE, PERIOD</th>
<th>ISSUES &amp; RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sias, 1996 Financial Analysts Journal</td>
<td>Weekly rate of returns for all securities listed on NYSE from 1977 to 1991</td>
<td>Focused on the relationship between volatility and institutional holdings. An increase in institutional holdings increased volatility; the increase preceded an increase in volatility because institutional investors played a destabilizing role in financial markets. However, higher returns resulted in relatively lower volatility.</td>
</tr>
</tbody>
</table>

### FIRM SIZE AND BETA-RETURN RELATIONSHIP

<table>
<thead>
<tr>
<th>AUTHOR, JOURNAL</th>
<th>SAMPLE, PERIOD</th>
<th>ISSUES &amp; RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lakonishok and Shapiro, 1986 J of Banking and Finance</td>
<td>All stocks traded on the NYSE for at least 8 years between 1954 and 1981 and CRSP monthly return data from the period 1962 -1981</td>
<td>Studied the historical relationship between stock market returns and the following variables: beta, residual standard deviation, and size. Neither the traditional measure of beta risk nor the alternative risk measures could explain the cross-sectional variation in returns; only size appeared to matter.</td>
</tr>
<tr>
<td>Ritter and Chopra, 1989 J of Finance</td>
<td>The CRSP monthly returns file of NYSE securities for the 1935-1986 period</td>
<td>They found a positive risk-return relation in January for small firms but not for large firms. High-beta small firms had higher excess returns than low-beta small firms in January, irrespective of whether the market provided a positive or negative return.</td>
</tr>
</tbody>
</table>
## Firm Size Effect

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Journal</th>
<th>Sample Period</th>
<th>Issues &amp; Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banz, 1981</td>
<td>J of Financial Economics</td>
<td>Monthly return data from CRSP files of all stocks traded in the NYSE during 1926 to 1975 period</td>
<td>Small NYSE firms have had significantly larger risk-adjusted returns than large NYSE firms over a forty-year period. He found a non-linear relation; the smallest earned larger excess returns, whereas the medium size portfolios showed little difference from that of the largest. The study found a size effect, but no clear explanation.</td>
</tr>
<tr>
<td>Roll, 1981</td>
<td>J of Finance</td>
<td>Several different interval returns of NYSE and AMEX from 1962 to 1977</td>
<td>An improper estimation of security betas could have explained part of the observed risk-adjusted excess returns related to size. Previous studies had improperly measured the riskiness of small firms.</td>
</tr>
<tr>
<td>Reinganum, 1981</td>
<td>J of Financial Economics</td>
<td>566 NYSE and AMEX stocks from 1976 to 1977 based on quarterly and annual earnings data</td>
<td>Small firms systematically experienced average rates of return significantly greater than those of large firms with equivalent beta risk. This suggested either a misspecified CAPM or inefficient capital markets.</td>
</tr>
<tr>
<td>Reinganum, 1983</td>
<td>J of Financial Economics</td>
<td>Daily return data of CRSP files from all securities traded on the NYSE and AMEX from 1962 to 1980</td>
<td>To test for size effects. Small firms experienced large returns during the first few trading days of January.</td>
</tr>
<tr>
<td>Brown, Kleidon, and Marsh, 1983</td>
<td>J of Financial Economics</td>
<td>Quarterly data of 566 firms listed on the NYSE (1926 - 1978) and AMEX (1963 - 1978)</td>
<td>The study found a linear size effect. It also found a sensitivity to the time period studied and methodologies applied.</td>
</tr>
</tbody>
</table>
FIRM SIZE EFFECT (continued)

<table>
<thead>
<tr>
<th>AUTHOR, JOURNAL</th>
<th>SAMPLE PERIOD</th>
<th>ISSUES &amp; RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keim, 1983, J of Financial Economics</td>
<td>CRSP daily stock files from 1963 to 1979 based on stocks listed on the NYSE and AMEX</td>
<td>A negative relation between size and average returns. Large means for January relative to the remaining eleven months.</td>
</tr>
<tr>
<td>Reinganum and Smith, 1983, J of Industrial Economics</td>
<td>CRSP daily files during the period from 1962 to 1978 from all securities traded on the NYSE and AMEX</td>
<td>Small firms experienced substantially higher average returns than large firms on a risk-adjusted basis.</td>
</tr>
<tr>
<td>Barry and Brown, 1984, J of Financial Economics</td>
<td>Monthly NYSE security returns for the period 1926 to 1980.</td>
<td>To find the cause of firm size effect with differential information. Factors other than differential information influenced the firm size effect.</td>
</tr>
<tr>
<td>Lakonishok and Shapiro, 1986, J of Banking and Finance</td>
<td>Monthly return data from the CRSP files and covering the period from 1954 to 1981</td>
<td>Small firms yielded higher returns than did larger firms; however, with January data, the size variable lost its statistical significance.</td>
</tr>
<tr>
<td>Jaffe, Keim and Westerfield, 1989, J of Finance</td>
<td>Monthly return data of AMEX and NYSE firms from the CRSP files during the period, 1951-1986</td>
<td>A significant size effect in January.</td>
</tr>
<tr>
<td>Ritter and Chopra, 1989, J of Finance</td>
<td>The CRSP monthly returns file of NYSE securities for the period 1935-1986</td>
<td>About the risk-return characteristics of small firms in January. The study found a positive risk-return relationship in January for small firms but not for large firms. High-beta small firms had higher excess returns than low-beta small firms in January, irrespective of positive or negative market returns.</td>
</tr>
</tbody>
</table>
FIRM SIZE EFFECT (continued)

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<thead>
<tr>
<th>AUTHOR, JOURNAL</th>
<th>SAMPLE PERIOD</th>
<th>ISSUES &amp; RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amihud and Mendelson, 1989 J of Finance</td>
<td>CRSP monthly return data of NYSE securities for the period 1960-1979</td>
<td>Tested whether asset returns served as an increasing function of their beta risk, residual risk, and firm size. Conclusion: a positive beta, but negative residual risk and firm size relationship with asset returns.</td>
</tr>
<tr>
<td>Tsetsekos and DeFusco, 1990 J of Portfolio Management</td>
<td>CRSP data files and Value Line for the 1979-1984 period</td>
<td>To test whether portfolios of firms with high managerial ownership outperformed portfolios of firms with low managerial ownership. They found the size effect, but it did not depend on the level of managerial ownership.</td>
</tr>
<tr>
<td>Leong and Zaima, 1991 J of Business Finance &amp; Accounting</td>
<td>CRSP files for NYSE-AMEX returns and National OTC Stock Journal from 1981 to 1983</td>
<td>Focused on OTC stocks to find the clue for the small firm effect because OTC stocks had lower values than those of NYSE-AMEX. All together, no small firm effect; however, the January excess return for OTC stocks exceeded that of the smallest market value NYSE-AMEX group.</td>
</tr>
</tbody>
</table>
**BETA NON-STATIONARITY**

<table>
<thead>
<tr>
<th>Author, Journal</th>
<th>Sample, Period, &amp; Methods</th>
<th>Issues &amp; Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabozzi and Francis, 1978, JFQA</td>
<td>Monthly Returns of NYSE stocks from CRSP files, 1965-71, random coefficient model.</td>
<td>True beta moved randomly, while the OLS beta performed as a point estimate which did not vary over the sample period.</td>
</tr>
<tr>
<td>Roenfeldt, Griepentrog, and Pflaum, 1978, JFQA</td>
<td>Monthly 664 firms from the Compustat Price-Div.-Earnings Tape, 1963-74</td>
<td>Betas had a definite tendency to remain in the same quintile over time.</td>
</tr>
<tr>
<td>Kon and Jen, 1979, J of Business</td>
<td>49 mutual funds, monthly return from 1960 to 1971 Quandt's switching regression model applied.</td>
<td>A mixture of two (21 funds) or three (6 funds) regression equations rather than that of the standard linear model. It tested for timing activities.</td>
</tr>
<tr>
<td>Fabozzi and Francis, 1979, J of Finance</td>
<td>Monthly rates of return for 85 mutual funds from 1965-71 single index market model</td>
<td>No indication of shifting mutual fund systematic risk for Bull and Bear markets.</td>
</tr>
<tr>
<td>Sunder, 1980, J of Finance</td>
<td>Monthly rates of return for NYSE stocks from 1926-75</td>
<td>The market risk followed a random walk over time, and it followed an autoregressive process. The average level of nonstationarity varied from one subperiod to another (high during 1926-50 and low during 1963-75).</td>
</tr>
<tr>
<td>Merton, 1981, J of Business</td>
<td>Simulations</td>
<td>Superior market-timing ability earned a substantial additional average rate of return.</td>
</tr>
<tr>
<td>Henriksson and Merton, 1981, J of Business</td>
<td>Statistical techniques for testing timing forecasting ability through both parametric and nonparametric</td>
<td>Tested for timing ability. Nonparametric: Forecasting skills differed for up markets and for down markets. Parametric: the expected &quot;up-market&quot; beta of the portfolio exceeded the expected &quot;down-market&quot; beta of the portfolio.</td>
</tr>
</tbody>
</table>
BETA NON-STATIONARITY (continued)

