DIFFERENTIAL INFORMATION, EXPECTATIONS, AND THE SMALL FIRM EFFECT

by

Arthur D. Neustel

Dissertation submitted to the Faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Business

Approved:

____
Arthur J. Keown, Chairman

____
Robert S. Hansen

____
Walter L. Young

____
John M. Pinkerton

____
Oral Capps, Jr.

June 1984
Blacksburg, Virginia

DIFFERENTIAL INFORMATION, EXPECTATIONS, AND THE SMALL FIRM EFFECT

by

Arthur D. Neustel

(ABSTRACT)

An empirical study of the effects of differential information and the expectations of investors is undertaken to test the differential information theory of Barry and Brown (1983). The theory is tested using the small firm effect. The excess returns found using ex post data are regressed against proxies for differential information and expectations. The residuals from these regressions are then tested to determine if the small firm effect is still observed.

The results of this study are:

1. The tests provided empirical evidence that is consistent with the theory of Barry and Brown (1983) when a suitable proxy for differential information is used.

2. For the sample studied, the differential information effect on perceived risk by investors largely explained the small firm effect, when a suitable proxy was used.

3. Evidence was found that the small firm effect is composed of two parts supporting the findings of Keim (1983). One is a January effect, and the other during the remainder of the year, with the January effect still observed.

4. The proxy chosen to represent heterogeneous expectations must be selected with care. In this study the one selected did not prove suitable. Reasons are provided which indicate that the proxy chosen was the principal cause of the failure of these tests to support the theory.

To my wife

Barbara

ACKNOWLEDGMENTS

I wish to thank the members of my dissertation committee, Professors Arthur J. Keown, Robert S. Hansen, John M. Pinkerton, Walter L. Young, and Oral Capps, Jr. I am especially indebted to Professor Keown for suggesting the subject area of the study, for his continual willingness to advise me and direct my efforts, and his support and encouragement. To Professor Pinkerton, I am deeply indebted for the data base he furnished, without which this study could not have been performed. In addition, I am indebted to him for his guidance, not only with this study, but throughout the entire course of my doctoral program. I am indebted to Professor Hansen for his encouragement during the entire program of study and the preparation of this study. To Professor Young, I am indebted for his willingness to help, and for his talents, in the computer programming area. Without his help, the time to perform this study would have been much longer. I am indebted to Professor Capps for his guidance in the statistical aspects of the study, and his ready availability for consultation concerning this study.

TABLE OF CONTENTS

Appendix

page

LIST OF TABLES

LIST OF FIGURES

Chapter I

INTRODUCTION

The capital asset pricing model (CAPM), which was developed by Sharpe (1964), Lintner (1965) and Mossin (1966), has been widely used by financial economists for many years. One of the assumptions on which the CAPM is based is that information is free and immediately available to investors. It is widely recognized that this assumption is not realistic, but modification of the CAPM to change this assumption complicates the model and makes its use much more complex. The effects of costly information, which results in differing information available to investors, affects their actions. The effect of such differential information has been the subject of somewhat limited study. Klein and Bawa (1976, 1977) have studied the effect of estimation risk and limited information on investors' choices. They found that investors perceive the risk of an investment to vary inversely with the amount of information that they have. As a result, investors adjust their portfolios according to their estimates of the risk of the securities. This means that it is the perceived risk that is important, and not the ex post risk which is normally used with the CAPM.

Recently, Barry and Brown (1983) extended the work of Klein and Bawa (1977). They developed a theoretical model that predicts that the risk perceived by investors will differ from that measured on an ex post basis. Furthermore, the perceived risk will differ between securities. Specifically, the model predicts that a low information security will have a larger expected return than an otherwise identical high information security. In this study, they suggest several possible proxies for differential information such as the period of listing on the exchanges. Barry and Brown (1983a) conducted an empirical test of this differential information effect, and found support for their theoretical model.

Another observable fact is that investors hold different expectations about the returns to be received from holding a security. These heterogeneous expectations violate another of the basic assumptions of the CAPM. This assumption is that investors hold identical beliefs about security returns and the probability distributions of these returns.

There have been several studies dealing with the theoretical effects of heterogeneous expectations and their effect on the CAPM. Lintner (1969) investigated the effect and found that, while there are many significant differences, the basic CAPM can be used for many purposes.

Results from Lintner's model explain why investors hold different portfolios and also show that the price of a security and the security's variance-covariance matrix depend on the assessments of the individuals who own it. Thus, although the relationships become much more complex, it is still possible to use the CAPM framework to model many situations involving heterogeneous expectations.

The empirical work that has been performed to date in the area of heterogeneous expectations has been limited. Among the more notable is the work of Cragg and Malkiel (1982), which, along with their earlier works, investigates the relationship between expectations and stock prices. They found that the use of the variance of analysts' forecasts of long term growth rates as a risk measure resulted in better correlation with stock prices than the correlation using the historical beta and the CAPM. They argue that analysts' forecasts are indicative of the information available, and they would expect them to be reflected in the market. The 1982 study used a multifactor linear model, identical in form to the Arbitrage Pricing Theory (APT) model of Ross (1976), but derived on the basis of different assumptions. No specific model for using the variance of long term growth rates as a risk measure is developed because of the econometric problem of errors in variables. Their results indicate strongly, however, that expectations do play a role in the price of securities.

The advent of this additional theory and evidence concerning differential information and heterogeneous expectations makes possible the investigation of previously unexplained anomalies that have been observed using the ex post CAPM. There are a number of such anomalies, but one of widespread current interest is the "small firm" effect reported by Banz (1981). It has been the subject of detailed scrutiny and to date remains unexplained. Generally, investigations have concluded that the most probable cause for the small firm effect is misspecification of the CAPM. Among the likely causes of such misspecification are the effect of differential information or the effect of heterogeneous expectations.

The small firm effect was discovered by Banz (1978, 1981), who used a modified form of the CAPM to test the relationship between total market value of the firm and the return on the common stock of the firm. He found that firms which have lower market value have higher risk adjusted returns than larger firms. This inverse relationship has been called the "small firm" or "size" effect. Banz was unable to explain these findings but suggested that they are possibly evidence of misspecification of the CAPM or an information effect based on a model of Klein and Bawa (1977). Based on a subsequent study by Reinganum (1981a), Banz (1981) concludes that it is unlikely that the effect is due to market inefficiency. It is not clear however, whether the observed differences in excess returns are due to size per se, or whether the size effect is merely a proxy for one or more unknown factors that are correlated with size.

Following the publication of this work of Banz, there have been a number of investigations of the size effect which have studied the phenomena from a statistical viewpoint. The investigations have included studies of the procedures followed in estimating the beta used to determine the risk adjusted return. Roll (1981) suggested that, since small firms' stocks trade less frequently than those of larger firms, there could be a downward bias in the risk estimates for these smaller firms. A subsequent study by Reinganum (1982) directly tested Roll's conjecture using betas estimated by the aggregated coefficients method suggested by Dimson (1979). He concludes that, while there is the bias suggested by Roll, it is not large enough to explain the "size effect". Other statistical tests have been conducted to investigate the possible effect of beta non-stationarity (Christie and Hertzel (1981)), and the effect of the method of calculating excess returns to determine the magnitude of the size of the effect (Roll (1982) and Blume and Stambaugh (1983)). These studies have been unable to explain the small firm effect, and in general have concluded that the anomaly arises from deficiencies in, or misspecification of, the capital asset pricing model. Market inefficiency is generally not considered a likely cause of the small firm effect.

Further work to define the nature of the small firm effect has been conducted. One area of such research is the investigation of the relationship of the small firm effect with earnings/price (E/P) ratio. Reinganum (1981a p.45) found that: "After controlling returns for any E/P effect, a strong firm size effect still emerged. But, after controlling returns for any market value effect, a separate E/P effect was not found." Basu (1983) found, in contrast, that, while small firms have appeared to earn higher returns than large firms, when the portfolios are controlled for E/P ratios, no significant risk adjusted returns related to firm size were found. Thus the evidence is conflicting with regard to the relationship between the E/P ratio and the small firm effect.

Evidence of seasonality has been found in the small firm effect. Keim (1983) found that the risk adjusted return for a portfolio of small firms is largest in January and much smaller during the remainder of the year. In fact, on average, about half of the annual size effect occurs in January, and about 25 percent of the total effect occurs during the first five trading days of January. Brown, Kleidon and Marsh (1983) found evidence of seasonality in the effect, but also found that the effect is not stable over time. They found a negative size effect for the period of 1969-73 and a positive size effect (excess return) for the period 1974-79.

The effect of the tax laws dealing with capital gains, which could result in tax-loss-selling-pressure at the end of the year and subsequent increases in price in early January, has been investigated by Reinganum (1983) and others. While it was found that the magnitude of the effect is positively related to the losses that could have been realized, Reinganum found that even those stocks that showed capital gains over the past year exhibited positive excess returns during the first five days of January. Further, small firms have higher returns than large firms for the entire month. Thus Reinganum concludes that tax-loss-selling cannot completely explain the "January" effect.

The international character of the small firm effect has been investigated by Brown, Keim, Kleidon and Marsh (1983) using Australian stocks, and by Berges, McConnell and Schlarbaum (1982) for Canadian stocks. Both of these studies have found evidence of the small firm effect, and indicate that the tax-loss-selling hypothesis does not explain the "January" effect.

There have also been investigations concerning transaction costs as a possible cause of the small firm effect. Stoll and Whaley (1983) and Schultz (1983) have investigated this possible cause. Schultz concluded that transaction costs can not explain the small firm effect, while Stoll and Whaley estimated that the costs of a round-trip security transaction every three months are sufficient to eliminate the effect.

To summarize, there is abundant evidence of an empirical anomaly that is not adequately explained by either the empirical testing that has been performed using existing models (principally the CAPM) or the potential economic causes that have been tested to date. Most investigators suggest that a probable cause is misspecification of the CAPM.

1.1 PURPOSE AND JUSTIFICATION OF THE STUDY

The studies of the small firm effect that have been performed to date can be grouped into three general categories: (1) those that investigate the small firm effect as a statistical artifact, particularly the proper estimation of risk (beta) in the CAPM; (2) those that investigate it in relationship to economic factors; and (3) those that investigate the nature of the effect. None of these approaches has satisfactorily explained the cause(s) of the observed anomaly. All of the studies which have been done have one element in common (except for Chan, Chen and Hsieh (1983) and Reinganum (1981)), and that is the use of the CAPM and its variants as the model used in the study.

The estimation of risk and the adequacy of the model used are clearly key elements in the investigation of the small firm effect. Investigators have generally concluded that misspecification of the model is a likely cause, but the effects of differential information and heterogeneous expectations have not been investigated. It is in this respect that this study will depart from earlier studies. The availability of a substantial body of expectational data in the form of analysts' estimates makes possible the use of ex ante information which was not previously available in studies of the size effect. These data are available on tapes called the "Institutional Brokers' Estimate System" (IBES), and gives estimates of earnings, growth rates, etc. for over 2,200 firms since 1976.

The use of these ex ante data makes possible the introduction of differential information and heterogeneous expectations into the investigation of the small firm effect. A study will be made of the effect of differential information on the excess returns obtained using the usual ex post CAPM. To assess the impact of the perceived risk resulting from differential information a simple linear regression will be run using proxies for differential information as the independent variable. The residual excess returns (the error term from this regression) will then be examined. The number of analysts making estimates and the variability of analysts' forecasts will be used as proxies for the differential information available to investors. This model, which effectively adds an additional explanatory variable, will be used to determine whether these differential information effects or heterogeneous expectations "explain" the small firm effect, including the January effect.

Justification of the approach is based on the theoretical work by Barry and Brown (1983) concerning differential information. Their model shows that the risk perceived by investors differs from that measured using historical data. The availability of an adequate body of ex ante information makes possible a test of their theory. This test will use the small firm effect as the unexplained anamoly which will be studied.

Using the number of analysts making forecasts as an added explanatory variable, this study will test whether the theorized differential information effect of analysts' forecasts is reflected in the returns on these securities.

The effect of heterogeneous expectations will be tested in similar fashion. Justification for this approach is based on the empirical work by Cragg and Malkiel (1982). Their study, which used a multifactor model, to investigate stock prices indicated that the dispersion of analysts' forecasts is the best single measure of risk. In addition the dispersion of forecasts made a significant (beyond that of merely an added explanatory variable) contribution to the explanatory power of the model used in their study, even when the usual CAPM beta was one of the independent variables.

The use of the dispersion of analysts' forecasts as a proxy for investors' expectations is a logical additional explanatory variable which should be explored in investigations of this unexplained phenomenon. Analysts' forecasts logically should contain more information and possibly a differing assessment of risk than is included in the historic beta or other published information available to most investors. Since these estimates are used by institutional investors and are frequently distributed to the customers of the brokerage firms, they can reasonably be expected to be one part of the information set that investors use in evaluating stocks.

The dispersion of analysts' forecasts is hypothesized to be larger for small firms for a number of reasons. These reasons include: (1) the impact of any expected economic change, such as changes in consumer spending, is likely be more difficult to estimate and hence relatively larger for the small firm since these firms tend to be less diversified; (2) There is a greater probability of analysts using different information concerning small firms since information is probably less readily available and the cost of information is likely to be higher (at least relatively); and (3) since there are more analysts following larger firms a consensus estimate is more likely (i.e. it is less likely that a widely differing estimate will be issued). As a result, the dispersion of forecasts is likely to be a factor correlated with the size effect.

The study will be limited to the implications of this methodology for a test of the differential information theory of Barry and Brown (1983) and a general explanation of the small firm effect. No effort will be made to directly investigate other aspects of the small firm effect such as the effect of economic factors.

The objective of this study is to serve as an empirical test of the theory of Barry and Brown (1983) on the effect of differential information. In making this test, the small firm effect will be the studied to determine if the use of this additional explanatory variable, in conjunction with the usual beta, explains the small firm effect which has been observed using the CAPM.

This study has the additional objective of testing the effect of heterogeneous expectations on security returns. The small firm effect will be used to test whether the effects of expectations explain this anamoly.

1.2 OUTLINE OF THE STUDY

This study is organized as follows. The relevant literature on differential information and heterogeneous expectations is reviewed in Chapter two. This review encompasses both the theoretical and empirical literature. This review is followed by a rather complete review of the small firm effect. The emphasis on the small firm effect is intended to show the failure of the CAPM to explain the anamoly, and also to show that no satisfactory economic or external factor has provided an adequate explanation.

The methodology to be used to empirically test for the differential information effect and the effect of heterogeneous expectations is discussed in Chapter three. The evaluation of the results is also discussed in Chapter three. The data to be used in the tests will also be discussed.

The results of the tests are discussed in Chapter four. A summary of results, the limitations of this study, and recommendations for further research are provided in Chapter five.

Chapter II

LITERATURE REVIEW

2.1 INTRODUCTION

After a brief introduction to the effects of differential information and expectations and the nature and significance of the small firm effect, this chapter reviews the relevant literature concerning them. The literature on differential information and expectations will each be divided into two sections, one dealing with theory and the other the empirical studies. To test these effects, the small firm effect will be the anamoly investigated. There will be a review of the small firm effect literature to show the failure alternative explanations for the effect. It will be presented in topical sections, each of which deals with a general area of the possible causes of the small firm effect. Emphasis will be placed on the methodology and conclusions presented in the literature and each topic will be concluded with a brief summary. Finally, the chapter will conclude with an overall summary of the main points of the literature.

2.2 DIFFERENTIAL INFORMATION EFFECT LITERATURE

One of the important assumptions made in the development of the CAPM is that investors have equal and costless information concerning each of the individual securities available. This implies that the risk and returns for securities are believed to be the same by all investors. In reality, of course, investors do not have identical information or beliefs. Because of these differences, the literature concerning differential information will be reviewed. The review will be divided into the theoretical literature and the empirical literature.