<table>
<thead>
<tr>
<th>AUTHOR, JOURNAL</th>
<th>SAMPLE, PERIOD, &amp; METHODS</th>
<th>ISSUES &amp; RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohlson and Rosenberg, 1982, J of Business</td>
<td>NYSE common stocks from 1926 - 1975, equal-weighted market portfolio preferred.</td>
<td>A tendency for betas to converge rather slowly toward a norm (the stationary mean) and a stationary first-order autoregressive process.</td>
</tr>
<tr>
<td>Lee and Chen, 1982, J of Economics and Business</td>
<td>Monthly rates of return for 363 NYSE companies from 1965 - 1979</td>
<td>65% of the sample firms showed an unstable beta over the ten-year period.</td>
</tr>
<tr>
<td>Kon, 1983, J of Business</td>
<td>Monthly rates of return for 37 mutual funds from 1960 - 1976</td>
<td>Individual mutual funds exhibited significant positive timing ability; however, portfolio betas remained stable over the study period.</td>
</tr>
<tr>
<td>Chang and Lewellen, 1984, J of Business</td>
<td>Monthly rate of returns for 67 mutual funds from 1971-1979</td>
<td>No evidence of skillful market timing or clever security selection abilities; mutual funds did not outperform a passive investment strategy.</td>
</tr>
<tr>
<td>Henriksson, 1984, J of Business</td>
<td>116 open-end mutual funds using the parametric and nonparametric techniques from 1968 - 1980.</td>
<td>Indicated little evidence of ability by portfolio managers to successfully engage in either market timing or selectivity during this period.</td>
</tr>
<tr>
<td>Simonds, LaMotte, and McWhorter, Jr., 1986, JFQA</td>
<td>100 firms from NYSE during 1951-1974</td>
<td>Betas for individual NYSE-listed stocks apparently nonstationary.</td>
</tr>
</tbody>
</table>
BETA NON-STATIONARITY (continued)

<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>SAMPLE, PERIOD, &amp; METHODS</th>
<th>ISSUES &amp; RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breen, Jagannathan, and Ofer, 1986</td>
<td>Simulation techniques and monthly return data on the stocks in the NYSE during the period 1968 - 1982, VW</td>
<td>The correction for heteroscedasticity significantly improved the power of testing market timing ability.</td>
</tr>
<tr>
<td>Collins, Ledolter, and Rayburn, 1987</td>
<td>Weekly return data for both 500 individual securities and 500 portfolios of size 10, 50, 100 from NYSE and AMEX covering 1962-81</td>
<td>Proved a stochastic variation in the beta risk of equity securities. Weekly data improved the power of the test.</td>
</tr>
<tr>
<td>Rahman, Kryzanowski, and Sim, 1987</td>
<td>119 utilities firms during the period 1974 through 1978 and 1979 through 1983, VW</td>
<td>53 and 69 utility firms rejected at the 5% and 10% level of significance, respectively.</td>
</tr>
</tbody>
</table>
### R&D Expenditure and Institutional Holdings

<table>
<thead>
<tr>
<th>Author, Journal</th>
<th>Sample, Period</th>
<th>Issues &amp; Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jarrell and Lehn, 1985</td>
<td>324 companies (19 industries) for the period 1980-1983</td>
<td>To look at the relationship between institutional ownership and R&amp;D spending. Found a positive relationship between the level of institutional ownership and the R&amp;D-to-sales ratio.</td>
</tr>
<tr>
<td>Securities and Exchange Commission</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graves, 1988</td>
<td>22 computer-manufacturing companies only for the period from 1976 to 1985</td>
<td>A negative relationship between R&amp;D spending and institutional ownership; high levels of institutional ownership may have suppressed R&amp;D spending of the computer industry. However, the study measured R&amp;D expenditures per employee rather than the R&amp;D-to-sales ratio.</td>
</tr>
<tr>
<td>Academy of Management J</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hill and Snell, 1989</td>
<td>Firms in COMPSTAT tapes for 1979-81</td>
<td>A positive relationship between major stockholders and R&amp;D expenditure per employee.</td>
</tr>
<tr>
<td>Academy of Management J</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hansen and Hill, 1991</td>
<td>129 firms based in four research-intensive industries over the period 1977-1986</td>
<td>Examined the relationship between R&amp;D spending and institutional ownership. Higher levels of institutional ownership may have coincided with greater R&amp;D expenditures. It defined R&amp;D intensity as the percentage of total R&amp;D spending to sales rather than R&amp;D per employee.</td>
</tr>
<tr>
<td>Strategic Management J</td>
<td></td>
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</tbody>
</table>
R&D EXPENDITURE AND INSTITUTIONAL HOLDINGS (continued)

<table>
<thead>
<tr>
<th>AUTHOR, JOURNAL</th>
<th>SAMPLE, PERIOD</th>
<th>ISSUES &amp; RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathala, Moon, and Rao, 1994 Financial Management</td>
<td>A sample firms from the NYSE, AMEX, OTC in existence at the end of 1988</td>
<td>A negative relationship among institutional ownership, the level of debt financing, and managerial equity holdings. An inverse relationship between the debt ratio and R&amp;D expenses.</td>
</tr>
<tr>
<td>Kochhar and David, 1996 Strategic Management J</td>
<td>135 mainly manufacturing firms traded on the NYSE, AMEX, and NASDAQ for 1989 year end data</td>
<td>Examined the relationship between institutional investors and firm innovation. The results indicated that institutions did not foster a short-term orientation; instead, they may have influenced firms to increase innovation.</td>
</tr>
</tbody>
</table>
## MUTUAL FUND PERFORMANCE

<table>
<thead>
<tr>
<th>AUTHOR, JOURNAL</th>
<th>SAMPLE, PERIOD</th>
<th>ISSUES &amp; RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965 Harvard Business Review</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jack Treynor and Kay Mazuy</td>
<td>Performance of 57 open-end mutual funds during the period of 1963</td>
<td>Devised a statistical test to estimate fund managers' timing abilities by introducing a curved term, $(r_m - r)^2$ in the characteristic line. Found little evidence of timing ability.</td>
</tr>
<tr>
<td>1966 Harvard Business Review</td>
<td></td>
<td></td>
</tr>
<tr>
<td>William Sharpe</td>
<td>Performance of 34 open-end mutual funds, 1954-63</td>
<td>Devised an R/V ratio for portfolio rankings. (Reward-to-variability ratio). Explained the relationship between risk premium and standard deviation. The Dow-Jones R/V had a .667 ratio; however, the average fund in this sample had a .633 R/V.</td>
</tr>
<tr>
<td>1966 J of Business</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Michael Jensen</td>
<td>The returns on the portfolios of 115 open-end mutual funds for the period 1955-64</td>
<td>Devised a way of evaluating the performance portfolios in terms of funds managers' selection abilities. The alpha-hat average, calculated net of expenses (-.011), indicated that on average the funds earned about 1.1% less per year than they should have earned, given their level of systematic risk.</td>
</tr>
<tr>
<td>1968 J of Finance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AUTHOR, JOURNAL</td>
<td>SAMPLE, PERIOD</td>
<td>ISSUES &amp; RESULTS</td>
</tr>
<tr>
<td>------------------------------------</td>
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<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>John McDonald 1974 JFQA</td>
<td>Return of 123 American mutual funds using monthly returns in the period 1960-1969</td>
<td>In a world of transaction costs and management fees, he found a zero alpha, which meant neutral performance.</td>
</tr>
<tr>
<td>Norman Mains 1977 J of Business</td>
<td>The same sample as Jensen's empirical, which is 115 mutual funds for the period 1955-64.</td>
<td>Based on monthly return data, mutual funds performed in an approximately neutral manner on a net return basis.</td>
</tr>
<tr>
<td>Grinblatt and Titman 1989 J of Business</td>
<td>Monthly mutual fund data from Dec. 1974 to Dec. 1984</td>
<td>Some evidence of superior forecasting ability on the part of the fund manager at the individual level; however, overall mutual fund actual returns, net of expenses, did not exhibit abnormal performance.</td>
</tr>
<tr>
<td>AUTHOR, JOURNAL</td>
<td>SAMPLE, PERIOD</td>
<td>ISSUES &amp; RESULTS</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Kon and Jen 1979</td>
<td>49 mutual funds from January 1960 to December 1971.</td>
<td>Some superior performance in terms of overall selection ability; however, mutual fund managers individually and on average could not forecast the future prices well enough to recover all fees.</td>
</tr>
<tr>
<td>Stanley Kon 1983</td>
<td>Monthly data of 37 mutual funds from Jan. 1960 to June 1976</td>
<td>Some success among individual fund managers; however, fund managers as a group had no special abnormal returns.</td>
</tr>
<tr>
<td>Henriksson 1984</td>
<td>116 open-end mutual funds monthly performance using the parametric and nonparametric techniques from 1968 to 1980.</td>
<td>Both tests showed that mutual fund managers could not forecast market movements. Only three funds successfully timed the market.</td>
</tr>
<tr>
<td>Lee and Rahman 1990</td>
<td>Monthly returns for 87 months (January 1977 - March 1984) for a sample of 93 mutual funds.</td>
<td>Some evidence of superior micro- and macro-forecasting ability on the part of the fund manager at the individual fund level.</td>
</tr>
</tbody>
</table>
Table 1-1 Sharpe Measure (SM) for Institutional Ownership Portfolio

(Based on Model 5-1)

<table>
<thead>
<tr>
<th></th>
<th>own&lt;20%</th>
<th>20%&lt;own&lt;40%</th>
<th>40%&lt;own&lt;60%</th>
<th>60%&lt;own&lt;80%</th>
<th>own&gt;80%</th>
<th>own overall</th>
<th>Market index P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio Return</td>
<td>.943</td>
<td>.983</td>
<td>1.039</td>
<td>1.561</td>
<td>.989</td>
<td>.991</td>
<td></td>
</tr>
<tr>
<td>Riskless Rate</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
</tr>
<tr>
<td>Risk Premium</td>
<td>.544</td>
<td>.584</td>
<td>.64</td>
<td>1.162</td>
<td>.59</td>
<td>.592</td>
<td></td>
</tr>
<tr>
<td>σ_p(%)</td>
<td>3.537</td>
<td>4.123</td>
<td>4.492</td>
<td>5.112</td>
<td>3.814</td>
<td>3.894</td>
<td></td>
</tr>
<tr>
<td>SM</td>
<td>.162</td>
<td>.142</td>
<td>.142</td>
<td>.227</td>
<td>.155</td>
<td>.152</td>
<td></td>
</tr>
<tr>
<td>N*</td>
<td>1,007</td>
<td>799</td>
<td>521</td>
<td>99</td>
<td>3,678</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*N represents average numbers of monthly sample size for the entire study period from Jan. 1989 to Dec. 1996.
### Table 1-2 Sharpe Measure (SM) for Beta (β) Portfolio

**Sample Beta Portfolios (Based on Model 5-1)**

<table>
<thead>
<tr>
<th>β_\text{m-1}</th>
<th>β_\text{m-2}</th>
<th>β_\text{m-3}</th>
<th>β_\text{m-4}</th>
<th>β_\text{m-5}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio Return (%)</td>
<td>0.573</td>
<td>0.827</td>
<td>1.055</td>
<td>1.359</td>
</tr>
<tr>
<td>Riskless Rate (%)</td>
<td>0.399</td>
<td>0.399</td>
<td>0.399</td>
<td>0.399</td>
</tr>
<tr>
<td>Risk Premium</td>
<td>0.174</td>
<td>0.428</td>
<td>0.656</td>
<td>0.96</td>
</tr>
<tr>
<td>σ_p (%)</td>
<td>1.244</td>
<td>2.788</td>
<td>4.480</td>
<td>6.366</td>
</tr>
<tr>
<td>SM</td>
<td>0.140</td>
<td>0.154</td>
<td>0.146</td>
<td>0.151</td>
</tr>
<tr>
<td>N</td>
<td>687</td>
<td>1,030</td>
<td>909</td>
<td>457</td>
</tr>
</tbody>
</table>

**Market Indexes Portfolio for Beta (Control Groups)**

<table>
<thead>
<tr>
<th>β_\text{m-1}</th>
<th>β_\text{m-2}</th>
<th>β_\text{m-3}</th>
<th>β_\text{m-4}</th>
<th>β_\text{m-5}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio Return (%)</td>
<td>0.614</td>
<td>0.826</td>
<td>1.012</td>
<td>1.329</td>
</tr>
<tr>
<td>Riskless Rate (%)</td>
<td>0.399</td>
<td>0.399</td>
<td>0.399</td>
<td>0.399</td>
</tr>
<tr>
<td>Risk Premium</td>
<td>0.215</td>
<td>0.427</td>
<td>0.613</td>
<td>0.93</td>
</tr>
<tr>
<td>σ_p (%)</td>
<td>1.222</td>
<td>2.771</td>
<td>4.464</td>
<td>6.338</td>
</tr>
<tr>
<td>SM</td>
<td>0.176</td>
<td>0.154</td>
<td>0.137</td>
<td>0.147</td>
</tr>
<tr>
<td>N</td>
<td>725</td>
<td>1068</td>
<td>934</td>
<td>500</td>
</tr>
</tbody>
</table>
### Table 1-3 Sharpe Measure (SM) for Volatility ($\sigma_i$) Portfolio

**Sample Volatility Portfolios (Based on Model 5-1)**

<table>
<thead>
<tr>
<th>$\sigma_{i-1} &lt; .10$</th>
<th>$.10 &lt; \sigma_{i-1} \leq .13$</th>
<th>$.13 &lt; \sigma_{i-1} \leq .16$</th>
<th>$.16 &lt; \sigma_{i-1} \leq .20$</th>
<th>$\sigma_{i-1} &gt; .20$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio Return (%)</td>
<td>.702</td>
<td>.897</td>
<td>1.168</td>
<td>1.792</td>
</tr>
<tr>
<td>Riskless Rate (%)</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
</tr>
<tr>
<td>Risk Premium</td>
<td>.303</td>
<td>.498</td>
<td>.769</td>
<td>1.393</td>
</tr>
<tr>
<td>$\sigma_i$ (%)</td>
<td>2.548</td>
<td>3.856</td>
<td>5.109</td>
<td>6.701</td>
</tr>
<tr>
<td>SM</td>
<td>.119</td>
<td>.129</td>
<td>.151</td>
<td>.208</td>
</tr>
<tr>
<td>N</td>
<td>1,396</td>
<td>963</td>
<td>594</td>
<td>354</td>
</tr>
</tbody>
</table>

**Market Indexes Portfolios for Volatility (Control Groups)**

<table>
<thead>
<tr>
<th>$\sigma_{i-1} &lt; .10$</th>
<th>$.10 &lt; \sigma_{i-1} \leq .13$</th>
<th>$.13 &lt; \sigma_{i-1} \leq .16$</th>
<th>$.16 &lt; \sigma_{i-1} \leq .20$</th>
<th>$\sigma_{i-1} &gt; .20$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio Return (%)</td>
<td>.706</td>
<td>.89</td>
<td>1.162</td>
<td>1.704</td>
</tr>
<tr>
<td>Riskless Rate (%)</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
</tr>
<tr>
<td>Risk Premium</td>
<td>.307</td>
<td>.491</td>
<td>.763</td>
<td>1.305</td>
</tr>
<tr>
<td>$\sigma_i$ (%)</td>
<td>2.518</td>
<td>3.842</td>
<td>5.151</td>
<td>6.8</td>
</tr>
<tr>
<td>SM</td>
<td>.122</td>
<td>.128</td>
<td>.148</td>
<td>.192</td>
</tr>
<tr>
<td>N</td>
<td>1,466</td>
<td>1,015</td>
<td>628</td>
<td>397</td>
</tr>
</tbody>
</table>

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Table 1-4 Sharpe Measure (SM) for Firm Size (FS) Portfolio

**Sample Firm Size Portfolios (Based on Model 5-1)**

<table>
<thead>
<tr>
<th>Portfolio Return(%)</th>
<th>$40 \leq FS _{n-1} &lt; $120</th>
<th>$120 &lt; FS _{n-1} \leq $340</th>
<th>$340 &lt; FS _{n-1} \leq $1,460</th>
<th>FS _{n-1} &gt; $1,460</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio Return(%)</td>
<td>1.730</td>
<td>1.141</td>
<td>0.956</td>
<td>0.832</td>
</tr>
<tr>
<td>Riskless Rate(%)</td>
<td>0.399</td>
<td>0.399</td>
<td>0.399</td>
<td>0.399</td>
</tr>
<tr>
<td>Risk Premium</td>
<td>1.331</td>
<td>0.742</td>
<td>0.557</td>
<td>0.433</td>
</tr>
<tr>
<td>(\sigma_p(%))</td>
<td>5.014</td>
<td>4.391</td>
<td>3.854</td>
<td>3.543</td>
</tr>
<tr>
<td>SM</td>
<td>0.265</td>
<td>0.169</td>
<td>0.145</td>
<td>0.122</td>
</tr>
<tr>
<td>N</td>
<td>455</td>
<td>692</td>
<td>716</td>
<td>780</td>
</tr>
</tbody>
</table>

*Million Dollars are omitted for all firm size.

**Market Indexes Portfolios for Firm Size (Control Groups)**

<table>
<thead>
<tr>
<th>Portfolio Return(%)</th>
<th>$40 \leq FS _{n-1} &lt; $120</th>
<th>$120 &lt; FS _{n-1} \leq $340</th>
<th>$340 &lt; FS _{n-1} \leq $1,460</th>
<th>FS _{n-1} &gt; $1,460</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio Return(%)</td>
<td>1.62</td>
<td>1.048</td>
<td>0.909</td>
<td>0.792</td>
</tr>
<tr>
<td>Riskless Rate(%)</td>
<td>0.399</td>
<td>0.399</td>
<td>0.399</td>
<td>0.399</td>
</tr>
<tr>
<td>Risk Premium</td>
<td>1.221</td>
<td>0.649</td>
<td>0.51</td>
<td>0.393</td>
</tr>
<tr>
<td>(\sigma_p(%))</td>
<td>5.294</td>
<td>4.575</td>
<td>3.913</td>
<td>3.585</td>
</tr>
<tr>
<td>SM</td>
<td>0.231</td>
<td>0.142</td>
<td>0.13</td>
<td>0.11</td>
</tr>
<tr>
<td>N</td>
<td>487</td>
<td>707</td>
<td>742</td>
<td>803</td>
</tr>
</tbody>
</table>

*Million Dollars are omitted for all firm size.