2.2.1 <u>THE THEORETICAL LITERATURE</u>

Studies of the effects of differential information and its relationship with heterogeneous beliefs and expectations is limited. Theoretical work in this area includes the work of Klein and Bawa (1976). They investigated the effect of using estimated parameters in the portfolio decision rather than the true market values of the parameters. Using a Bayesian approach with the assumption of normally distributed returns, they develop a number of theorems regarding the choices made by investors. If the prior information is non-informative and there is sufficient sample information, they show that the admissable set of portfolios is the same as in the analysis when the parameters are known. While the set is the same, the choice of the individual investor depends on the amount of sample information that the investor has. As the sample information decreases, the investor acts as though he is increasingly risk averse and chooses more of the riskless asset. Thus the portfolios actually held differ from the usual CAPM portfolios with equal and costless information. Two additional cases are examined: (1) where the prior information is informative; and (2) when the assumption of independence of the parameters is dropped. In the case of prior information being informative regarding the parameters, they show that, because of the estimation risk, the investor will want to invest in the securities about which he has the most information.

In Klein and Bawa (1977) the results of the 1976 study are extended to the cases of limited prior information and also to the case of differential information. They develop in detail the case of sufficient information, and then show that as the degree of information decreases, the investor acts as though he has increasing risk aversion. In this case, the traditional CAPM still holds. Continuing with the cases of limited prior information, they demonstrate that it is asymptotically optimal for the investor to limit his diversification to the riskless security if information on risky securities is minimal. In the case of differential information it is shown that it is optimal for the investor to invest in the subset of securities about which he has sufficient information and not to invest in the low information subset of securities.

Along somewhat similar lines, Barry and Brown (1983) develop a model to assess the impact of differential information on estimation risk. Using a Bayesian approach, they assume a normal distribution of parameters and two groups of securities which differ in the amount of information available. Using these groups, the predicted distribution of parameters is determined. Barry and Brown then demonstrate that, because of the uncertainty about the parameters, the beta of the high information group is smaller than it would be with equal estimation risk. Similarly, because these conditions exist in a portfolio context, the low information group must have a beta that is larger than would occur under equal estimation risk. The empirical implications are that lower information securities will have larger returns than appear justified since the betas are normally estimated without considering the estimation risk.

Discussing the question of relevant information, Barry and Brown point out, that, while their discussion deals with the number of historical observations of returns, there are many other possible measures of information. Examples given include the length of listing on the stock exchange, the number of analysts following the security and possibly some measure of financial disclosure in published records. They conclude this discussion as follows (p. 9):

> "... Whatever the measure, if less information is available about some securities, then those securities may have greater perceived risk. We have demonstrated that the differences may induce differences in perceived <u>systematic</u> risk of the security."

Barry and Brown consider the nonstationarity of returns and heterogeneous beliefs and show that their conclusions are not qualitatively affected by these relaxation of assumptions. They also show by using a simple model that divergence of opinion is likely to have an inverse relationship with the amount of shared information. This analysis leads to the following statement (p. 17):

> "... divergence of opinion and estimation risk are likely to be associated, i.e., analysts are likely to differ (in mean predictions) most sharply concerning securities for which relatively less public information is available. Divergence of analyst opinion is thus a potential proxy for amount of relevant information available."

To summarize, Barry and Brown (1983) have developed a theoretical model which predicts that the estimated risk perceived by investors will differ from the risk estimated by the use of historical data. They also suggest several proxies for the differential information which is the cause of the predicted effect.

2.2.2 THE EMPIRICAL LITERATURE

The effect of differential information available to investors has been investigated empirically by Barry and Brown (1983a). Using the length of listing on the NYSE as a proxy for the amount of information available to investors, they investigated the relationship between length of listing and the return on securities. Using a sample of all NYSE stocks on the Center for Research in Security Prices (CRSP) tapes they found that the stocks with short periods of listing earned significantly higher returns than predicted by the CAPM. Investigations of the relationship with size of the firms indicated that, while the period of listing effect explained a great deal of the small firm effect, there is clearly a period of listing effect apart from the size effect. The January effect appeared to be completely separate from the results of the differential information effect noted by Barry and Brown.

A study by Arbel and Strebel (1982), concerning the question of whether differential attention (i.e. differential information) which companies are given, indicated that firms that are neglected earned excess returns. They used a sample consisting of the S&P 500 for the period of 1967 to 1976, and measures of the number of analysts following each of the firms. Studying the period of 1972-1976, they found that firms which are not followed widely by analysts earned significant excess returns compared to the returns predicted by the ex post CAPM.

They tested for the small firm effect and found that the neglected firm effect exists over and above the small firm effect. They conclude that the ex post CAPM can not explain their results if the markets are efficient and investors are well diversified. They also state "The most plausible explanation for the neglected firm effect is greater uncertainty concerning ex-ante return distributions." (p. 216).

To summarize, the limited number of investigations to date indicate that the empirical evidence supports the differential information theory of Barry and Brown (1983). It shows that a plausible cause of the small firm effect is the risk estimates of investors based on their differential (ex ante) information.

2.3 HETEROGENEOUS EXPECTATIONS LITERATURE

Another effect of differential information is the fact that investors have heterogeneous expectations. The literature on heterogeneous expectations will now be reviewed. The theoretical effects of heterogeneous expectations on the CAPM will be reviewed, as well as the empirical studies that have been conducted. The first part of the review will deal with the theoretical aspects and the second with pertinent empirical works.

2.3.1 THE THEORETICAL LITERATURE

One of the early works dealing with heterogeneous expectations is that of Lintner (1969) who investigated the effect of heterogeneous expectations in the CAPM framework. The model he developed under these conditions, where investors hold differing probability judgments and have differing risk aversion, yields different results than the traditional CAPM. Under the conditions assumed, the variance-covariance matrix and the expected prices of securities become complex weighted averages of investors' assessments rather than the usual "simple" ones of homogeneous expectations. Another result of this model of Lintner is that the individual investors hold distinct portfolios of securities and none holds the market portfolio. Lintner's model also accomodates individual investor's lack of opinion about numerous securities. In the case of lack of knowledge about a subset of securities, the aggregate market price and variance-covariance matrices of these securities reflect only the opinions of those investors who actually hold those securities. There are additional implications of this model, but, overall, the impact of differing expectations on the part of investors does not critically change the CAPM.

Another model of capital market equilibrium under heterogeneous expectations has been developed by Gonedes (1976). This model accomodates only a particular class of heterogeneous expectations. The class is one in which investors agree on the returns from basic economic activities, but not the way in which they are combined in a particular security. The principal result of this model is that the traditional CAPM efficient frontier remains intact and all investors face the same combination of risk and return.

Examples of some other theoretical papers in the area of the relation between expectations and security prices and returns include Miller (1977), Williams (1977), and Jarrow (1980). Miller (1977) and Jarrow (1980) have studied the effect of heterogeneous expectations on asset prices when short sales are restricted. Williams (1977) developed a model of the CAPM with heterogeneous beliefs. The model resulting from Williams' study is similar to the traditional CAPM, but the security market line (SML) is a "consensus" SML rather than the traditional one. One significant result of this model is that beta no longer remains a complete measure of risk.

In summary, the effect of heterogeneous expectations does not invalidate the CAPM in general. There are expected differences from the usual case of homogeneous expectations, such as investors will no longer hold the market portfolio and there may be differences due to estimation risk, but the basic framework can still be used.

2.3.2 THE EMPIRICAL LITERATURE

Heterogeneous beliefs cannot, of course, be observed and are impossible to measure directly. Expectations in the form of forecasts are one of the few proxies which can be used as an indicator of the divergent beliefs of investors. Thus, expectations have become a primary area of interest for dealing with heterogeneous beliefs. Empirical work regarding the effects of expectations has been limited however, because expectations, in the form of forecasts, have been difficult to compile. There are few advisory services or security brokerage firms that publish expectations (Value Line being the major exception). Analysts' forecasts of earnings expectations have been used in a few instances as a proxy for investors expectations. Using such data for example, Malkiel and Cragg (1970) found that there is a significant relationship between earnings expectations, in the form of analysts' forecast growth rates, and the price-earnings ratio.

Surveys have been used (e.g. Bart and Masse (1981)), but surveys are restricted by their nature to a few securities for a limited time period. Still another technique that has been used is unexpected changes in earnings, based on a simple expectations model. The model used for this group of studies has been a simple extrapolative model based on earnings trends which includes seasonal dummy variables. Unexpected earnings which arise from the use of this model have been found to be an important factor in the returns on stocks by, among others, Joy, Litzenberger, and McEnally (1977) and Latane and Jones (1977, 1979). In general, these studies indicated that abnormal profits could have been earned based on such unexpected earnings. However, Reinganum (1981a), in an investigation of empirical anamolies based on earnings, E/P ratios and firm size, found no such excess returns based on these unexpected earnings announcements.

Among the major studies using expectational data is that of Friend, Westerfield and Granito (1978). This study deals with several aspects of the CAPM, but the first section of the study uses analysts' forecasts of long term (5 years or more) expected growth rate to investigate the CAPM. The sample was limited in size to 66 firms or less, in each of four years, 1972, 1974, 1976 and 1977. The stocks were all over $100 million in size and listed on the NYSE. Using this ex ante data, three cross-sectional regressions were run for each of the four samples: The first using beta alone (the CAPM); the second using beta and the residual standard deviation; and the third using beta, the residual standard deviation and the standard deviation of the expected return. The findings of Friend et al., while not strong, do support the view that the variance of expected growth rates plays a significant role in the pricing of risky assets.

It has been difficult and time consuming to compile information on analysts' forecasts because of the nature of the securities industry. Compilations of forecasts have been made and used as proxies for expectations, but such efforts have been limited in number and scope. Since 1976, one collection of forecasts has become available on magnetic tape through the Institutional Broker Estimate System (IBES) from the NYSE firm of Lynch, Ryan and Jones. A limited amount of research has been conducted using this data.

In a study using the IBES tapes, Elton, Gruber and Gultekin (1979) examined the efficiency of the market with respect to analysts' forecasted earnings. The sample used was the firms on the IBES tapes with fiscal years ending on December 31st for which three or more forecasts were available for the period of 1973-1975 inclusive. The consensus (mean) growth rate of forecasted earnings for the one year period (current fiscal year) was used to rank the stocks and place them into one of ten portfolios according to the forecasted growth rates. The market model was used to calculate the risk adjusted returns for each of the equally weighted portfolios. The difference between the actual returns and the predicted returns gave the risk adjusted excess return. These excess returns were adjusted by subtracting the mean excess return of all ten portfolios combined from the excess returns of each of the portfolios. Thus the portfolio excess returns reported are relative to the average stock in the sample.

Examining the adjusted excess returns, Elton, Gruber and Gultekin found that the market is efficient in the semi-strong form with regard to analysts' forecasts. They found that being able to predict the consensus forecast in advance, or the actual growth rate more accurately than the forecast, could lead to excess returns. However, the informational content of the consensus forecast itself is reflected in security prices.

Cragg and Malkiel (1982) used a sample of analysts' forecasts, collected from 17 major investment firms during the decade of the 1960s as the basis for their study concerning expectations. The sample included 178 firms which tended to be larger corporations of substantial interest to the investing public. To be included in the sample, at least three estimates of earnings and growth of earnings, in each of two years were required. The nature of the sample was such that no single forecaster made estimates in all of the nine years, and some forecasters were included for only two or three years. While this data is not necessarily an accurate picture of general market expectations, it is not unreasonable that it may well be representative of opinions of a certain segment of the professional investment institutions. In addition, it may not be unrepresentative of the general expectations, since several firms provided this data to their retail customers. Cragg and Malkiel conclude that these expectations may serve as acceptable proxies for market expectations.

Investigating the question of agreement between the analysts revealed that, although there was considerable consensus among the predictors, there was also a substantial lack of agreement between them.

To examine the accuracy of the predictions, simple parametric and nonparametric correlations were made between predictions and subsequently realized rates. In addition, an inequality coefficient similar to that of Theil (1966) was calculated. This coefficient consisted of the sum of the squared differences between predicted and realized growth rates divided by the sum of the squares of the realized rates. Using this framework, the errors in predictions were partitioned into three parts: (1) errors in predicting the average earnings growth of the firms; (2) errors in predicting industry growth rates; and (3) errors of growth rate of a firm within the industry. Using these various techniques, Cragg and Malkiel found that the mean industry growth rate accounted for only a small portion of the overall error, while the within industry component was the principal source of the error observed.

Testing for the effectiveness of other forecasting methods Cragg and Malkiel found that historical growth rates were not effective predictors and that the analysts' estimates were superior. The results were similar to the earlier ones of I. M. D. Little (1962) for British corporations. They did find, however, that the P/E multiple was generally as good a predictor as the analysts' forecasts, and provided the best forecasts based on historical data.

Cragg and Malkiel also tested the forecasts were "rational" in the sense of Muth (1961). The results of this testing were mixed with the short term forecasts possibly not being considered rational. In conclusion regarding rationality, Cragg and Malkiel state that, while they were able to reject the rationality of the forecasts (short term) based on a narrow interpretation of the hypothesis, the broader interpretation of the rational-expectations hypothesis cannot be rejected. They state: "...it appears that any useful information in the forecasts does get rationally included in share prices." (p. 96).

They also experimented with various combinations of forecasts and historical data as a broader test of whether the forecasts included <u>all</u> historical information available. While one combination would be effective for one year, the same combination would not give good results in the following year. The results indicated that there was no consistent combination of historical data and forecasts that could be used to make better predictions.

Because of the limitations of the CAPM, including the difficulties voiced by Roll (1977), Cragg and Malkiel developed a multifactor model for use in their study that they term the "diversification model." This model is identical in form to the APT model of Ross (1976), but is derived on the basis of somewhat different arguments. They then use this model to test alternative measures of risk. The measures of risk investigated included the traditional beta estimated from historical data with various "markets", the rate of change of national income, short term interest rates, the rate of change of the consumer price index, and the variance of predicted long term growth rates estimated by the analysts.

The results of these tests, using the risk measures both singly and in combination, indicate that the variance of analysts' forecasts of long term growth rates is an important factor in the determination of security returns. The results are not absolutely definitive, since the problem of errors in variables is not dealt with in this work, but nonetheless there are strong indications of the significance of this factor.

Cragg and Malkiel conclude that the variance of growth rates gives a closer account of the valuation of securities than does the normal beta or other alternatives studied. Thus, the study supports their hypothesis that analysts' forecasts, as part of the information available to investors, should be reflected in securities prices, though the appropriate model is not clear.

Malkiel (1981) reported, while discussing the results of Malkiel and Cragg (1980), results of one additional year of data which was taken from the IBES tapes. For the year 1980, the results were similar to those of the earlier study. In his concluding remarks he commented that the best single risk proxy appears to be the dispersion of analysts' forecasts of long term growth rates. Again this measure generally gave the highest correlations with expected returns and the highest t-values.

One recent empirical work dealing with expectations and stock returns is the study of Peterson and Peterson (1982). They examine the effect of changes in return distributions which may influence stock prices, and hence returns. They develop a model of heterogeneous expectations which has three linear segments. The segments represent price ranges in which the investor will buy the security, hold none of it, or sell it short. They investigate this model under conditions under varying restrictions concerning short selling. Their model predicts that the mean of the expected return distribution will have a direct effect on security prices. The effects of changes in the second and third moments will also be related to the equilibrium price, if there are constraints on short selling, but the exact relationships could not be derived since data was not available.

Using the information on the IBES tapes on an annual basis, Peterson and Peterson confirmed empirically that the change in mean assessment had a positive role in explaining the returns of the security. The second moment was positively and significantly related to the return of the security in two of the four periods studied. The third moment did not have any significant relationship with the return on the security. They conclude that further work is necessary to investigate the relationships between expectations and security returns.

To summarize, the empirical work that has been done supports the role of expectations as a "real world" phenomenon which is a possible explanation for certain observed phenomena, such as the small firm effect, which are not explained in the traditional CAPM framework.