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Table 1-5 Sharpe Measure (SM) for R&D Expenditures

Sample R&D Portfolios (Based on Model 5-1)

<table>
<thead>
<tr>
<th>Portfolio Return(%)</th>
<th>Own &lt; 30% &amp; RD &lt; $10</th>
<th>Own &lt; 30% &amp; 10 &lt; RD &lt; $100</th>
<th>Own &lt; 30% &amp; RD &gt; $100</th>
<th>30% &lt; Own &lt;=60% &amp; RD &lt; $10</th>
<th>30% &lt; Own &lt;=60% &amp; 10 &lt; RD &lt; $100</th>
<th>30% &lt; Own &lt;=60% &amp; RD &gt; $100</th>
<th>Own &gt; 60% &amp; RD &lt; $10</th>
<th>Own &gt; 60% &amp; 10 &lt; RD &lt; $100</th>
<th>Own &gt; 60% &amp; RD &gt; $100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riskless Rate(%)</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
</tr>
<tr>
<td>Risk Premium</td>
<td>1.073</td>
<td>.746</td>
<td>.399</td>
<td>1.055</td>
<td>.347</td>
<td>1.449</td>
<td>1.079</td>
<td>.502</td>
<td></td>
</tr>
<tr>
<td>σρ(%)</td>
<td>5.195</td>
<td>5.002</td>
<td>4.45</td>
<td>6.098</td>
<td>5.587</td>
<td>3.959</td>
<td>6.494</td>
<td>5.64</td>
<td>4.57</td>
</tr>
<tr>
<td>SM</td>
<td>.207</td>
<td>.149</td>
<td>.09</td>
<td>.207</td>
<td>.174</td>
<td>.088</td>
<td>.223</td>
<td>.191</td>
<td>.11</td>
</tr>
<tr>
<td>N</td>
<td>263</td>
<td>69</td>
<td>11</td>
<td>158</td>
<td>122</td>
<td>38</td>
<td>39</td>
<td>100</td>
<td>40</td>
</tr>
</tbody>
</table>

*Million Dollars are omitted for all R&D expenditures.

Market Indexes Portfolios for R&D Expenditures (Control Groups)

<table>
<thead>
<tr>
<th>Portfolio Return(%)</th>
<th>RD &lt; $10</th>
<th>10 &lt; RD &lt; $100</th>
<th>RD &gt; $100</th>
<th>&amp; RD &lt; $10</th>
<th>&amp; 10 &lt; RD &lt; $100</th>
<th>&amp; RD &gt; $100</th>
<th>RD &lt; $10</th>
<th>10 &lt; RD &lt; $100</th>
<th>RD &gt; $100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return (%)</td>
<td>1.403</td>
<td>1.265</td>
<td>.74</td>
<td>1.403</td>
<td>1.265</td>
<td>.74</td>
<td>1.403</td>
<td>1.265</td>
<td>.74</td>
</tr>
<tr>
<td>Riskless Rate(%)</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
<td>.399</td>
</tr>
</tbody>
</table>
Table 1-5 (continued)

<table>
<thead>
<tr>
<th></th>
<th>RD &lt;$10^a</th>
<th>10&lt;RD_z&lt;100</th>
<th>RD &gt; 100</th>
<th>&amp; RD &lt;$10^a</th>
<th>&amp; RD &lt; 10&lt;RD_z&lt;100</th>
<th>&amp; RD &gt; 10&lt;RD_z&lt;100</th>
<th>RD &lt;$10</th>
<th>10&lt;RD_z&lt;100</th>
<th>RD &gt; 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Premium</td>
<td>1.004</td>
<td>.866</td>
<td>.341</td>
<td>1.004</td>
<td>.866</td>
<td>.341</td>
<td>1.004</td>
<td>.866</td>
<td>.341</td>
</tr>
<tr>
<td>(\sigma_p(%))</td>
<td>5.443</td>
<td>5.541</td>
<td>4.02</td>
<td>5.443</td>
<td>5.541</td>
<td>4.02</td>
<td>5.443</td>
<td>5.541</td>
<td>4.02</td>
</tr>
<tr>
<td>SM</td>
<td>.184</td>
<td>.16</td>
<td>.085</td>
<td>.184</td>
<td>.16</td>
<td>.085</td>
<td>.184</td>
<td>.16</td>
<td>.085</td>
</tr>
<tr>
<td>N</td>
<td>480</td>
<td>297</td>
<td>95</td>
<td>480</td>
<td>297</td>
<td>95</td>
<td>480</td>
<td>297</td>
<td>95</td>
</tr>
</tbody>
</table>

\(^a\)Million Dollars are omitted for all R&D expenditures.

\(^1\)Information on ownership for market indexes portfolios are not available.
Table 2-1A Jobson and Korkie's Statistics for Institutional Ownership

Institutional Ownership Portfolios (Based on Model 5-2 and 5-3)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>EMR* ((\mu_{r_{m}}))%</th>
<th>(\sigma_{t,or,m%})</th>
<th>(\sigma_{im%})</th>
<th>(T)</th>
<th>(SH_{im})</th>
<th>(\theta)</th>
<th>(Z,SH_{im})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own (<em>{r</em>{t}}&lt;20%)</td>
<td>1,007</td>
<td>.541</td>
<td>3.372</td>
<td>13</td>
<td>94</td>
<td>.128</td>
<td>.219</td>
<td>.587</td>
</tr>
<tr>
<td>Market index (P_{(m)})</td>
<td>3,678</td>
<td>.592</td>
<td>3.905</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20%&lt;Own (<em>{r</em>{t}}\leq40%)</td>
<td>1,009</td>
<td>.605</td>
<td>3.9</td>
<td>15</td>
<td>94</td>
<td>.054</td>
<td>.273</td>
<td>.196</td>
</tr>
<tr>
<td>Market index (P_{(m)})</td>
<td>3,678</td>
<td>.592</td>
<td>3.905</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40%&lt;Own (<em>{r</em>{t}}\leq60%)</td>
<td>799</td>
<td>.584</td>
<td>4.129</td>
<td>16</td>
<td>94</td>
<td>-.163</td>
<td>.207</td>
<td>-.789</td>
</tr>
<tr>
<td>Market index (P_{(m)})</td>
<td>3,678</td>
<td>.592</td>
<td>3.905</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60%&lt;Own (<em>{r</em>{t}}\leq80%)</td>
<td>521</td>
<td>.64</td>
<td>4.498</td>
<td>17</td>
<td>94</td>
<td>-.163</td>
<td>.461</td>
<td>-.354</td>
</tr>
<tr>
<td>Market index (P_{(m)})</td>
<td>3,678</td>
<td>.592</td>
<td>3.905</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own (<em>{r</em>{t}}&gt;80%)</td>
<td>99</td>
<td>1.162</td>
<td>5.113</td>
<td>18</td>
<td>94</td>
<td>1.51</td>
<td>.928</td>
<td>1.63*</td>
</tr>
<tr>
<td>Market index (P_{(m)})</td>
<td>3,678</td>
<td>.592</td>
<td>3.905</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>own overall</td>
<td>3,440</td>
<td>.59</td>
<td>3.825</td>
<td>14</td>
<td>94</td>
<td>.03955</td>
<td>.301</td>
<td>.1314</td>
</tr>
<tr>
<td>Market index (P_{(m)})</td>
<td>3,678</td>
<td>.592</td>
<td>3.905</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*EMR represents excess mean return.

*represents significant at the 5% level.
Table 2-1B Jobson and Korkie’s Statistics for Institutional Ownership

Portfolio Comparisons Within Sample Portfolios (Based on Model 5-2 and 5-3)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>EMR* ($\mu_i$)%</th>
<th>$\sigma_{ii}$ %</th>
<th>$\sigma_{ij}$ %</th>
<th>T</th>
<th>$SH_{ij}$</th>
<th>$\theta$</th>
<th>$Z SH_{im}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own $\mu_2 &gt; 80%$</td>
<td>99</td>
<td>1.162</td>
<td>5.113</td>
<td>13.9</td>
<td>94</td>
<td>1.137</td>
<td>1.11</td>
<td>1.016</td>
</tr>
<tr>
<td>Own $\mu_1 &lt; 20%$</td>
<td>1,007</td>
<td>.544</td>
<td>3.372</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own $\mu_2 &gt; 80%$</td>
<td>99</td>
<td>1.162</td>
<td>5.113</td>
<td>17.7</td>
<td>94</td>
<td>1.44</td>
<td>.99</td>
<td>1.455</td>
</tr>
<tr>
<td>20%&lt;Own$\mu_2 \leq 40%$</td>
<td>1,009</td>
<td>.605</td>
<td>3.9</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Own $\mu_2 &gt; 80%$</td>
<td>99</td>
<td>1.162</td>
<td>5.113</td>
<td>19.5</td>
<td>94</td>
<td>1.812</td>
<td>.867</td>
<td>2.089*</td>
</tr>
<tr>
<td>40%&lt;Own$\mu_2 \leq 60%$</td>
<td>799</td>
<td>.584</td>
<td>4.129</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own $\mu_2 &gt; 80%$</td>
<td>99</td>
<td>1.162</td>
<td>5.113</td>
<td>21.4</td>
<td>94</td>
<td>1.954</td>
<td>.903</td>
<td>2.165*</td>
</tr>
<tr>
<td>60%&lt;Own$\mu_2 \leq 80%$</td>
<td>521</td>
<td>.64</td>
<td>4.498</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*EMR represents excess mean return.
*represents significant at the 2.5% level.
Table 2-2A Jobson and Korkie's Statistics for Beta (\( \beta \))