2.4 NATURE AND SIGNIFICANCE OF THE SMALL FIRM EFFECT

A systematic cross-sectional difference between the risk adjusted returns of firms with small market values and the risk adjusted returns of firms with large market values has become known as the size effect or small firm effect. This difference, which has not been adequately explained by any of the various forms of the CAPM or by possible economic causes, indicates that small firms have positive risk adjusted excess returns while large firms have negative risk adjusted excess returns. This inverse relationship between market value and excess returns is statistically significant as reported by most of the authors investigating the anomaly. It is large enough that it appears possible to use the phenomenon to earn excess profits, thus violating the efficient market hypothesis. This is a possibility which has not escaped attention in the trade and popular presses (e.g. Roll (1983) and Seligman (1983)). Schwert (1983 p.4) summarizes the significance of the effect as follows: "... the statistical association between the "size" of the firm and average stock returns is comparable to the association between average return and risk." This statement is based on the work of Banz (1981) who reported that for the entire period of his study (1936-1975) the t-statistic for testing whether the size coefficient was equal to zero (i.e. there is no relationship between size and return) is 2.54. In comparison, in testing the relationship between risk and return, Fama and MacBeth (1973) found that the t statistic testing whether the slope of the risk return relationship is zero was 2.57 for the 1935-1968 period. Thus the small firm effect is a significant empirical anamoly that has not been adequately explained. It joins the "weekend effect" documented by French (1980) and Gibbons and Hess (1981) and the "E/P effect" documented by Basu (1977) as an empirical regularity not explained by current theory or research.

2.5 THE SMALL FIRM EFFECT

The literature on the small firm effect, which will be the anamoly studied, will now be reviewed, as well as the work of Basu (1977) on the P/E effect. The literature concerning the small firm effect and the P/E effect (which appears related) will be divided into six topical areas. These are: (1) the investigations of the effect itself, verifying its existence through the use of various statistical techniques; (2) the P/E effect and its relationship with the small firm effect; (3) the studies concerning possible statistical explanations (e.g. estimation of beta); (4) the studies that investigate the detailed nature of the anomaly (e.g. stability over time); (5) the investigations which attempt to explain the existence of the size effect by economic factors that occur in the "real world" (e.g. transaction costs); and (6) other investigations (e.g. arbitrage pricing theory (APT) tests).

2.5.1 <u>EXISTENCE OF THE SMALL FIRM EFFECT</u>

The first study which explicitly investigated the relationship between firm size (market value) and return on common stock was the work of Banz (1978). Reporting on that work, Banz (1981) states "..., in the 1936-1975 period, the common stock of small firms had, on average, higher risk adjusted returns than the common stock of large firms." (pp. 3-4). The empirical tests that he conducted were based on a linear asset pricing model. This model contains a term related to the market value of the firm, as well as the usual constant and the expected risk adjusted market return terms. If the regression coefficient of the term relating to market value is zero (i.e. no relationship with the market value), then the model reduces to the traditional Black (1972) version of the CAPM.

Banz formed portfolios of small firms and large firms and then ran a simple time series regression to determine the difference in risk adjusted returns between large and small firms. The portfolio selection procedure was identical to that of Black and Scholes (1974) and consisted of 25 portfolios with similar numbers of securities. The sample was first divided into quintiles based on market value, and then each of these quintiles was subdivided into quintiles according to the beta of the stock.

The sample used for the study was all firms listed on the New York Stock Exchange (NYSE) for at least five years during the period from 1926 until 1975 inclusive. The data used was from the monthly return tapes of the Center for Research in Security Prices (CRSP).

A cross-sectional regression was run each month, and the portfolios were updated each year, resulting in a time series of estimated parameters. A second time series regression was used to obtain final estimates of the coefficients in order to eliminate the effect of having used estimated parameters in place of the true unknown values (as suggested by Black and Scholes (1974)). Various market indices were used, and the results were essentially the same regardless of the index used. The results showed a significantly negative estimate for the size coefficient. This indicated that firms with small market value have higher returns, on average, than large firms.

An analysis of the residuals showed that the relationship between returns and market value is neither linear nor logarithmic. To determine whether the effect occurred primarily for small firms, or was a general size effect, Banz regressed the residuals of the portfolios on beta alone. This regression resulted in significantly positive values for the small firm portfolios but values that are not significantly different from zero for the remaining portfolios, indicating that the effect is peculiar to small firms.

The significance of the observed differences in returns is the final question that Banz investigated. The difference in returns between small firms and large firms was approximately 0.4 percent per month. By forming arbitrage portfolios of long positions in small firms and short positions in large firms, and using equally weighted portfolios, he found that the small firms had average excess return of 1.52 percent per month (19.8 percent annualized) when the smallest firms were compared to largest firms.

Banz concluded that the evidence suggests that the CAPM is misspecified. Based on the evidence presented by Reinganum (1981a) about the persistence of the effect, Banz (1981) states that it is unlikely that the effect is due to market inefficiency. He also conjectures that the effect could be due to the limited information available on small firms. Such a lack of information could make investors less willing to hold the stocks, resulting in higher returns on them. This conjecture is based on a model suggested by Klein and Bawa (1977).

To summarize, this study by Banz (1978) is the initial study of the small firm effect. It has also been the principal incentive for further investigations of the small firm effect. As will be noted in subsequent sections, this study is remarkably free of statistical problems that affect certain other studies of the small firm effect. The possible misspecification of the CAPM, and the information effect which were suggested by Banz as possible causes for the effect are the subject of the present study.

2.5.2 THE P/E EFFECT AND THE SMALL FIRM EFFECT

The P/E effect, which was studied by Basu (1977), appears to be interrelated with the small firm effect. The P/E effect indicates that firms with low P/E ratios tend to earn higher returns than stocks with high P/E ratios. Because of the possible interrelationship between these anamolies, the study of Basu (1977) will be reviewed. This will be followed by reviews of Reinganum (1981a) and Basu (1983) which also deal with the P/E effect and the small firm effect.

Basu (1977) conducted an empirical study to determine whether the investment performance of common stocks is related to their P/E ratios. He investigated whether portfolios of stocks formed on the basis of stratification by P/E ratios performed equally well on a risk adjusted basis. Using a sample of NYSE stocks and information obtained from the COMPUSTAT and CRSP tapes, he selected stocks that met the following criteria for inclusion in the sample: (1) fiscal yearend coinciding with the calendar yearend; (2) historical data available; and (3) relevant data available on the tapes. The resulting sample averaged about 500 stocks over the period of the study (1956-1969).

Dividing the sample into five portfolios on the basis of P/E ratios, he compared the annual return for each of the five portfolios based on a buy and hold strategy. He found that the lowest P/E ratio portfolio had an average return of 16.3%, while the high P/E ratio portfolio had an average return of 9.3-9.5% (depending on whether firms with negative earnings are included). Surprisingly, the beta for the low P/E portfolios was lower than for the high P/E and, therefore, the difference can not be attributed to increased risk. Investigation of differential tax effects indicated that, while tax effects would reduce the observed differences, it would not eliminate the effect.

To investigate the adequacy of the model, Basu tested the relationship of the bias in the returns related to the beta of the portfolio. The test results were consistent with the bias found by Black, Jensen, and Scholes (1972) which indicated that low risk portfolios earn, on average, larger returns than predicted by the model, and high risk portfolios smaller returns. These results indicate either that the model omitted relevant factors and that the P/E ratio was acting as a proxy for them, or, if the model is assumed correct, the P/E effect is then a true effect.

In view of the observed bias, Basu tested the returns on each of the P/E portfolios by comparing their returns to randomly selected portfolios having similar betas and found that the P/E effect was still observed. The effects of outliers in the returns, and the general distribution of the "winners" and "losers" in the portfolios was compared, and the results indicated that there were no significant differences due to these causes.

Additional investigations were made to study the effect of factors such as transaction costs and search and information costs. Based on the assumptions made concerning these costs, Basu (1981) found that the tax exempt investors and tax paying investors could have rebalanced their portfolios annually and earned abnormal profits, while traders or speculators could not have earned significant abnormal returns.

Basu concludes that the results indicate a violation of the joint hypotheses of (1) the correct specification of the asset pricing model and (2) that security prices behave in a manner consistent with the efficient market hypothesis.

Reinganum (1981a) in an investigation of empirical anamolies based on earnings, E/P ratios and firm size extended the work of Banz (1981) regarding the size effect by using a sample of NYSE and American Stock Exchange (AMEX) stocks for the period of 1963-1977. Ranking the firms annually by market value on the basis of their December 31st values, Reinganum formed ten equally weighted portfolios based on these market values. Using daily returns, the returns of the NYSE-AMEX equally weighted index were subtracted from the portfolio return. Since the betas for the portfolios were estimated to be virtually one for the small market value portfolios, the difference between portfolio return and market return was interpreted as the abnormal return. He found that the two portfolios with the smallest market values have positive abnormal returns. These were approximately 12 percent per year for the smallest market value portfolio, and just over 4 percent per year for the next smallest. The larger market value portfolios all had negative excess returns. Extending the investigation into the second year, Reinganum found that the results persisted essentially unchanged through the second year.

Reinganum also investigated the E/P effect reported by Basu (1977) and found that, using both quarterly and annual data, the high E/P (low P/E) portfolios earned significantly higher returns than the low E/P portfolios. Furthermore these differing returns persisted for a two year period, the entire period studied. Because of the persistence of the abnormal returns Reinganum suggests the most likely cause is misspecification of the model rather than market inefficiency.

Using a two way classification scheme in which the sample was divided first into quintiles by market value, and each of these quintiles was further divided into E/P quintiles, he tested to determine whether the size effect or the E/P effect dominates when the other is held constant. These tests indicated that the size effect dominates the E/P effect.

Basu (1983), using a sample of NYSE stocks for the period 1963-1980, found the existence of the small firm effect, but also found that it is interrelated with an earnings/price (E/P) effect. His investigations of the E/P and size effect were designed to test the robustness of the results of Reinganum (1981a). Using a different sample and various techniques to control for risk, Basu investigated the interrelationship between size effect and E/P effect. Basu formed control portfolios of similar E/P ratio but of varying market value, and portfolios of similar market value but of varying E/P ratios to isolate the effects of size and E/P ratio. Testing these control portfolios, he found that the risk adjusted return on the high E/P portfolios was significantly positive. In the case of the market value portfolios, he found no statistically different risk adjusted returns based on market value when the E/P ratio was controlled. Using a two way classification scheme similar to that of Reinganum (1981a) Basu found that the E/P effect was present within each of the market value categories, but that it appears to decrease in importance as the market value of the portfolios increases. Basu concludes that the effects of size and E/P appear to be interrelated, but, that for the period of the study, the size effect appeared to have been of secondary importance. He also concludes, following the reasoning of Ball (1978), that the evidence probably implies a misspecification of the model rather than evidence of market inefficiency per se. He also concludes that it is probable that both the small firm effect and the P/E effect are proxies for a more fundamental factor.

In summary, there is clear evidence that there is a P/E effect and that it is interrelated with the small firm effect. The nature of this relationship is not clear, but is possibly due to omission of a common factor(s) from the model. As noted above, the evidence as to which effect is dominant is conflicting. Differences in the samples used is one possible explanation for the conflicting results. Reinganum (1981a) used a sample including NYSE and AMEX stocks, and thus more small firms, while Basu (1983) used only NYSE stocks. Another possible source of the reported difference is the fact that Reinganum (1981a) used arithmetic averaging of daily returns, while Basu (1977, 1983) used monthly returns. These differing methods can result in biases which result in misestimation of the returns on small firms (See 2.5.3 below). Thus while there is clear evidence of a P/E effect, its relationship with the small firm effect remains unclear. Basu's conclusion that these effects are possibly proxies for some other factor(s) remains a plausible explanation. This study will investigate the effect of differential information as the possible missing factor causing the small firm effect.

2.5.3 STATISTICAL INVESTIGATIONS

There have been a number of studies dealing with the statistical implications of the methods used in the investigations of the small firm effect. These include the method of estimating beta (risk) in the study, and the calculation of the excess returns. The studies of that type will be reviewed in this section.

Based on the work of Reinganum (1981a) and Banz (1981), Roll (1981) hypothesized that the small firm effect which was reported could be due to improper estimation of the risk of the small firms (the beta). Specifically, he conjectured that auto-correlation in portfolio returns caused by infrequent trading, especially when using daily returns, could result in underestimation of the betas of the small firms. He investigated the effect of such improper estimation using Dimson (1979) aggregated coefficient (AC) estimators and ordinary least squares (OLS) estimators on the returns of the equally weighted Standard and Poor's (S&P) 500. He found significant differences in the betas estimated by the different estimation methods as conjectured and concludes that this is a possible cause of the reported small firm effect.

Reinganum (1982) directly tested Roll's conjecture by using daily return data on a sample of stocks contained on the CRSP daily tape files. Using a variety of techniques for estimating beta, he found that there were the differences suggested by Roll (1981). Formally testing for the size effect using a Fama-MacBeth type methodology and daily returns compounded into a monthly return, Reinganum found that the coefficient of the firm size term significant (more than four standard errors from zero) and that the excess returns for small firms were significant. Reinganum estimated that the difference in beta estimates for the small and large firms of about 0.7 could account for only about thirty percent of the difference in portfolio returns. He concludes: "... the excess returns not explained by the misestimation could easily exceed twenty percent per year on average." (p.35).

Givoly, Kumar, Mandelker, and Rhee (1983) investigated measurement problems associated with risk and return estimation in small firm effect studies. They point out that, since small firms tend to be the lower priced stocks, the minimum price change reported (1/8 point in general) is a larger percentage of the value for small firm (low price) stocks than for large firm (high price) stocks. As a result, they hypothesize that there is a difference between the reported returns, and the true returns which would be observed if there were no minimum price change in the reporting system. The effect is hypothesized to be larger for small firms than for large firms, and thus contribute to a downward bias in the beta estimates, which will be more pronounced for the small firms. Using NYSE and AMEX daily data from the CRSP tapes for the period of 1962-1979, they calculated betas using OLS, Dimson (1979) AC and the AC method using only those days for which there are non-zero returns. The results confirm the hypothesized bias, but the magnitude of the bias in the estimated beta is not sufficient to explain the small firm effect.

Givoly et al. (1983) also examine the effect of the computational procedures used to measure the returns to the portfolios. They compare the simple arithmetic average used by Reinganum (1981a, 1982) to compute portfolio return, with a daily compound rate on the portfolio as a whole, and with a procedure they call "Security Daily Compounding" (SDC) in which the returns for each security are calculated on a compound basis for the year, and the portfolio return is calculated as the average of these individual returns for the stocks in the portfolio. The results of their tests, using the same sample as before, confirm their hypothesis that arithmetic averaging causes an upward bias in the returns of small firms. While the results do not "explain" the small firm effect, they indicate that care must be taken in the procedures used in calculating the returns in testing for the small firm effect.

Blume and Stambaugh (1983) investigated the implications of the method used to estimate the abnormal returns in the earlier studies of the small firm effect. The fact that the closing prices used to calculate returns frequently differ from the prices at which rebalancing would actually occur. This effect, which is caused by the bid-asked spread and the fact that closing prices are typically not "crossed" transactions, causes an upward bias in the calculated returns. The effect is significant for arithmetically averaged daily returns and is larger for the lower priced stocks (principally low market value firms). If returns are not arithmetically averaged, but are calculated on a buy and hold basis, the effect is reduced to insignificant levels because of the number of securities in the portfolio. The principal source of this bias is the implicit rebalancing which occurs when the daily returns are arithmetically averaged. To empirically test the significance of this effect, Blume and Stambaugh (1983) essentially duplicated the study of Reinganum (1981a). They found that this bias resulted in observed returns for small firms that are approximately double the returns which are calculated when a buy and hold strategy is followed.

Roll (1983a) also investigated the effect of the computational method used for calculating the estimated premium for small firms. Using first a theoretical approach, he shows that the expected results of the different methods of calculating excess returns are not the same. The effects of serial dependence are discussed, and it is noted that the exact impact cannot be determined on a theoretical basis. Turning to empirical data on AMEX and NYSE stocks for the period 1963-1981 inclusive, the results of using an arithmetic mean method, a buy and hold method and a daily rebalancing method are compared. The small firm premium was similar for the daily rebalancing and arithmetic methods, but was less for the buy and hold method, especially as longer intervals were used to compute the portfolio returns. Using monthly or longer periods, the premium using a buy and hold strategy was half or less of the premium calculated by the other methods. Roll concludes that serial dependence can make a material difference in results if the factor being determined differs systematically with such serial dependence as it does in this case.