<table>
<thead>
<tr>
<th>Beta Portfolios (Based on Model 5-2 and 5-3)</th>
<th>N</th>
<th>EMR( (\mu_r - \mu))%</th>
<th>( \sigma_{crm} )%</th>
<th>( \sigma_{im} )%</th>
<th>T</th>
<th>SH_{im}</th>
<th>( \delta )</th>
<th>Z SH_{im}</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \beta_{ar} &lt; 0.5 )</td>
<td>687</td>
<td>.174</td>
<td>1.32</td>
<td>1.6</td>
<td>94</td>
<td>-0.0663</td>
<td>.0424</td>
<td>-1.563</td>
</tr>
<tr>
<td>( \beta_{ar} &lt; 0.5 )</td>
<td>725</td>
<td>.215</td>
<td>1.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( 0.5 &lt; \beta_{ar} \leq 1.0 )</td>
<td>1,029</td>
<td>.428</td>
<td>2.802</td>
<td>7.8</td>
<td>94</td>
<td>-0.0036</td>
<td>.0393</td>
<td>-0.092</td>
</tr>
<tr>
<td>( 0.5 &lt; \beta_{ar} \leq 1.0 )</td>
<td>1,068</td>
<td>.427</td>
<td>2.787</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( 1.0 &lt; \beta_{ar} \leq 1.5 )</td>
<td>909</td>
<td>.656</td>
<td>4.492</td>
<td>20.1</td>
<td>94</td>
<td>.1853</td>
<td>.103</td>
<td>1.79*</td>
</tr>
<tr>
<td>( 1.0 &lt; \beta_{ar} \leq 1.5 )</td>
<td>934</td>
<td>.613</td>
<td>4.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( 1.5 &lt; \beta_{ar} \leq 2.0 )</td>
<td>457</td>
<td>.96</td>
<td>6.372</td>
<td>40.3</td>
<td>94</td>
<td>.1652</td>
<td>.337</td>
<td>.490</td>
</tr>
<tr>
<td>( 1.5 &lt; \beta_{ar} \leq 2.0 )</td>
<td>500</td>
<td>.930</td>
<td>6.345</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \beta_{ar} &gt; 2.0 )</td>
<td>340</td>
<td>1.439</td>
<td>9.209</td>
<td>85.6</td>
<td>94</td>
<td>.961</td>
<td>1.192</td>
<td>.807</td>
</tr>
<tr>
<td>( \beta_{ar} &gt; 2.0 )</td>
<td>431</td>
<td>1.361</td>
<td>9.378</td>
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</tr>
</tbody>
</table>

*EMR represents excess mean return.

*represents significant at the 5% level.
Table 2-2B Jobson and Korkie’s Statistics for Beta (β)

<table>
<thead>
<tr>
<th>Portfolio Comparisons Within Sample Portfolios (Based on Model 5-2 and 5-3)</th>
<th>N</th>
<th>EMR*(μi)%</th>
<th>σi%</th>
<th>αi%</th>
<th>T</th>
<th>SHi</th>
<th>θ</th>
<th>Z SH in</th>
</tr>
</thead>
<tbody>
<tr>
<td>βi &gt; 2.0</td>
<td>340</td>
<td>1.439</td>
<td>9.209</td>
<td>5.40</td>
<td>94</td>
<td>.2280</td>
<td>1.259</td>
<td>.1811</td>
</tr>
<tr>
<td>βi &lt; 0.5</td>
<td>687</td>
<td>.174</td>
<td>1.272</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>βi &gt; 2.0</td>
<td>340</td>
<td>1.439</td>
<td>9.209</td>
<td>23.8</td>
<td>94</td>
<td>.091</td>
<td>1.05</td>
<td>.0863</td>
</tr>
<tr>
<td>0.5 &lt; βi ≤ 1.0</td>
<td>1,029</td>
<td>.428</td>
<td>2.802</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>βi &gt; 2.0</td>
<td>340</td>
<td>1.439</td>
<td>9.209</td>
<td>40.0</td>
<td>94</td>
<td>.4230</td>
<td>1.103</td>
<td>.3833</td>
</tr>
<tr>
<td>1.0 &lt; βi ≤ 1.5</td>
<td>909</td>
<td>.656</td>
<td>4.492</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 &lt; βi ≤ 2.0</td>
<td>457</td>
<td>.96</td>
<td>6.372</td>
<td>28.2</td>
<td>94</td>
<td>.1323</td>
<td>.51</td>
<td>.2600</td>
</tr>
<tr>
<td>1.0 &lt; βi ≤ 1.5</td>
<td>909</td>
<td>.656</td>
<td>4.492</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

*EMR represents excess mean return.
Table 2-3A Jobson and Korkie's Statistics for Volatility ($\sigma$)

Volatility Portfolios (Based on Model 5-2 and 5-3)

<table>
<thead>
<tr>
<th>$\sigma_{\alpha 1}$</th>
<th>N</th>
<th>EMR*((\mu_{1,\alpha 1}))%</th>
<th>$\sigma_{1,\alpha 1}$%</th>
<th>$\sigma_{1,\alpha 1}$%</th>
<th>T</th>
<th>$SH_{1,\alpha 1}$</th>
<th>$\theta$</th>
<th>$Z_{SH_{1,\alpha 1}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\sigma_{1,\alpha 1}$&lt;.10</td>
<td>1,396</td>
<td>.303</td>
<td>2.60</td>
<td>6.5</td>
<td>94</td>
<td>-.0316</td>
<td>.105</td>
<td>-.301</td>
</tr>
<tr>
<td>$\sigma_{1,\alpha 1}$&lt;.10</td>
<td>1,466</td>
<td>.307</td>
<td>2.53</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\sigma_{1,\alpha 1}$&lt;.13</td>
<td>963</td>
<td>.498</td>
<td>3.87</td>
<td>14.9</td>
<td>94</td>
<td>.0206</td>
<td>.0923</td>
<td>.2233</td>
</tr>
<tr>
<td>$\sigma_{1,\alpha 1}$&lt;.13</td>
<td>1,016</td>
<td>.491</td>
<td>3.857</td>
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</tr>
<tr>
<td>$\sigma_{1,\alpha 1}$&lt;.16</td>
<td>594</td>
<td>.769</td>
<td>5.119</td>
<td>26.3</td>
<td>94</td>
<td>.063</td>
<td>.26</td>
<td>.242</td>
</tr>
<tr>
<td>$\sigma_{1,\alpha 1}$&lt;.16</td>
<td>629</td>
<td>.763</td>
<td>5.161</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\sigma_{1,\alpha 1}$&lt;.20</td>
<td>354</td>
<td>1.393</td>
<td>6.704</td>
<td>45.2</td>
<td>94</td>
<td>.7280</td>
<td>.637</td>
<td>1.14</td>
</tr>
<tr>
<td>$\sigma_{1,\alpha 1}$&lt;.20</td>
<td>398</td>
<td>1.305</td>
<td>6.803</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\sigma_{1,\alpha 1}$&gt;20</td>
<td>131</td>
<td>2.121</td>
<td>8.475</td>
<td>73.2</td>
<td>94</td>
<td>1.126</td>
<td>1.8</td>
<td>.613</td>
</tr>
<tr>
<td>$\sigma_{1,\alpha 1}$&gt;20</td>
<td>153</td>
<td>2.089</td>
<td>8.878</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*EMR represents excess mean return.
Table 2-3B Jobson and Korkie's Statistics for Volatility (\( \sigma \))

<table>
<thead>
<tr>
<th>Portfolio Comparisons within Sample Portfolios (Based on Model 5-2 and 5-3)</th>
<th>N</th>
<th>EMR( \times (\mu,%))</th>
<th>( \sigma_1 )%</th>
<th>( \sigma_2 )%</th>
<th>T</th>
<th>( \text{SH}_2 )</th>
<th>( \Theta )</th>
<th>( Z \text{SH}_m )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sigma_{12} &gt; 20 )</td>
<td>131</td>
<td>2.121</td>
<td>8.475</td>
<td>16.5</td>
<td>94</td>
<td>2.868</td>
<td>1.577</td>
<td>1.819</td>
</tr>
<tr>
<td>( \sigma_{12} &lt; 10 )</td>
<td>1,396</td>
<td>.303</td>
<td>2.563</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma_{12} &gt; 20 )</td>
<td>131</td>
<td>2.121</td>
<td>8.475</td>
<td>28</td>
<td>94</td>
<td>3.988</td>
<td>1.865</td>
<td>2.138*</td>
</tr>
<tr>
<td>.10 &lt; ( \sigma_{12} \leq .13 )</td>
<td>963</td>
<td>.498</td>
<td>3.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \sigma_{12} &gt; 20 )</td>
<td>131</td>
<td>2.121</td>
<td>8.475</td>
<td>40.3</td>
<td>94</td>
<td>4.34</td>
<td>1.732</td>
<td>2.506**</td>
</tr>
<tr>
<td>.13 &lt; ( \sigma_{12} \leq .16 )</td>
<td>594</td>
<td>.769</td>
<td>5.119</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>.16 &lt; ( \sigma_{12} \leq .20 )</td>
<td>354</td>
<td>1.393</td>
<td>6.704</td>
<td>33</td>
<td>94</td>
<td>1.975</td>
<td>.998</td>
<td>1.979*</td>
</tr>
<tr>
<td>.13 &lt; ( \sigma_{12} \leq .16 )</td>
<td>594</td>
<td>.769</td>
<td>5.119</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*EMR represents excess mean return.

*represents significant at the 5% level.

** represents significant at the 2.5% level.
Table 2-4A Jobson and Korkie's Statistics for Firm Size

<table>
<thead>
<tr>
<th>Firm Size Portfolios (Based on Model 5-2 and 5-3)</th>
<th>N</th>
<th>EMR*(μ_i or n)%</th>
<th>σ_i or m%</th>
<th>σ_im%</th>
<th>T</th>
<th>SH_im</th>
<th>θ</th>
<th>Z SH_im</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS_{i&lt;40}</td>
<td>455</td>
<td>1.331</td>
<td>5.013</td>
<td>26.2</td>
<td>94</td>
<td>.9268</td>
<td>.4524</td>
<td>2.049**</td>
</tr>
<tr>
<td>FS_{m&lt;40}</td>
<td>488</td>
<td>1.221</td>
<td>5.295</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$40&lt;FS_{i&lt;120}$</td>
<td>692</td>
<td>.742</td>
<td>4.397</td>
<td>19.9</td>
<td>94</td>
<td>.539</td>
<td>.2958</td>
<td>1.819*</td>
</tr>
<tr>
<td>$40&lt;FS_{m&lt;120}$</td>
<td>708</td>
<td>.649</td>
<td>4.571</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$120&lt;FS_{i&lt;340}$</td>
<td>716</td>
<td>.557</td>
<td>3.868</td>
<td>15.1</td>
<td>94</td>
<td>.2152</td>
<td>.1754</td>
<td>1.227</td>
</tr>
<tr>
<td>$120&lt;FS_{m&lt;340}$</td>
<td>743</td>
<td>.51</td>
<td>3.928</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$340&lt;FS_{i&lt;1,460}$</td>
<td>780</td>
<td>.433</td>
<td>3.56</td>
<td>12.8</td>
<td>94</td>
<td>.161</td>
<td>.0864</td>
<td>1.863*</td>
</tr>
<tr>
<td>$340&lt;FS_{m&lt;1,460}$</td>
<td>804</td>
<td>.393</td>
<td>3.603</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FS_{i&gt;1,460}</td>
<td>781</td>
<td>.31</td>
<td>3.53</td>
<td>12.6</td>
<td>94</td>
<td>.177</td>
<td>.171</td>
<td>1.032</td>
</tr>
<tr>
<td>FS_{m&gt;1,460}</td>
<td>811</td>
<td>.266</td>
<td>3.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*EMR represents excess mean return.

*represents significant at the 5% level.

** represents significant at the 2.5% level.
Table 2.4B Jobson and Korkie's Statistics for Firm Size

<table>
<thead>
<tr>
<th>Portfolio Comparisons within Sample Portfolios</th>
<th>N</th>
<th>EMR*(Hn)%</th>
<th>σij(%)</th>
<th>T</th>
<th>SHij</th>
<th>θ</th>
<th>Z:SHim</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS \text{1}&lt;$40</td>
<td>455</td>
<td>1.331</td>
<td>5.013</td>
<td>21.4</td>
<td>94</td>
<td>2.133</td>
<td>.576</td>
</tr>
<tr>
<td>$40&lt;FS \text{1}\leq$120</td>
<td>692</td>
<td>.742</td>
<td>4.397</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FS \text{1}&lt;$40</td>
<td>455</td>
<td>1.331</td>
<td>5.013</td>
<td>17.9</td>
<td>94</td>
<td>2.356</td>
<td>.8097</td>
</tr>
<tr>
<td>$120&lt;FS \text{1}\leq$340</td>
<td>716</td>
<td>.557</td>
<td>3.868</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FS \text{1}&lt;$40</td>
<td>455</td>
<td>1.331</td>
<td>5.013</td>
<td>15.3</td>
<td>94</td>
<td>2.58</td>
<td>1.01</td>
</tr>
<tr>
<td>$340&lt;FS \text{1}\leq$1,460</td>
<td>780</td>
<td>.433</td>
<td>3.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FS \text{1}&lt;$40</td>
<td>455</td>
<td>1.331</td>
<td>5.013</td>
<td>13</td>
<td>94</td>
<td>3.144</td>
<td>1.356</td>
</tr>
<tr>
<td>FS \text{1}&gt;$1,460</td>
<td>781</td>
<td>.31</td>
<td>3.53</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*EMR represents excess mean return.

**represents significant at the 2.5% level.
<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>EMR*((\mu_{1}))%</th>
<th>(\sigma_{1\text{ or }m})%</th>
<th>(\sigma_{\text{im}})%</th>
<th>T</th>
<th>(SH_{\text{im}})</th>
<th>(\theta)</th>
<th>(ZH_{\text{im}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own&lt;30% &amp; Rd&lt;11</td>
<td>263</td>
<td>1.073</td>
<td>5.192</td>
<td>27.7</td>
<td>94</td>
<td>.6224</td>
<td>.5875</td>
<td>1.059</td>
</tr>
<tr>
<td>RD&lt;11&lt;10</td>
<td>480</td>
<td>1.005</td>
<td>5.443</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own&lt;30% &amp; $10&lt;RD&lt;12 \leq$100</td>
<td>69</td>
<td>.746</td>
<td>4.993</td>
<td>24.7</td>
<td>94</td>
<td>-.287</td>
<td>1.16</td>
<td>-.248</td>
</tr>
<tr>
<td>$10&lt;RD&lt;100$</td>
<td>297</td>
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<td>5.411</td>
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</tr>
<tr>
<td>Own&lt;30% &amp; $10&lt;RD&lt;13 \leq$100</td>
<td>11</td>
<td>.399</td>
<td>4.439</td>
<td>14.1</td>
<td>94</td>
<td>.0919</td>
<td>1.2</td>
<td>.0766</td>
</tr>
<tr>
<td>RD&lt;100</td>
<td>95</td>
<td>.341</td>
<td>4.024</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30%&lt;Own&lt;60% &amp; Rd&lt;10</td>
<td>158</td>
<td>1.055</td>
<td>5.101</td>
<td>26.7</td>
<td>94</td>
<td>.6159</td>
<td>.8</td>
<td>.7698</td>
</tr>
<tr>
<td>RD&lt;10</td>
<td>480</td>
<td>1.005</td>
<td>5.443</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30%&lt;Own&lt;60% &amp; $10&lt;RD&lt;12 \leq$100</td>
<td>122</td>
<td>.97</td>
<td>5.589</td>
<td>29.6</td>
<td>94</td>
<td>.4086</td>
<td>.6478</td>
<td>.6307</td>
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<tr>
<td>$10&lt;RD&lt;100$</td>
<td>297</td>
<td>.866</td>
<td>5.411</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30%&lt;Own&lt;60% &amp; $10&lt;RD&lt;13 \leq$100</td>
<td>38</td>
<td>.347</td>
<td>3.959</td>
<td>15.1</td>
<td>94</td>
<td>.0463</td>
<td>.5317</td>
<td>.087</td>
</tr>
<tr>
<td>RD&lt;100</td>
<td>95</td>
<td>.341</td>
<td>4.024</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>EMR(\d_1)</td>
<td>(\d_{er,m})</td>
<td>(\d_{em,m})</td>
<td>(\d_{er,m})</td>
<td>(\d_{em,m})</td>
<td>T</td>
<td>(\d_{SH,m})</td>
<td>Z</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td>--------------</td>
<td>---------------</td>
<td>---------------</td>
<td>---------------</td>
<td>-----</td>
<td>--------------</td>
<td>-----</td>
</tr>
<tr>
<td>Own&gt;60% &amp; RD&lt;3</td>
<td>480</td>
<td>1.005</td>
<td>5.443</td>
<td>5.645</td>
<td>29</td>
<td>94</td>
<td>1.357</td>
<td>2.067</td>
</tr>
<tr>
<td>Own&lt;60% &amp; RD&lt;3</td>
<td>100</td>
<td>1.079</td>
<td>5.765</td>
<td>5.866</td>
<td>29</td>
<td>94</td>
<td>1.357</td>
<td>2.067</td>
</tr>
<tr>
<td>$10&lt;RD&lt;100 &amp; Own&gt;60% &amp;</td>
<td>297</td>
<td>5.02</td>
<td>4.584</td>
<td>4.584</td>
<td>17.6</td>
<td>94</td>
<td>4.569</td>
<td>4.569</td>
</tr>
<tr>
<td>$10&lt;RD&lt;100 &amp; Own&lt;60% &amp;</td>
<td>40</td>
<td>5.02</td>
<td>4.584</td>
<td>4.584</td>
<td>17.6</td>
<td>94</td>
<td>4.569</td>
<td>4.569</td>
</tr>
<tr>
<td>RD&gt;100 &amp; Own&gt;60% &amp;</td>
<td>95</td>
<td>341</td>
<td>4.024</td>
<td>4.024</td>
<td>17.6</td>
<td>94</td>
<td>4.569</td>
<td>4.569</td>
</tr>
<tr>
<td>RD&gt;100 &amp; Own&lt;60% &amp;</td>
<td>95</td>
<td>341</td>
<td>4.024</td>
<td>4.024</td>
<td>17.6</td>
<td>94</td>
<td>4.569</td>
<td>4.569</td>
</tr>
</tbody>
</table>

*EMR represents excess mean return.*
Table 2-5B Jobson and Korkie's Statistics for R&D Expenditures

<table>
<thead>
<tr>
<th>Portfolio Comparisons within Sample Portfolios</th>
<th>N</th>
<th>EMR*μ_r0m %</th>
<th>σ_0r_m %</th>
<th>T</th>
<th>SH_lm</th>
<th>θ</th>
<th>Z SH_lm</th>
</tr>
</thead>
<tbody>
<tr>
<td>30%&lt;Own≤60% &amp; Rd_{0,t1}&lt;$10</td>
<td>158</td>
<td>1.055</td>
<td>5.1</td>
<td>18.3</td>
<td>94</td>
<td>2.276</td>
<td>1.6</td>
</tr>
<tr>
<td>Own&gt;60% &amp; RD_{0,t1}&gt;$100</td>
<td>40</td>
<td>.502</td>
<td>4.584</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own&gt;60% &amp; Rd_{0,t1} &lt;$10</td>
<td>39</td>
<td>1.449</td>
<td>6.497</td>
<td>23</td>
<td>94</td>
<td>3.387</td>
<td>1.827</td>
</tr>
<tr>
<td>Own&gt;60% &amp; RD_{0,t1}&gt;$100</td>
<td>40</td>
<td>.502</td>
<td>4.584</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30%&lt;Own≤60% &amp; Rd_{0,t1}&lt;$10</td>
<td>158</td>
<td>1.055</td>
<td>5.101</td>
<td>14</td>
<td>94</td>
<td>2.41</td>
<td>1.647</td>
</tr>
<tr>
<td>30%&lt;Own≤60% &amp; $10&lt;RD_{0,t1}≤$100</td>
<td>38</td>
<td>.347</td>
<td>3.959</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*EMR represents excess mean return.