To summarize, various investigations have shown that the estimation of beta used to calculate excess returns and the method of calculating the portfolio returns are extremely important when daily returns are used. Specifically, when using daily returns, the beta used in the calculation of excess returns should be estimated using a method that accounts for the intervaling effect. In addition, when calculating portfolio returns, the returns should be calculated on a buy and hold basis, rather than on an arithmetic average. When monthly data is used, these effects are much smaller and less significant. Thus, the work of Banz (1978), who used monthly data, suffers little from these criticisms which arise with methods using daily returns. While the magnitude of the effect and the proper estimation of the risk and returns of small firms have been studied, none of the statistical techniques have completely explained the observed results. The small firm effect remains an unexplained anomaly from a statistical viewpoint.

2.5.4 THE NATURE OF THE EFFECT

There have been a number of investigations into the general nature of the small firm effect to determine if additional clues to the cause(s) could be found. These include studies of the stability of the effect over time and the international aspects of the effect. This diverse body of literature will be reviewed in this section.

Keim (1983) investigated the month to month stability of the small firm effect, and found that nearly fifty percent of the effect occurs in the month of January. In addition he found that over half of the "January" effect occurs in the first five trading days of the month. For the study he used a sample of NYSE and AMEX stocks for the period of 1963-1979, and adjusted for risk by using an AC estimate of beta. The abnormal returns were calculated using the arithmetic average of the daily abnormal returns. He also found that the January effect is always observed, even in those years when the size effect was not observed for the year as a whole. Thus he indicates that a complete explanation of the small firm effect will require separate explanations of the January effect and the effect during the remainder of the year. He suggests several possible hypotheses to explain the January effect. These include tax loss selling, an information hypothesis based on Rozeff and Kinney (1976), and other possible noneconomic causes such as data errors, outliers in the data, etc. In conclusion he states that the hypotheses proposed to explain the small firm effect appear unable to explain the January effect.

Brown, Kleidon and Marsh (1983) investigated the stability of the small firm effect over time. Using essentially the same sample as Reinganum (1981a) and a sample of all stocks on the CRSP tapes for the period of 1962-1979 with the Seemingly Unrelated Regression Model (SURM), they found that the size effect is not stable over time. Using the SURM, they found a positive but statistically insignificant size effect (ie. the signs of effect were reversed and large firms had positive abnormal excess returns) over the period January 1969 to December 1973. They also observed a statistically significant negative size effect for the period of 1974-1979. Brown, et. al found that the size effect is linear in the logarithm of size, and that tests comparing OLS and SURM results over the same period gave significantly different results. They conclude that different methodologies can lead to different conclusion regarding the size effect, and that the effect itself is not constant over time.

Roll (1983) investigated the abnormally high returns observed in early January, and found that small firms exhibit larger returns than do large firms, though both exhibit above average returns for the period. Using the CRSP tapes and daily data for twenty days before the end of the month to twenty days after, he investigated every month from July 1962 to December 1980 and found the only consistent pattern of abnormal returns for small firms occurred in January. The last trading day in December and the first four trading days in January always exhibited abnormal returns for small firms, while the next ten trading days had eight days, on average, during which the premia were significant. He attributes the effect to tax loss selling, since he was unable to find other causes for these abnormal returns such as data errors, listing changes, or outliers in the data. Roll conjectures that low liquidity and transaction costs probably prevent arbitrageurs from eliminating the effect.

Brown, Keim, Kleidon and Marsh (1983) investigated the seasonality of returns and the tax-loss selling hypothesis using data on Australian stocks. They investigated the raw data for seasonality and the small firm effect. They found a July-August seasonality (corresponding to the Australian personal tax year) and a December-January seasonal as well. A small firm premium of about four percent per month was also observed with the raw data. A study of the risk adjusted excess return relative to the CAPM showed that the small firm effect is still observed at a value of about four percent across all months. The seasonal effects were not as pronounced as with the raw data and are small in comparison with the results obtained using U.S. data. The possible explanation of an integrated world market causing the January seasonal is considered, but rejected. They conclude: "In one sentence, tax-loss selling still leaves us at a loss for an explanation of the January effect." (p.126).

In summary, there is evidence that the small firm effect includes a pronounced January seasonal effect. Investigations of this January effect considering possible tax causes have been conducted but have not adequately explained the small firm effect. (Note further studies of tax considerations in Section 2.5.5 below.) There is also evidence that the small firm effect is not unique to U. S. markets, and is not constant over time on a yearly basis as well as a monthly basis. These investigations, while they have added to our knowledge of the small firm effect, have failed to give an "explanation". Again, misspecification of the model is considered by most investigators as a possible cause for the effect.

2.5.5 ECONOMIC INVESTIGATIONS

Additional investigations have been made to determine if there are external economic factors which are possible causes of the small firm effect. Two such factors are tax effects and transaction costs. The existence of the January effect, in particular, has prompted a number of investigations to determine if the observed effect arises from tax law considerations. The tax-loss-selling hypothesis suggests that, in order to realize losses for tax purposes, investors sell securities at the end of the tax year in December depressing prices of stocks abnormally. As a result, as prices return to "normal" in early January there are abnormally large price increases. The result of these hypothesized conditions is that the returns experienced in the first days of January are predicted to be abnormally high. The existence of such an effect is supported by the study of Dyl (1977) who found abnormal trading volumes which correspond to the hypothesized behavior of tax conscious investors.

Investigations of the possible tax causes for the small firm effect include Brown, Kleidon and Marsh (1983), Roll (1983), and Brown, Keim, Kleidon and Marsh (1983) noted above, as well the following studies.

Reinganum (1983) investigated the January effect using the portfolios he used in earlier work (Reinganum 1981a, 1982). Securities which were considered to be candidates for tax-loss selling were identified by the difference in price at the end of the year and the high price during the holding period for short term capital gains. Using this classification scheme, he found that the observed data is consistent with tax-loss selling. Estimating the magnitude of the possible dollar gain to be made trading these stocks, he suggests that the dollar gains do not appear large, and may be nonexistent after transaction costs. He also found that small firms which showed gains in value during the holding period exhibited large, though not unusually large, average January returns in the first few days of the month. These securities were not candidates for tax-loss selling and thus had no theoretical reason to exhibit such returns. Reinganum concludes that the observed effect is consistent with tax-loss selling but also concludes that this cannot be the complete explanation.

Givoly and Ovadia (1983) also investigated the tax induced effects on the returns of stocks. Using stocks which reach a 12-month (or 24-month) low in December as candidates for tax-loss selling, they found that this group exhibited abnormal returns in early January. Dividing the sample into five portfolios, they found that the tax-loss selling effect was more pronounced for small firms than for large firms. The evidence is consistent with the tax-loss selling hypothesis but they found that the tax-loss selling hypothesis does not explain why a larger effect is observed for small firms.

Constantinides (1983) investigated the optimal pattern of stock trading under personal tax laws. He theorizes that the optimal pattern of trading will be complex based on the long term and short term capital gain provisions of the tax laws. He suggests that the optimal trading pattern should include the realization of long term gains in high variance stocks in order to reestablish Short term positions in them, as well as the realization of capital losses. Empirically, he simulates the strategies, and finds support for this theory. Since small firms are, in general, high variance stocks this makes the tax timing option more valuable for them than for the large firms. He argues that, because of this, tax considerations exacerbate the anamoly. Constantinides points out that tax benefits may well exceed transaction costs, and thus transaction costs alone may not explain the anomaly as suggested by Stoll and Whaley (1983).

Stoll and Whaley (1983) investigated another possible economic cause of the small firm effect--transaction costs. Using a sample of NYSE stocks and monthly returns, they formed arbitrage portfolios based on market value and tested for the small firm effect. For the period of their study (1955-1979), they found an excess return to small firms of about twelve percent per year compared to the large firm portfolio. They also investigated the estimation of risk using an AC estimator and found that the results are not substantially different. With regard to the question of transaction costs, they estimated transaction costs as a percentage of market value for each of the portfolios. Using these estimates, they then calculated the portfolio returns net of transaction costs. Their results indicate that transaction costs reverse the direction of the small firm effect (p.74). Since these results were based on a holding period of one month, they investigated the question of a longer investment horizon by using 2, 4, 6, and 12 month holding periods. Their results indicate that an investor could not earn excess returns for holding periods of a year or less.

Schultz (1983), in contrast to Stoll and Whaley (1983), found that in a study using both AMEX and NYSE stocks that excess returns, after transaction costs, could be earned on holding periods as short as one month if January was included. The sample chosen by Schultz differs from that of Stoll and Whaley in that AMEX stocks are included. This substantially increases the number of small firms. Theoretically this should bias the test results to support the transaction cost hypothesis, since it is, in general, more costly to trade these stocks. After estimating the transactions costs, Schultz found that, except for the month of January, like Stoll and Whaley (1983) negative excess returns are earned for holding periods of one month. Over the period of his study (1963-1979) the results indicate, contrary to the findings of Stoll and Whaley, that the average annual excess return for small firms is almost 31% using holding periods of twelve months. Thus he concludes that transaction costs alone cannot explain the small firm effect.

To summarize, the evidence concerning possible external economic causes have failed to explain the small firm effect. The evidence on tax-loss selling, while generally consistent with the January effect, fails to explain the small firm effect. Stoll and Whaley's (1983) results using transactions costs would seem to explain the January effect, but when the evidence of Schultz (1983) is considered, the inclusion of significantly more small firms makes the robustness of Stoll and Whaley's results questionable. The results of this group of studies give further information concerning the small firm effect, but fail again to adequately explain it. The omission of some factor(s) from the CAPM, such as the effect of differential information or heterogeneous expectations, remains a likely cause.

2.5.6 ADDITIONAL INVESTIGATIONS

There have been two other investigations of the small firm effect that have used an arbitrage pricing theory (APT) approach. Reinganum (1981) conducted an APT test using three, four, and five factor models, with the factors being determined by factor analysis (economic interpretations are not given). He found that there is evidence that small firms earn excess returns of nearly .1% per day (about 20% annualized) compared to portfolios of large firms. Reinganum points out that there are several joint hypotheses being tested in this study and that, while the results are not consistent with the APT, it is not clear which hypothesis (hypotheses) should be accepted. Regardless of the cause of these results, no explanation for the small firm effect is derived from this testing.

Chan, Chen, and Hsieh (1983) used a multifactor APT model to test for the existence of the small firm effect. They used a five factor model, whose five factors had been related to the economy in a separate study by Chen, Roll, and Ross (1983). The factors used include: (1) industrial production or stock exchange indices as proxies for changing business conditions; (2) change in expected inflation; (3) difference between expected and realized inflation; (4) interest rate difference between long term government bonds and T-bills; and (5) the difference in returns between bonds rated "under Baa" and Aaa bonds. They used a series of twenty nonoverlapping one year periods from 1958 to 1977 and ran regressions using the five factor model. They found that the variable used as a proxy for changing business conditions explained a large portion of the small firm effect. They also found that the difference in returns between large and small firms is of the order of one to two percent per year. Thus they conclude that the small firm effect is essentially captured in their multifactor pricing model and that the return of small firms is justified by higher risk.

In summary, the results of these two studies are conflicting and it appears possible that Chan, Chen and Hsieh (1983) have indeed explained the small firm effect. If this is true, there remains the question of why the CAPM has failed, and exactly what factor(s) are needed to resolve the anamoly using the CAPM. Further testing, using both the CAPM and the APT appears justified.

2.6 SUMMARY OF THE LITERATURE

There is theoretical and empirical evidence that the incorporation of the effect of differential information can modify the predictions made using the traditional CAPM. The use of Barry and Brown's (1983) theoretical model for differential information can potentially contribute to the understanding of the small firm effect and of other anomalies. The choice of a suitable proxy for differential information is necessary. Several such proxies, including the divergence of analysts' opinions, have been suggested.

The empirical evidence indicates that, if suitable proxies can be found for the ex ante expectations of investors, it may be possible to explain certain of the existing anomalies including the small firm effect. These studies indicate that the use of the divergence of analysts' long term forecasts may be a suitable proxy the effects of heterogeneous expectations.

The small firm effect is one anomaly that has been thoroughly investigated and has not been adequately explained by the CAPM. As such, it is a suitable anamoly for testing the above effects. Since the discovery of the small firm effect by Banz (1978), numerous others have investigated the effect to determine the nature of, and causes for, the effect. The current results of these investigations are as follows:

(1) The existence of the effect has been confirmed by numerous investigations, most of which use the CAPM, or a modified CAPM as the model for the investigation.

(2) To date, no author has satisfactorily explained the effect as a statistical artifact or as an economic phenomenon.

(3) Almost without exception, no investigator has suggested that the market itself is inefficient, per se. Some have suggested that it is not efficient for a specific

reason (e.g. transaction costs), but none attribute the anomaly to market inefficiency.

(4) The opinions of a majority of the investigators include (a) that the model used to investigate the effect is misspecified or, (b) that the risk of the small firms is improperly measured.

CHAPTER III

DATA AND METHODOLOGY

3.1 INTRODUCTION

The data and methodology to be used in this study will be presented in this chapter. First there will be a short discussion of the calculation of excess returns. The use of analysts' forecasts as a proxy for risk changes resulting from differential information or some other factor that may be omitted from the CAPM will be discussed. This will be followed by brief discussion of expectations and their possible role as a factor missing from the CAPM. The use of analysts' forecasts as a proxy for expectations will also be discussed. A description of the model and the details of the methodology to be used to evaluate the excess returns and residuals will follow this. Finally the data to be used in the study will be discussed.

3.2 CALCULATION OF EXCESS RETURNS

Investigation of the small firm effect requires the calculation of excess returns. The general formula for calculating such returns is:

(3.2.1) Excess return = (Actual return) - (Expected return)

The actual return is easily obtained from statistical data readily available on magnetic tapes such as the CRSP daily return tapes. The actual return is calculated as the change in price over the holding period plus any dividends paid during the holding period, and is normally expressed as a percentage of the price of the security at the beginning of the holding period.

The expected return, however, cannot be measured from the data and must be estimated. The accuracy with which expected return is estimated is, of course, the determining factor in the correctness of the excess return calculation. The procedure used to estimate the expected return in a majority of the studies of the small firm effect is to use the CAPM as the model for determining this value. The usual procedure is to estimate the beta of the security by the use of historical data for a significant length of time (usually five years). The beta obtained from this regression is then assumed to be constant for the period being studied and is used to calculate the expected return for the security over the period of interest. This basic procedure has been used by Banz (1981), Reinganum (1981a) and Basu (1983) and by most other investigators of the small firm effect.

Recently an "Excess Daily Returns Tape" has been released by CRSP. This tape presents, in computer readable form, the daily excess returns for numerous securities calculated using equation (3.2.1). There are two sets of excess returns available on this tape. One is calculated using a beta calculated by the Scholes and Williams (1977) method. The stock's excess return is computed using the CAPM and one of ten "market" portfolios. These "market" portfolios have been formed on the basis of their betas. The "market" portfolio used is chosen to have a beta similar to the stock in question. This procedure was followed to eliminate the bias in returns due to the estimation of beta as found by Black, Jensen and Scholes (1972). The other set is calculated by determining the standard deviation of returns of each security. This standard deviation of returns is then used as a risk statistic. As with the Scholes and Williams beta, securities are grouped into ten portfolios based on this statistic, and excess returns are obtained by using the appropriate portfolio return as the expected "market" return. In this study, the excess returns calculated using the Scholes-Williams beta estimates will be used directly. They will be treated as the "accepted" excess returns of the given security.

3.3 EFFECTS OF DIFFERENTIAL INFORMATION AND EXPECTATIONS

The various studies of the small firm effect generally conclude that the small firm effect is the result of the omission of one or more factors from the CAPM or the improper estimation of risk. These studies have generally also concluded that the small firm effect is not the result of market inefficiency per se. Since the traditional CAPM uses the assumption of equal and costless information, a possible missing factor in existing investigations of the small firm effect is the effect of the differential information known by investors concerning securities. Brief arguments concerning the use of the number of analysts making forecasts as a proxy for such differential information and its role as the missing factor follow.

Barry and Brown (1983) developed a model for the effect of differential information on market equilibrium. In this model, because of differential information, there is a difference between risk perceived by investors and the "true" risk (as estimated by statistical methods) of securities. This difference in risk assessments causes small firms (low information group) to be regarded as having higher risk than the "true" risk. Since investors require returns commensurate with the perceived risk (the "true" risk being unknown to investors), the model suggests that this estimation risk is a likely cause of the observed excess returns of small firms. (It should be noted that the excess returns are calculated using the "true" risk.)

Barry and Brown (1983a) have performed a test using the period of listing as a proxy for such differential information and have found support for their theory. In addition, the results of Arbel and Strebel (1982, 1983), while not tests of Barry and Brown (1983), present evidence that firms that are neglected (i.e. receive little attention from analysts) offer higher returns than those that are more widely followed. The proxy used in these studies was the number of analysts following the firms.

In view of the results of Arbel and Strebel (1982, 1983) using the number of analysts and the theoretical work of Barry and Brown (1983), this study will use the number of analysts as the proxy for differential information. The number of analysts making forecasts of earnings per share for the current fiscal year will be used in order to obtain the largest possible sample.

The expectations of investors, which reflect their heterogeneous beliefs, is another factor that may be missing from the CAPM. To account for these differences, the use of a proxy for the ex ante expectations of investors also represents a plausible explanation for the small firm effect. The divergence of analysts' forecasts is one such proxy that appears suitable. The larger the divergence of forecasts, the greater the risk, and the greater the rewards demanded by investors.

This view is consistent with the results of studies of Friend, Westerfield and Granito (1978) and Cragg and Malkiel (1982). These investigations found that the variance of estimated growth rates, as estimated by analysts, contributed significantly to the explanatory power of their regressions. The variance of long term growth rates was, in general, more significant than the traditional beta in regressions using both. When it was used alone, it generally gave a better fit for the regression than the traditional beta.

Brief arguments for the use of the variablity of analysts' forecasts as the proxy for expectations are as follows. In making their estimates, analysts consider many diverse factors, including but not limited to the following: (1) Economic forecasts of all types, such as estimated gross national product, expected inflation rates, personal incomes and spending, capital investment projections; (2) Industry forecasts concerning estimated sales, operating capacities, price outlooks; (3) The impact of political actions such as tax law changes, government programs and purchases, regulatory climate and changes; and (4) Company factors including market position, financial condition, new product development, and management. In order to carry out the search process to obtain this information there are costs incurred by the analysts. Additional costs are incurred to analyze and publish the results of the analysis. Paralleling the arguments of Stigler (1961), it follows that more expense and effort will be expended (from a macro viewpoint) on the analysis of firms in which there is the greatest interest. For these firms (generally large firms) there should logically be greater quantities of common information. In contrast for firms in which there is less investor interest, less money and effort will be expended. The result is likely to be less common information and wider dispersion of forecasts.

This study is therefore premised on the argument that, because of heterogeneous beliefs, the effect of differential information or the expectations held by investors are factors that may be omitted from the CAPM. For the effect of differential information one potential proxy is the number of analysts making forecasts concerning a given security. The use of the divergence of analysts' forecasts is one plausible proxy for investors' expectations and will be used in this study. Tests will be made using each of these possible proxies for the effects of heterogeneous beliefs.

3.4 EMPIRICAL TESTING

In order to estimate the effect of differential information or investors' expectations, as approximated by the number of analysts making forecasts or analysts' forecasts respectively, has on the return of firms the following model will be used. This model makes the assumption that the traditional CAPM holds, and that the effect of the missing factor is captured in an additional term. The relationship between the proxy and return is assumed to be linear. The linear relationship is assumed because the true relationship is not known and this is a convenient assumption for the empirical work.

The model is:

(3.4.1) $\varepsilon_{it} = \alpha + \gamma \Delta + \varepsilon'_{it}$

where ε_{it} is the usual (CAPM) excess return of security i at time t

α and γ are coefficients of the regression

Δ is the proxy for differential information or expectations

and ε'_{it} is the remaining error term.

The proxies that will be used in the above equation are the number of analysts making estimates of earnings per share for the current fiscal year and the inverse of the coefficient of current fiscal year earnings estimates. The proxies actually used in the regressions will be the ranks (from 1 to 100) of the raw data. Ranks will be used for the number of analysts because of the variation in number analysts making estimates (for a given firm) during the year. In the case of the inverse coefficient of variation, the use of the inverse rather than the coefficient of variation eliminates the discontinuity which occurs in the coefficient of variation with zero earnings estimates. With both proxies, ranking retains the relative variability of the proxy between firms throughout the year.

Both proxies will be calculated monthly for each of the firms in the sample. Then the mean monthly excess returns for each firm, as calculated from the CRSP excess daily returns tapes, will be adjusted using equation 3.4.1 and the regression coefficients determined in the cross-sectional regression.

It is hypothesized that α will have a positive value in this regression. The coefficient γ is expected to have a negative sign. These hypothesized values arise from the fact that the proxies used vary inversely with the amount of differential information and the divergent expectations of investors. It is expected that the small (large) firms will have smaller (larger) values of the proxies used than the average. When the excess returns of the small (large) firms are adjusted to reflect the effect of this expectations proxy, the residual excess returns are expected to be reduced or eliminated.

Firms in the sample will be grouped into ten portfolios based on the market value of the firms at the beginning of each twelve month period. The mean excess daily returns of the each of market value portfolios will be calculated for the entire sample period and annually on an equally weighted basis. A comparison will be made of the portfolio returns, both of the mean excess daily returns and the mean residual excess returns to ascertain the explanatory power of the two proxies. This comparison will be made by t tests to evaluate the significance of the excess returns and the residual excess returns.

3.5 DATA

The sample used in this study will include only those firms on the IBES historic summary data tapes for the period of 1976-1982 which meet the following criteria: (1) the firm's fiscal year ends on December 31st; (2) price and common share data is available on the COMPUSTAT tapes for the study period; (3) excess returns for the firms are available on the CRSP daily excess return tapes; and (4) for the inverse coefficient of variation proxy only, there are three or more analysts making forecasts of earnings per share for the current fiscal year.

The data regarding differential information and heterogeneous expectations will be taken from the IBES historical tapes. These tapes are prepared by the firm of Lynch, Jones & Ryan, members of the New York Stock Exchange and distributed under the IBES system. Information concerning analysts' forecasts of earnings, growth, etc. is compiled by Lynch, Jones & Ryan for companies of interest to institutional investors. Estimates are provided by the analysts as changes occur and the remaining pertinent data is reused as current data. While this procedure may result in somewhat "stale" data, it is the most current data that is generally available. The estimates are provided by the research departments of various New York and regional brokerage firms on a weekly basis. After compilation the information is published in weekly, monthly, and in historic summary data formats.

The historic summary data tape covering the period of January 1976 through July 1982 will be used for this study. This tape provides, among other data, the mean estimate of earnings per share for the current and coming fiscal year, the the standard deviation of the estimates, and the number of analysts contributing to each of these estimates.

Each of the proxies used, the number of analysts and the inverse of the coefficient of variation, will be ranked by month into 100 groups. The ranks will then be used as the proxy, Δ , in equation 3.4.1 above.

The market value of the sample firms will be calculated from the September 1983 COMPUSTAT Primary, Secondary, Tertiary (PST) tapes based on the closing market price and the number of common shares outstanding at the end of the previous year. This value will not be recalculated over the following twelve month period. The market value of the firms will be recalculated annually and the portfolios reformed on the basis of this value for each study period.

The choice of the sample based on a fiscal year ending of December 31st is made because of the following considerations. The majority of firms have fiscal years ending on the calendar year end (about 65-70% of the firms on the tapes). Since the estimates of the analysts are made on a fiscal year basis, choosing this date gives the broadest sample possible, while avoiding the issue of comparability which would arise if various dates for the end of the fiscal year were included. The January 1st portfolio formation date is chosen since the earlier studies have used calendar years for portfolio formation and changes. Since knowledge of the previous fiscal years' results will be comparable for all firms, this date gives a reasonably well defined, uniform date upon which the data and estimates should be comparable.

The data concerning excess returns will be taken from the 1983 CRSP daily excess return tapes using the excess returns calculated using the Scholes-Williams beta. Since excess returns are being used, compound returns can not be calculated and arithmetic means will be used in this study. Because of the large number of individual daily excess returns involved, the monthly mean excess return for each firm will be calculated from the excess return tapes.

These mean monthly returns will then be used to calculate the portfolio returns and in the regression in equation 3.4.1 above.

Chapter IV

EMPIRICAL RESULTS

4.1 INTRODUCTION

In this chapter each of the samples studied is examined and discussed, including the composition and market value of them. The mean excess daily returns of each sample are then determined from the CRSP daily excess return tapes. Regressions are run on each sample, both over the entire period and on a yearly basis, to determine the explanatory power of the hypothesized information proxy or the heterogeneous expectations proxy. Finally, the residual mean excess daily returns (the remaining error term from these regressions) are tested to determine the effectiveness of the proxy. The results for each of the two samples will be discussed individually in the order outlined above. The chapter concludes with a discussion of the probable reasons for the results obtained.

4.2 SAMPLE O

The first sample will be titled sample O, and consists of all firms on the IBES historic tapes which met the following criteria: (1) price and the number of common shares outstanding at the end of the previous calendar year were available on the COMPUSTAT PST tapes; and (2) daily excess returns were available on the CRSP Daily Excess Return tapes (Scholes-Williams beta data set) for the period of interest.

The market value of each firm in the sample was determined on a yearly basis and the firms were then ranked into deciles based on this value for each year. The market value deciles are numbered from MV1 (lowest market value) to MV10 (highest market value). The mean market value by deciles is shown in Table 1 for the entire sample period. The mean market value on a yearly basis was also obtained and the values were similar to the results for the entire sample period.

The statistical information about sample 0 is summarized in Table 2. The total sample consists of 850 firms. These firms had a minimum number of 1 observation and a maximum of 78 observations on the IBES tape. It should be noted that there were no observations for any firm in the sample for the month of January 1976. The sample period therefore is February 1976 to July 1982, inclusive.

The number of firms included in the sample (on a yearly basis) increases throughout the sample period, with the largest number of firms occurring in 1982. It should also be noted that the number of firms in the low market value decile, MV1, tends to be somewhat larger than the

TABLE 1

Mean Market Value by Deciles
Sample 0
Entire Period
(in millions of dollars)

MV	Mean Value
1	25.26
2	57.71
3	99.07
4	160.26
5	240.26
6	352.99
7	531.07
8	789.37
9	1296.83
10	5994.18

Table 2

Summary statistics Sample 0

Total Firms in Sample: 850

Firms by Decile and Year

MV	1976	1977	1978	1979	1980	1981	1982
1	59	67	113	77	76	83	83
2	46	59	75	72	74	78	81
3	45	51	72	72	74	76	85
4	44	51	63	69	73	79	85
5	43	49	61	72	73	77	80
6	44	47	60	70	72	78	81
7	41	45	59	72	74	77	79
8	43	46	58	69	72	76	79
9	42	45	58	71	73	77	78
10	42	46	58	70	73	77	82
Total Firms	449	506	677	714	734	778	813
Total Obs	4591*	5461	6953	8422	8710	9186	5382**

* For 11 months (No January 1976 observations)
** Sample ended in July 1982

average number of firms in the larger market value deciles. This indicates that the smaller firms tend to have fewer observations per firm. This observation is consistent with the hypothesis that small firms receive less attention from analysts, and less information is published about them.

4.2.1 EXCESS RETURNS

Using the CRSP Daily Excess Return tapes, the mean daily excess return for each firm was determined on a calendar month basis. These mean returns were then used to determine the arithmetic mean monthly excess return for each of the market value deciles on a yearly basis. The mean excess daily return of the entire sample was also determined and was found to be -0.00028041. While the excess returns for the market are, by definition, zero, the sample used is not typical of the market. Since the firms in the sample are the firms of institutional interest which are followed by the IBES system, many of the smaller firms which are included in the "market" but are not of institutional interest, are not included in the sample. Therefore, this negative excess return for the sample as a whole should be expected since large firms tend to have negative excess returns. The result found with this sample is consistent with earlier work of Banz (1981) and others which have shown the same tendency for larger firms to have negative excess returns.

For convenience in interpretation and testing, all results using the mean excess returns in the main body of this study are shown relative to the sample mean (centered about the sample mean). This centering, which has been used by Elton and Gruber and Gultekin (1979), makes the sample mean excess return equal zero. Thus the excess returns are being measured on a basis relative to the sample as a whole. The uncentered values on a yearly basis are shown in Appendix A, Tables A1 through A7.

The mean monthly excess daily returns decrease monotonically with market value decile. This is shown in the top half of Table 3 and graphically in Figure 1. It should be noted that most of the tables (figures) in this chapter and the appendix have two panels (graphs). The upper panel (one graph) shows the excess returns for the sample and the lower panel (other graph) shows the residual excess returns after the regression. This permits a "before and after" comparison showing the effect of the regression.

4.2.2 DIFFERENTIAL INFORMATION PROXY

For sample 0 the rank of the number of analysts following the firm (as reported by the IBES tapes) was used as the proxy for the amount of information available to investors. As noted in Chapter three, this proxy is consistent with the theoretical and empirical studies of

TABLE 3

Excess Returns, Sample 0, Entire Period

Mean Monthly Excess Daily Returns
(Centered about sample mean)

MV	Excess Return	T	P-value
1	0.00028994	4.0660	0.000100**
2	0.00019753	3.0040	0.002678**
3	0.00011945	1.9715	0.048723*
4	0.00004984	0.8864	0.375460
5	0.00000037	0.0070	0.994386
6	-0.00002495	-0.4663	0.641037
7	-0.00008641	-1.7151	0.086387
8	-0.00013711	-2.9965	0.002744**
9	-0.00015820	-3.3741	0.000746**
10	-0.00024997	-5.2831	0.000100**

Residual Excess Return

MV	Residual	T	P-value
1	0.000128944	1.8083	0.070616
2	0.000079888	1.2149	0.224455
3	0.000036252	0.5981	0.549778
4	-0.000002814	-0.0500	0.960097
5	-0.000022107	-0.4218	0.673180
6	-0.000009357	-0.1749	0.861203
7	-0.000034108	-0.6770	0.498460
8	-0.000051078	-1.1163	0.264330
9	-0.000037297	-0.7953	0.426499
10	-0.000088013	-1.8604	0.062891

* Significant at the .05 level
** Significant at the .01 level

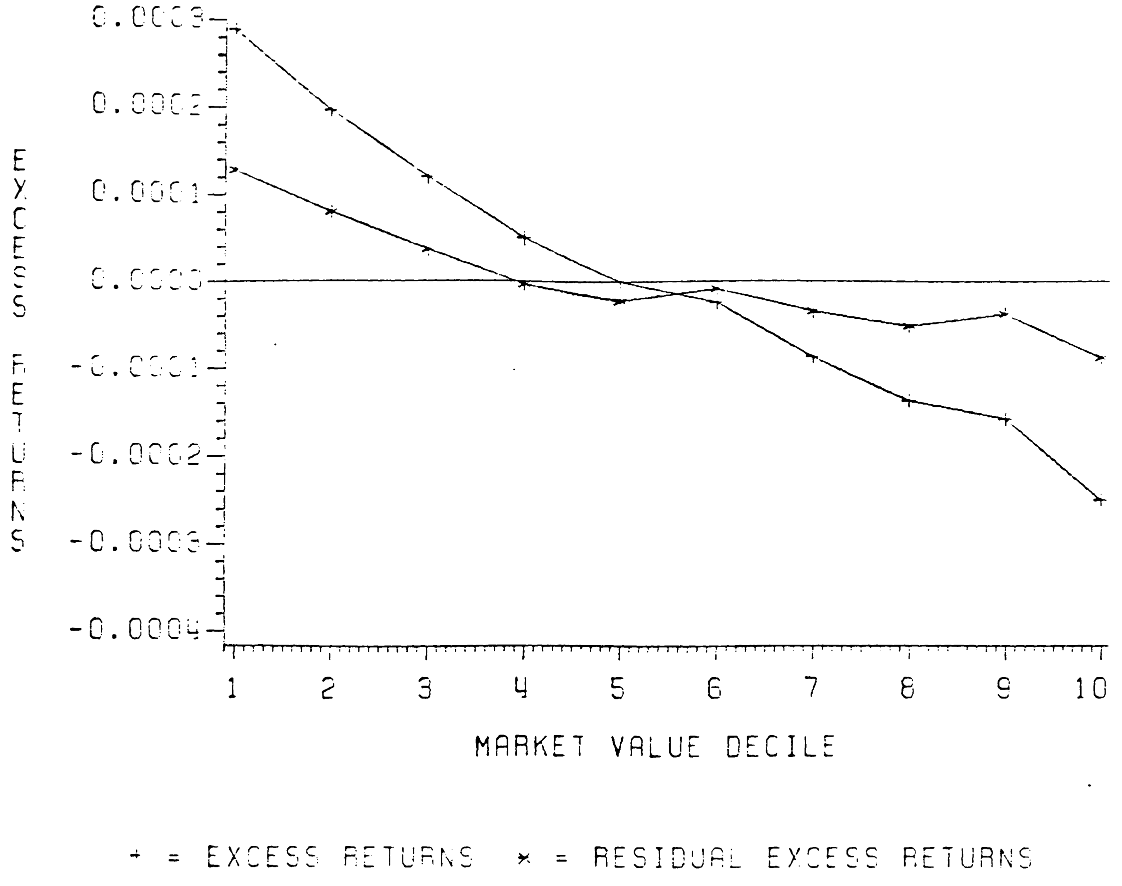

Figure 1: Excess Returns, Sample 0

more representative of the differential information than the period of listing which Barry and Brown (1983a) used.