*represents significant at the 5% level.
Table 3-1 Portfolio Betas ($\beta_p$) for Institutional Ownership (Based on Model 5-6)

<table>
<thead>
<tr>
<th></th>
<th>Own $t_1$&lt;20%</th>
<th>20%&lt;Own $t_1$ ≤40%</th>
<th>40%&lt;Own $t_1$ ≤60%</th>
<th>60%&lt;Own $t_1$ ≤80%</th>
<th>Own $t_1$&gt;80%</th>
<th>Own overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_p$</td>
<td>.9342</td>
<td>1.188</td>
<td>1.212</td>
<td>1.258</td>
<td>1.217</td>
<td>1.112</td>
</tr>
</tbody>
</table>

Table 3-2 Portfolio Betas ($\beta_p$) for Beta (Based on Model 5-6)

<table>
<thead>
<tr>
<th></th>
<th>$\beta_{t_1}$&lt;.5</th>
<th>0.5&lt;$\beta_{t_1}$≤1.0</th>
<th>1.0&lt;$\beta_{t_1}$≤1.5</th>
<th>1.5&lt;$\beta_{t_1}$≤2.0</th>
<th>$\beta_{t_1}$&gt;2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_p$</td>
<td>.3411</td>
<td>.7548</td>
<td>1.229</td>
<td>1.722</td>
<td>2.82</td>
</tr>
</tbody>
</table>

Table 3-3 Portfolio Betas ($\beta_p$) for Volatility (Based on Model 5-6)

<table>
<thead>
<tr>
<th></th>
<th>$\sigma_{t_1}$&lt;.10</th>
<th>.10&lt;$\sigma_{t_1}$≤.13</th>
<th>.13&lt;$\sigma_{t_1}$≤.16</th>
<th>.16&lt;$\sigma_{t_1}$≤.20</th>
<th>$\sigma_{t_1}$&gt;2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_p$</td>
<td>.663</td>
<td>1.085</td>
<td>1.427</td>
<td>1.846</td>
<td>2.514</td>
</tr>
</tbody>
</table>

Table 3-4 Portfolio Betas ($\beta_p$) for Firm Size (Based on Model 5-6)

<table>
<thead>
<tr>
<th></th>
<th>FS $t_1$&lt;40</th>
<th>$40&lt;$FS $t_1$≤$120</th>
<th>$120&lt;$FS $t_1$≤$340</th>
<th>$340&lt;$FS $t_1$≤$1,460</th>
<th>FS $t_1$&gt;1,460</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_p$</td>
<td>1.556</td>
<td>1.415</td>
<td>1.112</td>
<td>.9584</td>
<td>.932</td>
</tr>
</tbody>
</table>
Table 3-5 Portfolio Betas ($\beta_p$) for R&D Expenditures (Based on Model 5-6)

<table>
<thead>
<tr>
<th></th>
<th>Own&lt;30% &amp; $\text{RD}_{p11}&lt;$10$</th>
<th>Own&lt;30% &amp; $10&lt;\text{RD}_{p12} \leq $100$</th>
<th>Own&lt;30% &amp; $\text{RD}_{p13} \leq $100$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_p$ (Portfolio beta)</td>
<td>1.601</td>
<td>1.521</td>
<td>1.024</td>
</tr>
<tr>
<td></td>
<td>30%&lt;Owns60% &amp; $\text{RD}_{p21}&lt;$10$</td>
<td>30%&lt;Owns60% &amp; $10&lt;\text{RD}_{p22} \leq $100$</td>
<td>30%&lt;Owns60% &amp; $\text{RD}_{p23} \leq $100$</td>
</tr>
<tr>
<td>$\beta_p$ (Portfolio beta)</td>
<td>1.708</td>
<td>1.406</td>
<td>.903</td>
</tr>
<tr>
<td>Own&gt;60% &amp; $\text{RD}_{p31}&lt;$10$</td>
<td>Own&gt;60% &amp; $10&lt;\text{RD}_{p32} \leq $100$</td>
<td>Own&gt;60% &amp; $\text{RD}_{p33} \leq $100$</td>
<td></td>
</tr>
<tr>
<td>$\beta_p$ (Portfolio beta)</td>
<td>1.624</td>
<td>1.398</td>
<td>1.194</td>
</tr>
</tbody>
</table>
Table 4-1 Jensen's Alpha (α) Measure for Institutional Ownership Portfolio (Based on Model 5-4)

| Portfolios       | Intercept(α) | P-value | Prob>|T| | R²  | F-value | Prob >F | N     |
|------------------|--------------|---------|------|-----|-----|---------|---------|-------|
| Own _μ1_<20%     | .000554      | .59     | .92  | .0001| 1.007|
| 20%<Own _μ2_≤40% | .000216      | .74     | .97  | .0001| 1.009|
| 40%<Own _μ2_≤60% | -.000278     | .76     | .96  | .0001| 799  |
| 60%<Own _μ2_≤80% | -.000095     | .95     | .91  | .0001| 521  |
| Own _μ2_>80%     | .004595      | .0457   | .82  | .0001| 100  |
| Own overall      | .000127      | .74     | .99  | .0001| 3,440|

Table 4-2 Jensen's Alpha (α) Measure for Beta Portfolio (Based on Model 5-4)

| Portfolios       | Intercept(α) | P-value | Prob>|T| | R²  | F-value | Prob >F | N     |
|------------------|--------------|---------|------|-----|-----|---------|---------|-------|
| β _μ_<.5         | .000626      | .57     | .33  | .0001| 687  |
| 0.5<β _μ_≤1.0    | .000166      | .82     | .94  | .0001| 1,030|
| 1.0<β _μ_≤1.5    | -.000014     | .87     | .97  | .0001| 909  |
| 1.5<β _μ_≤2.0    | .0000159     | .91     | .96  | .0001| 457  |
| β _μ_>2.0        | .000849      | .72     | .94  | .0001| 341  |
Table 4-3 Jensen's Alpha (α) Measure for Volatility Portfolio (Based on Model 5-4)

| Portfolios        | Intercept(α) | P-value Prob>|T| | R²  | F-value Prob >F | N    |
|-------------------|--------------|--------------|-----|----|-----------------|------|
| $\sigma_{\mu} < .10$ | -0.000593    | .54          | .87 | 1.396 | .0001           |       |
| $.10 < \sigma_{\mu} \leq .13$ | -0.000764    | .35          | .96 | .963 | .0001           |       |
| $.13 < \sigma_{\mu} \leq .16$ | 0.000123     | .92          | .95 | .594 | .0001           |       |
| $.16 < \sigma_{\mu} \leq .20$ | 0.004393     | .07          | .88 | .594 | .0001           |       |
| $\sigma_{\mu} > .20$ | 0.009559     | .01          | .82 | 1.131 | .0001           |       |

Table 4-4 Jensen's Alpha (α) Measure for Firm Size Portfolio (Based on Model 5-4)

| Portfolios        | Intercept(α) | P-value Prob>|T| | R²  | F-value Prob >F | N    |
|-------------------|--------------|--------------|-----|----|-----------------|------|
| FS $_{1} < $40    | 0.006213     | .001         | .87 | 4.55  | .0001           |       |
| $40 < FS $_{1} \leq $120 | 0.000956     | .40          | .94 | .692  | .0001           |       |
| $120 < FS $_{1} \leq $340 | -0.000195    | .80          | .97 | .716  | .0001           |       |
| $340 < FS $_{1} \leq $1,460 | -0.00092     | .29          | .95 | .780  | .0001           |       |
| FS $_{1} > $1,460 | -0.001717    | .29          | .81 | 3.780 | .0001           |       |
Table 4-5 Jensen's Alpha (α) Measure for R&D Expenditures Portfolio (Based on Model 5-4)