The number of analysts making forecasts of earnings per share for the current fiscal year was the specific proxy chosen. The number of analysts making such estimates, which varied from 1 to over 20, was ranked monthly on a scale of 1 to 100, with the small values representing the low information group (few analysts following the firm) and the large ranks representing the high information group. The rank itself was used as the proxy in the regressions which were then performed.

4.2.3 REGRESSIONS

The following regression, which was defined in equation 3.4.1 was run, both for the entire sample for the entire period, and on a yearly basis:

$$\varepsilon_{it} = \alpha + \gamma \Delta + \varepsilon'_{it}$$

The result of this regression over the entire period shows that the estimated intercept was slightly negative, but not significantly different from zero. The coefficient of the differential information proxy (the slope) was negative and significant. The estimate for the intercept was -0.0000545901 with a t value of -1.354 (p-value 0.1251) and the slope coefficient was -0.0000044673 with a t value of -7.297 (p-value of 0.0001). While the intercept was not positive as hypothesized, it is clearly positive relative to the sample mean. The sign of the slope is negative as hypothesized.

When the regression was repeated on a yearly basis, the results were not completely stable. The intercept term was positive in three years (1976, 1977 and 1979) and negative the remaining years, with it significantly different from zero (at the 0.05 level) in two years (1978 and 1979). The slope estimates are all negative, but are statistically significant (at the 0.05 level) only four of the seven years. The slope coefficients and intercept estimates for the yearly regressions are shown in Table 4. The fact that the yearly regressions are not completely stable is typical of results of other studies using cross-sectional data. The fact that the slopes are all negative is indicative of a rather consistent relationship among the variables.

4.2.4 ANALYSIS OF THE RESIDUALS

Analysis of the residuals from the single regression of the entire sample for the whole period shows that none of the remaining mean residual excess returns for any market value group are statistically significant (Table 3). This result provides strong support for for the differential information theory of Barry and Brown (1983). It also provides strong empirical support for the use of the number of analysts following a firm as a proxy for the

TABLE 4

SAMPLE O
Regression Coefficients
(Yearly regressions)

Slope

Year	Slope	T	P-value
1976	-0.000008107	-4.617	0.0001**
1977	-0.000011006	-7.989	0.0001**
1978	-0.000000349	-0.229	0.8191
1979	-0.000009531	-6.865	0.0001**
1980	-0.000000499	-0.303	0.7619
1981	-0.000003143	-2.048	0.0406*
1982	-0.000000836	-0.425	0.6711

Intercepts

Year	Intercept	T	P-value
1976	0.00008640858	0.847	0.3968
1977	0.00008324135	1.039	0.2986
1978	-0.000382768	-4.317	0.0001**
1979	0.000229998	2.850	0.0044**
1980	-0.000185672	-1.938	0.0526
1981	-0.0000254348	-0.285	0.7756
1982	-0.000172358	-1.506	0.1322

* Significant at the .05 level
** Significant at the .01 level

differential information effect and differences in the information available to investors.

There is some evidence that the negative slope observed with the raw mean excess returns as a function of market value is still present in the residuals (Figure 1). This may be due to a number of causes. The possible causes include the following factors: (1) Barry and Brown (1983) develop only that the theoretical relationship between differential information and investor's perceived risk and required returns have negative correlation, but do not attempt to define the mathematical relationship; (2) The relationship between the rank of the number of analysts (the proxy) and the differential information available to investors differs from the linear relationship assumed; (3) the observed values are merely a random occurrence; and (4) the small firm effect is not a simple effect, but consists of at least two effects, a differential information effect and a January effect.

The mean residual excess returns from the single regression, when analyzed on a yearly basis (Tables 5 through 11), show the expected decrease in the number and frequency of significant mean excess residual returns. For comparative purposes, the centered mean excess returns are shown in the upper panel of these tables.

The mean excess residuals resulting from the yearly

TABLE 5

Excess Returns, Sample 0, 1976

Mean Excess Daily Returns
(Centered on Sample Mean)

MV	Mean Excess Return	T	P-value
1	0.00027538	1.3134	0.189719
2	0.00023806	1.3264	0.185365
3	0.00020097	1.2515	0.211366
4	-0.00008296	-0.5830	0.560149
5	0.00017372	1.1098	0.267659
6	-0.00007078	-0.4647	0.642398
7	-0.00000073	-0.0052	0.995838
8	-0.00033956	-2.4087	0.016405*
9	-0.00037310	-2.4786	0.013548*
10	-0.00044719	-3.0139	0.002723**

Mean Residual Excess Daily Returns

MV	Mean Excess Residual	T	P-value
1	0.00012166	0.5803	0.562002
2	0.00013384	0.7452	0.456537
3	0.00012984	0.8101	0.418326
4	-0.00017229	-1.2102	0.226812
5	0.00015274	0.9766	0.329306
6	-0.00004481	-0.2936	0.769233
7	0.00003203	0.2290	0.818977
8	-0.00026545	-1.8879	0.059671
9	-0.00024513	-1.6302	0.103734
10	-0.00027152	-1.8301	0.067884

* Significant at 0.05 level
** Significant at 0.01 level

TABLE 6

Excess Returns, Sample 0, 1977

Mean Excess Daily Returns
(Centered on Sample Mean)

MV	Mean Excess Return	T	P-value
1	0.00084158	4.5323	0.000100**
2	0.00006923	0.4796	0.631707
3	-0.00009041	-0.7094	0.478387
4	-0.00012179	-0.9559	0.339546
5	-0.00024504	-2.3141	0.021034*
6	-0.00043808	-3.9207	0.000100**
7	-0.00037775	-3.5756	0.000380**
8	-0.00029670	-3.0737	0.002219**
9	-0.00063672	-5.5066	0.000100**
10	-0.00063987	-6.5162	0.000100**

Mean Residual Excess Daily Returns

MV	Mean Excess Residual	T	P-value
1	0.00069082	3.7202	0.000220**
2	-0.00003891	-0.2695	0.787635
3	-0.00015437	-1.2114	0.226286
4	-0.00019032	-1.4928	0.136072
5	-0.00028709	-2.7096	0.006948**
6	-0.00041348	-3.7098	0.000229**
7	-0.00032918	-3.1194	0.001908**
8	-0.00021821	-2.2634	0.023997*
9	-0.00052705	-4.5605	0.000100**
10	-0.00046679	-4.7569	0.000100**

* Significant at 0.05 level
** Significant at 0.01 level

TABLE 7

Excess Returns, Sample 0, 1978

Mean Excess Daily Returns (Centered on Sample Mean)

MV	Mean Excess Return	T	P-value
1	-0.00003392	-0.1734	0.862425
2	0.00012061	0.7270	0.467477
3	0.00012838	0.8386	0.402002
4	-0.00012541	-0.9794	0.327733
5	-0.00019499	-1.5659	0.117834
6	-0.00003353	-0.2571	0.797158
7	-0.00023656	-2.0686	0.038953*
8	-0.00021609	-2.0315	0.042587*
9	-0.00025671	-2.1913	0.028764*
10	-0.00035364	-2.9063	0.003773**

Mean Residual Excess Daily Returns

MV	Mean Excess Residual	T	P-value
1	-0.00019433	-0.9932	0.320946
2	0.00001439	0.0868	0.930876
3	0.00004670	0.3044	0.760911
4	-0.00017415	-1.3560	0.175549
5	-0.00022930	-1.8378	0.066521
6	-0.00002611	-0.1998	0.841721
7	-0.00018123	-1.5821	0.114082
8	-0.00012726	-1.1958	0.232181
9	-0.00014217	-1.2120	0.225925
10	-0.00018512	-1.5206	0.128810

* Significant at 0.05 level
** Significant at 0.01 level

TABLE 8

Excess Returns, Sample 0, 1979

Mean Excess Daily Returns
(Centered on Sample Mean)

MV	Mean Excess Return	T	P-value
1	0.00014595	0.8821	0.377996
2	0.00054443	3.3327	0.000898**
3	0.00028686	1.8177	0.069457
4	0.00025499	2.1309	0.033391*
5	-0.00003290	-0.2866	0.774509
6	-0.00011612	-0.9807	0.327034
7	-0.00005981	-0.5578	0.577144
8	-0.00024143	-2.4732	0.013587*
9	-0.00013711	-1.3883	0.165424
10	-0.00035938	-4.0082	0.000100**

Mean Residual Excess Daily Returns

MV	Mean Excess Residual	T	P-value
1	-0.00001887	-0.1140	0.909281
2	0.00042006	2.5728	0.010259*
3	0.00019684	1.2473	0.212617
4	0.00021097	1.7644	0.078035
5	-0.00005179	-0.4507	0.652286
6	-0.00010757	-0.9102	0.362996
7	-0.00001406	-0.1316	0.895300
8	-0.00013422	-1.3760	0.169191
9	-0.00002359	-0.2391	0.811068
10	-0.00019270	-2.1543	0.031499*

* Significant at 0.05 level
** Significant at 0.01 level

TABLE 9

Excess Returns, Sample 0, 1980

Mean Excess Daily Returns (Centered on Sample Mean)

MV	Mean Excess Return	T	P-value
1	0.00006098	0.3191	0.749691
2	-0.00000487	-0.0310	0.975260
3	0.00009249	0.5829	0.560078
4	-0.00001784	-0.1195	0.904914
5	0.00004364	0.3104	0.756331
6	0.00015026	1.0531	0.292591
7	0.00004169	0.2786	0.780630
8	0.00001150	0.0878	0.930058
9	0.00009474	0.7061	0.480331
10	0.00022183	1.6470	0.099916

Mean Residual Excess Daily Returns

MV	Mean Excess Residual	T	P-value
1	-0.00010318	-0.5403	0.589143
2	-0.00012908	-0.8223	0.411146
3	0.00001104	0.0695	0.944610
4	-0.00006572	-0.4409	0.659403
5	0.00002578	0.1833	0.854602
6	0.00016790	1.1758	0.240006
7	0.00008913	0.5960	0.551327
8	0.00009819	0.7506	0.453089
9	0.00022343	1.6648	0.096312
10	0.00037592	2.7902	0.005383**

* Significant at 0.05 level
** Significant at 0.01 level

TABLE 10

Excess Returns, Sample 0, 1981

Mean Excess Daily Returns
(Centered on Sample Mean)

MV	Mean Excess Return	T	P-value
1	0.00038470	2.4028	0.016468*
2	0.00013596	0.8094	0.418473
3	-0.00010360	-0.7129	0.476061
4	0.00035940	2.2490	0.024746*
5	0.00016342	1.2158	0.224368
6	0.00017714	1.2970	0.194968
7	0.00006604	0.5173	0.605050
8	0.00008161	0.7234	0.469613
9	0.00000550	0.0493	0.960693
10	-0.00031175	-2.5216	0.011851*

Mean Residual Excess Daily Returns

MV	Mean Excess Residual	T	P-value
1	0.00022464	1.4028	0.161012
2	0.00001252	0.0745	0.940640
3	-0.00019363	-1.3345	0.182363
4	0.00031673	1.9827	0.047699*
5	0.00015325	1.1385	0.255209
6	0.00018548	1.3597	0.174261
7	0.00013770	1.0776	0.281500
8	0.00015411	1.3627	0.173305
9	0.00012540	1.1237	0.261419
10	-0.00015757	-1.2740	0.202977

* Significant at 0.05 level
** Significant at 0.01 level

TABLE 11

Excess Returns, Sample 0, 1982

Mean Excess Daily Returns
(Centered on Sample Mean)

MV	Mean Excess Return	T	P-value
1	0.00059187	2.7311	0.006522**
2	0.00028342	1.2543	0.210268
3	0.00040987	2.1150	0.034892*
4	-0.00017888	-1.0161	0.310017
5	0.00006163	0.3410	0.733259
6	-0.00004536	-0.2468	0.805131
7	-0.00017803	-1.0972	0.273041
8	-0.00014843	-0.9756	0.329686
9	-0.00008867	-0.6445	0.519547
10	-0.00004343	-0.3089	0.757483

Mean Residual Excess Daily Returns

MV	Mean Excess Residual	T	P-value
1	0.00042301	1.9529	0.051357
2	0.00016093	0.7121	0.476742
3	0.00031416	1.6174	0.106375
4	-0.00022802	-1.2939	0.196262
5	0.00003901	0.2153	0.829594
6	-0.00001711	-0.0930	0.925955
7	-0.00012393	-0.7609	0.447024
8	-0.00005936	-0.3897	0.696888
9	0.00004649	0.3377	0.735750
10	0.00010583	0.7523	0.452214

* Significant at 0.05 level
** Significant at 0.01 level

regressions on this sample for the entire period are shown in Table 12. They are similar in size to the residuals found using a single regression for the entire period. The yearly mean excess daily return residuals (Tables B1 through B7, Appendix B) display the same number of significant mean excess residuals as do the yearly data for the single regression.

To investigate the possibility of two separate effects (cause 5 above), additional regressions were run. This was done by dividing the sample into two parts, the first containing January excess returns only and the second the excess returns for the remaining eleven months. The same regression was run on these two subsamples as with the basic sample. The results of these regressions are shown in Tables 13 and 14 and Figures 2 and 3. It should be noted that the excess returns in these results are centered on the means of each of these subsamples.

The results obtained are consistent with the view that there are two separate effects. When the results with January only are considered, there remains a significant small firm effect (Table 13 and Figure 2). However, when the other months are considered, the effect of the differential information proxy is to eliminate any significant small firm effect (Table 14 and Figure 3). The general tendency for negative slope noted with the

TABLE 12

Excess Returns, Sample 0, Entire Period, Yearly Regressions

Mean Monthly Excess Daily Returns (Centered about sample mean)

MV	Excess Return	T	P-value
1	0.00028994	4.0660	0.000100**
2	0.00019753	3.0040	0.002678**
3	0.00011945	1.9715	0.048723*
4	0.00004984	0.8864	0.375460
5	0.00000037	0.0070	0.994386
6	−0.00002495	−0.4663	0.641037
7	−0.00008641	−1.7151	0.086387
8	−0.00013711	−2.9965	0.002744**
9	−0.00015820	−3.3741	0.000746**
10	−0.00024997	−5.2831	0.000100**

Residual Excess Return (Yearly regressions)

MV	Residual	T	P-value
1	0.000131418	1.8425	0.065461
2	0.000081337	1.2373	0.216029
3	0.000040109	0.6620	0.507981
4	−0.000008838	−0.1572	0.875066
5	−0.000024411	−0.4661	0.641137
6	−0.000008493	−0.1589	0.873720
7	−0.000037977	−0.7548	0.450402
8	−0.000048789	−1.0673	0.285887
9	−0.000041602	−0.8891	0.373987
10	−0.000082449	−1.7469	0.080720

* Significant at the .05 level
** Significant at the .01 level

TABLE 13

Excess Returns, Sample 0, January

Mean Monthly Excess Daily Returns (Centered about sample mean)

MV	Excess Return	T	P-value
1	0.00222254	7.3811	0.000100**
2	0.00091515	3.8883	0.000119**
3	0.00037647	1.6690	0.095958
4	0.00000601	0.0305	0.975677
5	-0.00010847	-0.5586	0.576786
6	-0.00022473	-1.0178	0.309375
7	-0.00080813	-4.0137	0.000100**
8	-0.00052628	-3.3747	0.000812**
9	-0.00070580	-4.0011	0.000100**
10	-0.00078725	-4.7688	0.000100**

Residual Excess Return

MV	Residual	T	P-value
1	0.00126704	4.2287	0.000100**
2	0.00017983	0.7650	0.444765
3	-0.00012965	-0.5777	0.563795
4	-0.00029045	-1.4728	0.141639
5	-0.00026731	-1.3784	0.168871
6	-0.00016310	-0.7457	0.456286
7	-0.00051800	-2.5302	0.011784*
8	-0.00004641	-0.2957	0.767579
9	-0.00002016	-0.1138	0.909478
10	0.00013919	0.8391	0.401916

* Significant at the .05 level
** Significant at the .01 level

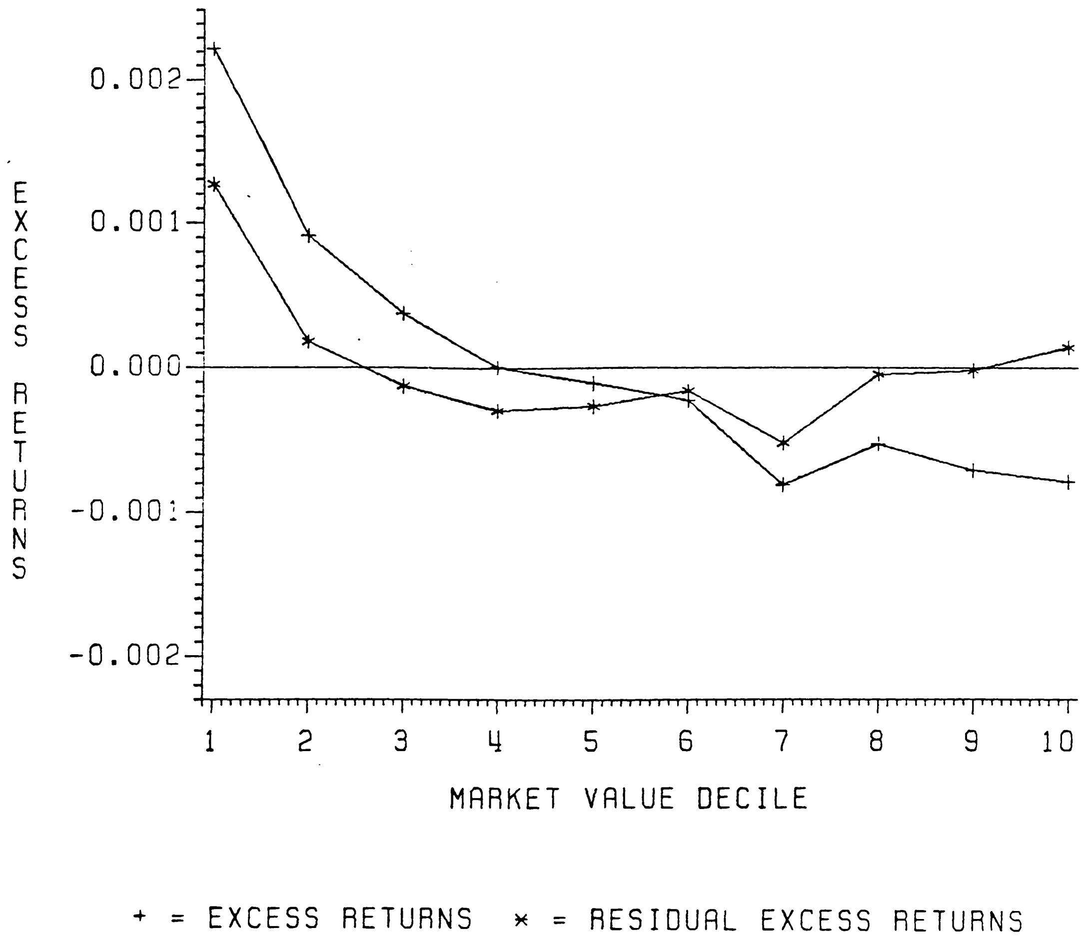

Figure 2: Excess Returns, (January Returns only), Sample 0

TABLE 14

Excess Returns, Sample 0, February-December

Mean Monthly Excess Daily Returns
(Centered about sample mean)

MV	Excess Return	T	P-value
1	0.00013649	1.8694	0.061630
2	0.00013606	1.9867	0.047017*
3	0.00009642	1.5334	0.125242
4	0.00005264	0.8982	0.369131
5	0.00001034	0.1905	0.848913
6	-0.00000484	-0.0885	0.929522
7	-0.00002053	-0.3987	0.690125
8	-0.00010074	-2.1145	0.034526*
9	-0.00010862	-2.2484	0.024600*
10	-0.00020002	-4.0727	0.000100**

Residual Excess Return

MV	Residual	T	P-value
1	0.00004240	0.5807	0.561454
2	0.00006764	0.9876	0.323414
3	0.00004791	0.7617	0.446275
4	0.00002173	0.3708	0.710779
5	-0.00000257	-0.0474	0.962178
6	0.00000455	0.0831	0.933766
7	0.00001020	0.1981	0.842960
8	-0.00005020	-1.0538	0.292032
9	-0.00003770	-0.7803	0.435274
10	-0.00010508	-2.1399	0.032420*

* Significant at the .05 level
** Significant at the .01 level

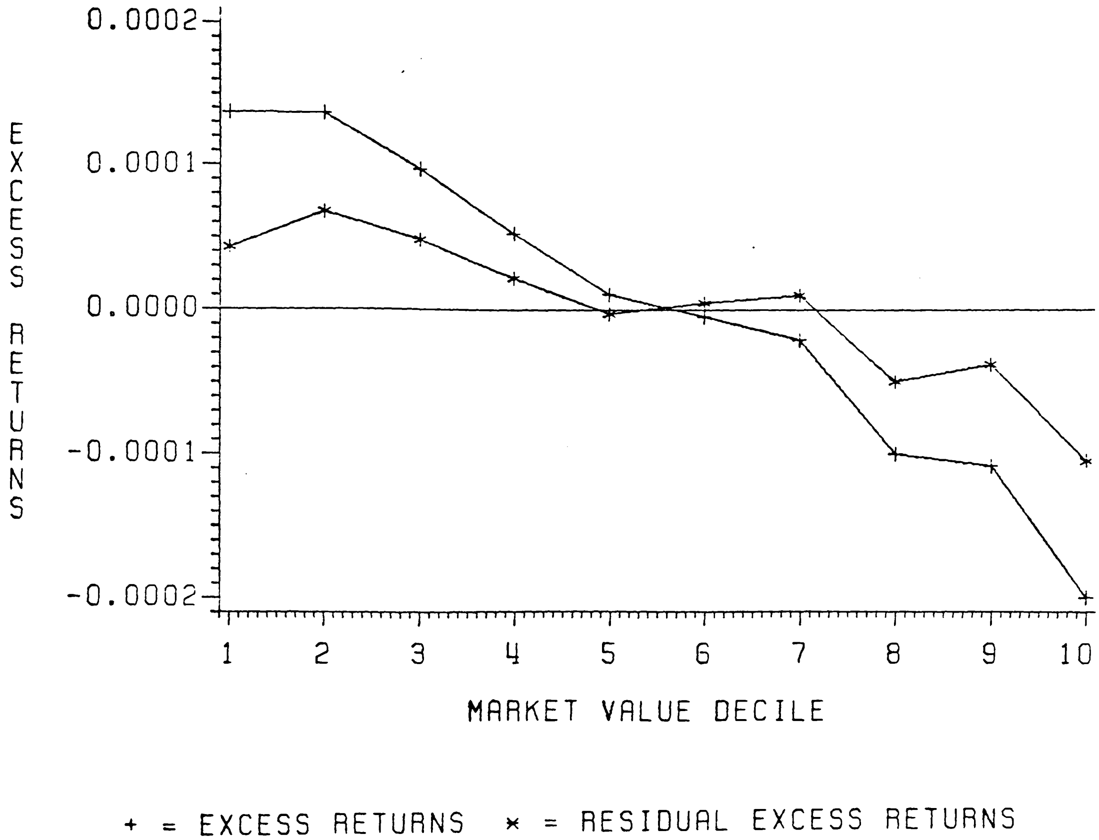

Figure 3: Excess Returns, (Feb-Dec Returns only), Sample 0

residuals in Figure 1 is also reduced when the January returns are omitted from the sample (Figure 3).

4.3 SAMPLE 1

The second sample used was all firms on the IBES tapes that met the criteria for sample 0 with the additional requirement that there be at least 3 analysts making estimates for earnings per share for the current fiscal year. The overall effect of this additional requirement was to reduce the sample size by about 20% and increase the average market value of the firms included.

The statistical information about sample 1 is summarized in Table 15. The total sample consists of 687 firms. It should be noted, again, that there were no observations for any firm in the sample for the month of January 1976. The sample period therefore is February 1976 to July 1982, inclusive.

Again, as with sample 0, the number of firms included in the sample (on a yearly basis) increases throughout the sample period, with the largest number of firms occurring in 1982. It should also be noted that the number of firms in the low market value decile, MV1, tends to be somewhat larger than the average number of firms in the larger market value deciles. This indicates that the smaller firms tend to have fewer observations per firm. This observation is consistent with small firms receiving less

Table 15

Summary statistics Sample 1

Total Firms in Sample: 687

Firms by Decile and Year

MV	1976	1977	1978	1979	1980	1981	1982
1	42	46	65	70	63	71	77
2	37	41	54	62	59	65	69
3	35	44	52	55	56	64	68
4	31	35	50	52	58	62	65
5	31	34	46	52	57	64	64
6	30	31	44	52	55	60	64
7	31	33	42	51	54	60	62
8	29	33	42	49	54	60	62
9	30	33	42	50	54	61	63
10	30	31	42	51	54	60	64
Total Firms	326	361	479	544	564	627	658
Total Obs	3264*	3774	4693	5998	6408	7137	4239**

* For 11 months (No January 1976 observations)
** Sample ended in July 1982

attention from analysts, and less information being published about them.

The firms were ranked by market values using the same procedures as with sample 0 and the resultant mean market value by decile for the entire sample are shown in Table 16. Yearly market values by decile were checked and did not differ substantially from those for the entire period.

4.3.1 EXCESS RETURNS

Mean excess daily returns were obtained and centered in the same manner as with sample 0. For this sample the sample mean excess daily return was -0.00033763. This figure is somewhat larger than the result obtained for sample 0, but is consistent with the larger market value of the firms in the sample and the tendency of larger firms to have negative excess returns (e.g. Banz 1981). The centered mean excess returns are tabulated in the top portion of Table 17 and shown graphically in Figure 4. The strongly inverse relation between market value decile and excess return is noted again, with the exception that the MV6 and MV10 deciles have larger negative returns than the MV5 and MV9 deciles respectively.

4.3.2 HETEROGENEOUS EXPECTATIONS PROXY

The ranks of the inverses of the coefficient of variation (the mean divided by the standard deviation) of anlaysts' earnings per share estimates for the current

TABLE 16

Mean Market Value by Deciles
Sample 1
Entire Period
(in millions of dollars)

MV	Mean Value
1	61.16
2	124.53
3	197.66
4	286.72
5	393.20
6	542.27
7	739.21
8	1024.91
9	1717.98
10	7365.53

TABLE 17

Excess Returns, Sample 1, Entire Period

Mean Monthly Excess Daily Returns
(Centered about sample mean)

MV	Excess Return	T	P-value
1	0.00022234	2.9679	0.003019**
2	0.00016470	2.5162	0.011907*
3	0.00010843	1.8303	0.067289
4	0.00006887	1.1799	0.238112
5	-0.00003483	-0.5747	0.565562
6	0.00000158	0.0265	0.978831
7	-0.00007338	-1.3682	0.171323
8	-0.00009527	-1.7562	0.079147
9	-0.00018067	-3.3720	0.000754**
10	-0.00017682	-3.1477	0.001659**

Residual Excess Return

MV	Residual	T	P-value
1	0.00024452	3.2647	0.001106**
2	0.00017195	2.6285	0.008613**
3	0.00011260	1.9020	0.057254
4	0.00007088	1.2142	0.224757
5	-0.00002943	-0.4856	0.627270
6	-0.00000060	-0.0100	0.991998
7	-0.00007550	-1.4089	0.158941
8	-0.00010133	-1.8681	0.061836
9	-0.00019409	-3.6230	0.000295**
10	-0.00019358	-3.4446	0.000579**

* Significant at the .05 level
** Significant at the .01 level

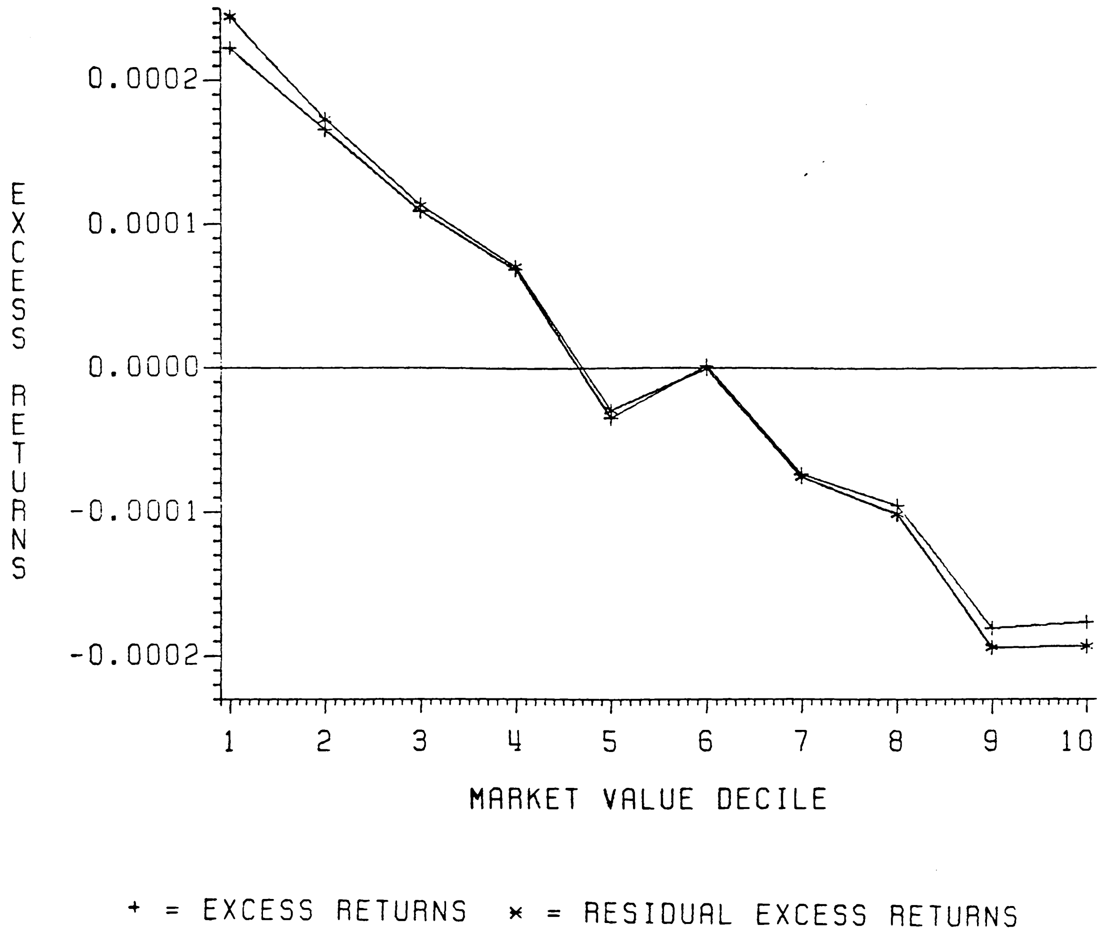

Figure 4: Excess Returns, Sample 1

fiscal year were used as the proxy for heterogeneous expectations for this sample. This proxy is analogous to the proxy used by Cragg and Malkiel (1982). They used the variance of estimated long term growth rates, which is a relative measure of the expectations of the analysts. The proxy used in this study is the inverse of a relative measure of variability of analysts' forecasts, but uses short term forecasts rather than long term forecasts.