| Portfolios | Intercept(α) | P-value | Prob>|T| | R² | F-value | Prob >F | N |
|------------|-------------|---------|------|-----|-----|---------|---------|---|
| Own<30% & RdH)<$10 | .003511 | .11 | .84 | .0001 | 263 |
| Own<30% & $10<RdH ≤$100 | .00101 | .71 | .73 | .0001 | 69 |
| Own<30% & $10<RdH ≤$100 | -.000419 | .91 | .43 | .0001 | 11 |
| 30%<Own≤60% & RdH<10 | .003351 | .089 | .87 | .0001 | 158 |
| 30%<Own≤60% & $10<RdH ≤$100 | .001878 | .41 | .85 | .0001 | 122 |
| 30%<Own≤60% & $10<RdH ≤$100 | -.000108 | .69 | .58 | .0001 | 38 |
| Own>60% & RdH<10 | .00612 | .09 | .72 | .0001 | 39 |
| Own>60% & $10<RdH ≤$100 | .003298 | .25 | .77 | .0001 | 100 |
| Own>60% & $10<RdH ≤$100 | -.0000826 | .75 | .71 | .0001 | 40 |
Table 5-1 Jensen's Alpha (α) Measure for the January Firm Size Portfolio (Based on Model 5-4)

| Portfolios       | Intercept(α) | P-value | prob>|T| | R²  | F-value | Prob >F | N   |
|------------------|--------------|---------|------|----|----|---------|---------|-----|
| FS_{1}<$40       | 0.00111      | .88     | .78  | .004 | 377 |
| $40<FS_{1}≤$120  | -0.002585    | .55     | .91  | .0002 | 649 |
| $120<FS_{1}≤$340 | -0.002039    | .57     | .92  | .0002 | 680 |
| $340<FS_{1}≤$1,460 | -0.00039 | .90     | .95  | .0001 | 743 |
| FS_{1}>$1,460    | -0.00597     | .12     | .96  | .0001 | 753 |

Table 5-2 Portfolio Betas (β_p) for the January Firm Size (Based on Model 5-4)

<table>
<thead>
<tr>
<th></th>
<th>FS_{1}&lt;$40</th>
<th>$40&lt;FS_{1}≤$120</th>
<th>$120&lt;FS_{1}≤$340</th>
<th>$340&lt;FS_{1}≤$1,460</th>
<th>FS_{1}&gt;$1,460</th>
</tr>
</thead>
<tbody>
<tr>
<td>β_p</td>
<td>1.3714</td>
<td>1.4164</td>
<td>1.112</td>
<td>.9566</td>
<td>.926</td>
</tr>
</tbody>
</table>
Table 6-1 Regression Results for the Relationship Between Institutional Ownership and R&D Expenditures (Based on Model 5-9)

| Variable              | Parameter Estimate | P-valueProb>|T| | R²  | F-value Prob >F | N  |
|-----------------------|--------------------|-------------|---|----|-----------------|----|
| Intercept             | 7.4058             | .0001       | -.27| .0001| 9,621           |
| Institutional Ownership| .042214            | .0001       |    |    |                 |    |

Table 6-2 Regression Results for R&D Expenditures and Ownership Model Which Incorporates Variables for Asset (Based on Model 5-9)

| Variable              | Parameter Estimate | P-valueProb>|T| | R²  | F-value Prob >F | N  |
|-----------------------|--------------------|-------------|---|----|-----------------|----|
| Intercept             | .4917              | .0006       | .62 | .0001| 2,481           |
| Institutional Ownership| .009771            | .0001       |    |    |                 |    |
| Asset*                | .700629            | .0001       |    |    |                 |    |

*Asset is represented by natural logarithm.
Table 6-3 Regression Results for the Relationship Between R&D Expenditures and Total Assets (Based on Model 5-9)

| Variable | Parameter Estimate | P-Value | Prob>|T| | R² | F-value | Prob >F | N |
|----------|--------------------|---------|------|-----|------|---------|--------|---|
| Intercept| -0.28766           | .0001   | 0.66 | .0001 | 9,621 |
| Asset    | .788853            | .0001   |      |      |      |         |        |   |

Table 7-1 Pearson Correlation Coefficients

<table>
<thead>
<tr>
<th>Volatility</th>
<th>Beta</th>
<th>R&amp;D</th>
<th>Asset</th>
<th>Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatility</td>
<td>1</td>
<td>.50921</td>
<td>-.197</td>
<td>-0.3651</td>
</tr>
<tr>
<td>Beta</td>
<td>1</td>
<td>-.042</td>
<td>-0.1368</td>
<td>0.098</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>1</td>
<td>0.767</td>
<td>0.454</td>
<td></td>
</tr>
<tr>
<td>Asset</td>
<td>1</td>
<td>0.322</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ownership</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
Table 7-2 Multiple Regression Results for Joint Effect Test with All Variables (Based on Model 5-10)

| Variable | Parameter Estimate | P-Value | Prob>|T| | VIF | Eigenvalue | Condition Index |
|----------|--------------------|---------|--------|------|--------|------------|----------------|
| Intercept | -0.0364 | 0.0001 | 0.0001 | 0 | - | - |
| Ownership | 0.000213 | 0.0001 | 1.274 | 0.205 | 3.3555 |
| Beta | 0.0021 | 0.0006 | 1.444 | 1.403 | 1.2835 |
| Volatility | 0.06754 | 0.0001 | 1.631 | 2.313 | 1.0000 |
| R&D* | -0.00253 | 0.0001 | 2.582 | 0.430 | 2.3192 |
| Asset* | 0.004 | 0.0001 | 2.949 | 0.648 | 1.8888 |

R-square = 0.0591  Adjusted R-square = 0.0571
F - Value = 28.749  F-value Prob >F = 0.0001
N = 2,292

*Two variables are represented by natural logarithm.
Table 7-3 Multiple Regression Results for Joint Effect Test Without R&D Expenditures

(Based on Model 5-10)

| Variable  | Parameter Estimate | P-Value Prob>|T| | VIF | Eigenvalue | Condition Index |
|-----------|--------------------|--------------|-----|-----|------------|-----------------|
| Intercept | -0.00615           | 0.0234       | 0   | -   | -          | -               |
| Ownership | 0.000173           | 0.0001       | 1.105 | 0.41187 | 2.049      |
| Beta      | 0.001314           | 0.0001       | 1.423 | 1.21274 | 1.194      |
| Volatility| 0.028149           | 0.0004       | 1.591 | 1.72901 | 1.000      |
| Asset*    | 0.000285           | 0.1323       | 1.258 | 0.64637 | 1.635      |

R-square = 0.0232  Adjusted R-square = 0.0227
F - Value = 47.175  F-value Prob >F = 0.0001
N = 7,959

*Two variables are represented by natural logarithm.
### HYPOTHESES TEST RESULTS

<table>
<thead>
<tr>
<th>NULL HYPOTHESIS</th>
<th>REJECT</th>
<th>IMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₀₁: Mean risk-adjusted excess returns of stock portfolios do not correlate positively with institutional investor concentration percentages.</td>
<td>XXXXX</td>
<td>Institutional investors as a whole are not better performers than market index. However, they possessed a partial superior stock selection ability. Individual portfolios performed in a superior manner. Portfolios held in greater percentage by institutions performed better than those with less holdings by institutions.</td>
</tr>
<tr>
<td>H₀₂: Stock portfolios with higher β risk do not exhibit greater risk-adjusted abnormal rates of return than those with lower β risk for market-based portfolios of equal systematic risk.</td>
<td>XXXXX</td>
<td>Portfolios with larger beta stocks did not outperform portfolios with small beta stocks for market based portfolios of equal systematic risk. Higher beta portfolio did not contribute to the institutional investors' superior stock selection ability.</td>
</tr>
<tr>
<td>H₀₃: Stock portfolios with higher volatility exhibit greater or less rates of return than those with lower volatility.</td>
<td>XXXXX</td>
<td>Stock portfolios with higher volatility exhibited greater rates of return than those with lower volatility. Jensen's alpha measure implies that stock volatility may be used to contribute to institutional investor's excess stock selection ability.</td>
</tr>
<tr>
<td>H₀₄: Stock portfolios composed of small firms' stocks do not exhibit greater risk-adjusted rates of return than those composed of large firms' stocks, ceteris paribus.</td>
<td>XXXXX</td>
<td>The smaller firms generated higher monthly mean excess risk-adjusted rates of return. The larger firms generated lower mean excess risk-adjusted rates of return. In this study, the small firm effect resulted in the greatest contribution to institutions' superior selection power. However, the small firm-January effect could not be found.</td>
</tr>
</tbody>
</table>
### HYPOTHESES TEST RESULTS (continued)

<table>
<thead>
<tr>
<th>NULL HYPOTESIS</th>
<th>REJECT</th>
<th>FAIL TO REJECT</th>
<th>IMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H_{5a}$: Firms' R&amp;D expenditures and institutional stock ownership percentages do not correlate.</td>
<td>XXXXX</td>
<td></td>
<td>Institutional investors are not myopic investors. They are consistent to previous results by Kochhar and David (1996) and Hansen and Hill (1991). In the context of R&amp;D expenditures, institutional investors acted hyperopically.</td>
</tr>
<tr>
<td>$H_{5b}$: Stock portfolios with higher R&amp;D expenditures and higher concentrations of institutional investors do not exhibit greater risk-adjusted rates of return than those with less R&amp;D expenditures and lower concentrations of institutional investors, ceteris paribus.</td>
<td>XXXXX</td>
<td></td>
<td>R&amp;D expenditures were not positively correlated with portfolio performance. Both bigger firms and higher institutional ownership are positively correlated with higher R&amp;D expenditures. However, bigger firms are inversely related to portfolio performance. It implies that institutional investors prefer larger firms with higher R&amp;D expenditures. They expect higher R&amp;D expenditures would bring higher profits in the long-run.</td>
</tr>
</tbody>
</table>
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