The inverses of the coefficient of variation were ranked from 1 to 100 on a monthly basis. These ranks were used directly as the proxy in the regressions. It should be noted that the larger the rank, the less divergent the estimates with the implication that there is less difference in investors' expectations. Because of the inverse relationship used, the coefficient of the slope term in the regression is hypothesized to be negative.

4.3.3 REGRESSIONS

Regressions were run, using both the entire sample and on a yearly basis, as with sample 0. Results for the sample as a whole resulted in an intercept estimate of -0.000451365 with a t value of -11.825 and the corresponding p-value of 0.0001. The slope estimate was 0.0000225346 with a t-value of 3.431 and p-value of 0.0006. The negative sign of the intercept estimate is not, in itself, surprising given the large negative sample mean excess daily return and the results with sample 0. The magnitude of the intercept and the statistical significance are both large however. This indicates that the intercept is significantly different from that estimated with sample 0.

The slope, however, is of the opposite sign from the hypothesized sign. This implies that the effect of heterogeneous expectations would be the opposite of the theoretical and hypothesized effect. There are two possible causes for these results. The first is that the theory and hypothesis are incorrect. The second is that the proxy chosen is not suitable for the purpose intended. It is considered that the second of these causes is more probable for reasons that will be discussed in the concluding section of this chapter, Section 4.4.

On a yearly basis, the intercept estimates were all negative in sign and significant (at the .05 level) in 6 of the 7 sample years. The slope estimates were of mixed signs (3 negative and 4 positive) and are shown in Table 18. The slope estimates were significant (at the 0.05 level) in all but one year which had a negative estimate. These results are not consistent with the basic hypothesis and theory. As with the intercept, the proxy chosen is believed to be the cause of these results for reasons discussed below.

TABLE 18

SAMPLE 1
Slope Regression Coefficients
(Yearly regressions)

Year	Slope	T	P-value
1976	-.0000064796	-3.292	0.0010**
1977	0.0000034932	2.281	0.0226*
1978	-.0000014743	-0.909	0.3635
1979	-.0000030528	-2.116	0.0344*
1980	0.0000048615	2.758	0.0058**
1981	0.0000047971	3.037	0.0024**
1982	0.0000114995	5.399	0.0001**

Intercepts

Year	Intercept	T	P-value
1976	-0.0000793813	-0.694	0.4877
1977	-0.000807854	-9.078	0.0001**
1978	-0.000321497	-3.412	0.0007**
1979	-0.000254123	-3.031	0.0025**
1980	-0.00048841	-4.768	0.0001**
1981	-0.000435955	-4.747	0.0001**
1982	-0.000820677	-6.627	0.0001**

* Significant at the .05 level
** Significant at the .01 level

4.3.4 ANALYSIS OF THE RESIDUALS

The residual mean excess daily excess returns from the single regression over the entire sample period show only slight differences from the mean excess daily returns (Table 16 and Figure 4). This slight difference is consistent with the weak relationship found between the proxy and the mean excess daily returns.

Analysis of the residuals on a yearly basis also indicates that the results are generally consistent with weak significance of the individual regressions.

4.4 SUMMARY AND CONCLUDING COMMENTS

The summary and comments will be separated by the sample and proxy used because of the widely differing results obtained with two samples.

4.4.1 SAMPLE O

The results using the rank of the number of analysts making estimates as a proxy for differential information are in agreement with the theoretical and hypothesized relationship. For this sample and period, the absence of significant residual mean excess daily returns indicates that the cross-sectional differences in excess returns between firms of differing market value can be largely explained by the difference in perceived risk resulting from differential information.

When the sample was tested separating the effect of

January returns from the other months, the evidence supports the view that what has been called the small firm effect is in fact two separate anamolies. For the subsample excluding January, there remained little evidence of the small firm effect when the effects of differential information were incorporated. For January returns only, however, there remained significant evidence of a small firm effect for January.

4.4.2 SAMPLE 1

For the second sample and proxy, the results are not consistent with the hypothesized relationships. There are a number of possible reasons for these results discussed below. While the results with sample 0 support the theory and yield significant results, the results with this sample do not. The conflicting results obtained using sample 1 are believed to be caused by the proxy and the sample used.

The proxy chosen for heterogeneous expectations is considered the most probable cause for the observed results. The following factors are considered to be important concerning the proxy chosen. First, the fact that a minimum of three estimates were used to determine the proxy may have eliminated a large portion of the difference in expectations, since the relative difference between 1 and 3 analysts may be larger than the difference between 3 and 10, for example. The result may be that the rankings and the inverses do not bear a consistent relationship with the differences in expectations. Second, Cragg and Malkiel (1982) found that forecasts of earnings per share for the current year were not reliable predictors of stock prices, which are a major portion of the return on a stock. Third, the hypothesized difficulty in estimating earning for small firms may not exist. It is plausible that information may be more accurate for the smaller firms and that the estimates may not be more divergent than for larger firms. Fourth, there may be a tendency for analysts to make their estimates conform with the estimates of other analysts (i.e. a "herd" tendency). Such a tendency would clearly increase the inverse of the coefficient of variation and its rank, which was used as the proxy.

The choice of the rank of the inverse coefficient of variation of the current year earnings per share appears to have been a poor choice as a proxy. The choice was dictated by the information available for this study, since the variance of the long term growth rate forecasts was not available on the IBES tape used. Based on the theoretical work by Barry and Brown (1983) and the empirical study of Cragg and Malkiel (1982), the variance of analysts' forecasts for longer term factors, such as long term growth rates, should not be ruled out as factors that may be suitable proxies for differing expectations of investors.

Regarding the second sample, the fact that the market value of the small market value deciles in this sample are larger than in the first sample must be considered. The MV1 decile mean market value in sample 1 is larger than the mean market value of decile MV2 in sample 0. Previous studies by Banz (1978, 1981), Reinganum (1981a), and others dealing with the small firm effect have shown consistently that the smaller market value firms have the positive excess returns that are significant. For this sample (and sample 0 as well) the MV1 deciles have mean excess daily returns (uncentered) that are not significantly different from zero. This is consistent with the fact that the firms used in this study are of larger mean market value than used in many previous studies. The difference in excess returns thus has been truncated in comparison with samples used by others. While the observed mean excess returns have the size tendencies noted by others, the range of market values is higher, and thus probably more difficult to detect. The size of the samples used permitted detection of a size effect, but the range of differences in excess returns is expected to be smaller. Since the firms in the sample are "larger" firms, the differences between the extreme deciles would logically be smaller. This would make the detection of the effects of heterogeneous expectations more difficult.

In conclusion, the results of the tests with sample 0 provide strong support for the differential information effect theorized by Barry and Brown (1983). The failure of the tests using sample 1 to support the use of expectations as an explanatory variable are attributed primarily to the choice of the proxy used, and to some degree to the sample used.

Chapter V

CONCLUSIONS

This study has been a test of the differential information theory of Barry and Brown (1983) applied to the small firm effect. The principal effects studied have been:

1. Empirical tests to determine if the theoretical effects of differential information are observed with actual data.

2. Application of the theory to the small firm effect to determine if differential information is the explanation for this anamoly.

3. The suitability of a proxy for heterogeneous expectations as an explanatory factor for the small firm effect.

The results of the study are detailed in Chapter four of this study and may be summarized briefly as follows:

1. The tests provided empirical evidence that is consistent with the theory of Barry and Brown (1983) when a suitable proxy for differential information is used.

2. For the sample studied, the differential information effect on perceived risk by investors largely explained the small firm effect, when a suitable proxy was used.

3. Evidence was found that the small firm effect is composed of two parts supporting the findings of Keim (1983). One is a January effect, and the other during the remainder of the year.

4. The proxy chosen to represent heterogeneous expectations must be selected with care. In this

> study the one selected did not prove suitable. Reasons are provided which indicate that the proxy chosen was the principal cause of the failure of these tests to support the theory.

This study has contributed to the knowledge of effects of differential information and the heterogeneous beliefs of investors. It has also contributed to the understanding of the small firm effect.

5.1 LIMITATIONS OF THE STUDY

As with most empirical studies, this study is subject to a number of limitations. First, a major limitation of the study is the fact that firms included in the sample were limited to larger market value firms which are of institutional interest. This makes the study of limited value when considering the validity of the differential information effect as an explanation of the small firm effect. The exclusion of smaller firms makes any claim that differential information explains the small firm effect tenuous at best.

A second limitation is the fact that the sample studied covers a relatively short time period. While the results are known for this period, the persistence of the differential information effect over longer periods with varying market conditions should be studied.

A third limitation is the fact that only one of many potential proxies for differential information and one for heterogeneous expectations were used. There are many other proxies that may, in fact, be better proxies for these purposes.

5.2 RECOMMENDATIONS FOR FURTHER RESEARCH

The effects of differential information and its explanatory power for the small firm effect and other empirical anamolies should be continued and extended in the following areas.

The choice of the proxy chosen to represent differential information should be expanded by the investigation of other possible proxies suggested by Barry and Brown (1983) or others considered plausible by the investigator. These proxies should include ones which are available for firms of smaller size than the firms in the present study.

The time frame for the sample studied should be extended to include more diverse market and economic conditions.

Samples studied should include a greater differences in firm size and/or differential information to further test the significance of the differential information effect and its relationship with the small firm effect.

Last, but not least, the explanatory power of the differential information effect with respect to other empirical anamolies should be investigated. In particular, the relationship with the P/E effect found by Basu (1977) should be investigated.

APPENDIX A

EXCESS RETURNS (NOT CENTERED), SAMPLE O

TABLE A1

SAMPLE O
1976
Mean Excess Daily Returns
(Not centered)

MV	Mean Excess Return	T	P-value
1	-0.00000503	-0.0240	0.980882
2	-0.00004235	-0.2360	0.813563
3	-0.00007943	-0.4947	0.621070
4	-0.00036336	-2.5539	0.010977*
5	-0.00010669	-0.6816	0.495853
6	-0.00035119	-2.3055	0.021587*
7	-0.00028114	-2.0090	0.045115*
8	-0.00061997	-4.3978	0.000100**
9	-0.00065350	-4.3414	0.000100**
10	-0.00072760	-4.9037	0.000100**

* Significant at the .05 level
** Significant at the .01 level

TABLE A2

SAMPLE 0
1977
Mean Excess Daily Returns
(Not centered)

MV	Mean Excess Return	T	P-value
1	0.00056117	3.0222	0.002627**
2	-0.00021118	-1.4629	0.144063
3	-0.00037082	-2.9096	0.003767**
4	-0.00040219	-3.1569	0.001684**
5	-0.00052544	-4.9621	0.000100**
6	-0.00071848	-6.4303	0.000100**
7	-0.00065815	-6.2297	0.000100**
8	-0.00057711	-5.9786	0.000100**
9	-0.00091713	-7.9317	0.000100**
10	-0.00092027	-9.3718	0.000100**

* Significant at the .05 level
** Significant at the .01 level

TABLE A3

SAMPLE 0
1978
Mean Excess Daily Returns
(Not centered)

MV	Mean Excess Return	T	P-value
1	-0.00031433	-1.6064	0.108651
2	-0.00015980	-0.9632	0.335775
3	-0.00015203	-0.9930	0.321056
4	-0.00040582	-3.1692	0.001595**
5	-0.00047540	-3.8177	0.000147**
6	-0.00031394	-2.4074	0.016326*
7	-0.00051697	-4.5207	0.000100**
8	-0.00049649	-4.6676	0.000100**
9	-0.00053712	-4.5849	0.000100**
10	-0.00063405	-5.2108	0.000100**

* Significant at the .05 level
** Significant at the .01 level

TABLE A4

SAMPLE 0
1979
Mean Excess Daily Returns
(Not centered)

MV	Mean Excess Return	T	P-value
1	-0.00013446	-0.8126	0.416675
2	0.00026402	1.6162	0.106423
3	0.00000645	0.0409	0.967412
4	-0.00002542	-0.2124	0.831848
5	-0.00031331	-2.7289	0.006486**
6	-0.00039653	-3.3488	0.000848**
7	-0.00034022	-3.1728	0.001564**
8	-0.00052184	-5.3457	0.000100**
9	-0.00041752	-4.2274	0.000100**
10	-0.00063979	-7.1355	0.000100**

* Significant at the .05 level
** Significant at the .01 level

TABLE A5

SAMPLE 0
1980
Mean Excess Daily Returns
(Not centered)

MV	Mean Excess Return	T	P-value
1	-0.00021943	-1.1485	0.251069
2	-0.00028528	-1.8171	0.069547
3	-0.00018792	-1.1844	0.236575
4	-0.00029825	-1.9974	0.046093*
5	-0.00023677	-1.6842	0.092494
6	-0.00013014	-0.9121	0.361969
7	-0.00023872	-1.5951	0.111051
8	-0.00026891	-2.0534	0.040328*
9	-0.00018566	-1.3836	0.166825
10	-0.00005858	-0.4349	0.663735

* Significant at the .05 level
** Significant at the .01 level

TABLE A6

SAMPLE 0
1981
Mean Excess Daily Returns
(Not centered)

MV	Mean Excess Return	T	P-value
1	0.00010429	0.6514	0.514960
2	-0.00014444	-0.8599	0.390053
3	-0.00038401	-2.6426	0.008368**
4	0.00007899	0.4943	0.621215
5	-0.00011698	-0.8703	0.384349
6	-0.00010327	-0.7561	0.449796
7	-0.00021437	-1.6793	0.093433
8	-0.00019880	-1.7622	0.078378
9	-0.00027491	-2.4656	0.013862*
10	-0.00059216	-4.7896	0.000100**

* Significant at the .05 level
** Significant at the .01 level

TABLE A7

SAMPLE 0
1982
Mean Excess Daily Returns
(Not centered)

MV	Mean Excess Return	T	P-value
1	0.00031146	1.4372	0.151254
2	0.00000302	0.0133	0.989354
3	0.00012946	0.6680	0.504399
4	-0.00045929	-2.6090	0.009332**
5	-0.00021878	-1.2104	0.226674
6	-0.00032576	-1.7729	0.076819
7	-0.00045844	-2.8254	0.004899**
8	-0.00042884	-2.8187	0.004998**
9	-0.00036907	-2.6826	0.007533**
10	-0.00032384	-2.3037	0.021617*

* Significant at the .05 level
** Significant at the .01 level

APPENDIX B

EXCESS RETURNS (YEARLY REGRESSIONS), SAMPLE 0

TABLE B1

SAMPLE 0
1976
Residual Excess Returns

(Yearly regressions)

MV	Mean Excess Return	T	P-value
1	0.00012166	0.5803	0.562002
2	0.00013384	0.7452	0.456537
3	0.00012984	0.8101	0.418326
4	-0.00017229	-1.2102	0.226812
5	0.00015274	0.9766	0.329306
6	-0.00004481	-0.2936	0.769233
7	0.00003203	0.2290	0.818977
8	-0.00026545	-1.8879	0.059671
9	-0.00024513	-1.6302	0.103734
10	-0.00027152	-1.8301	0.067884

* Significant at the .05 level
** Significant at the .01 level

TABLE B2

SAMPLE 0
1977
Residual Excess Returns

(Yearly regressions)

MV	Mean Excess Return	T	P-value
1	0.00069082	3.7202	0.000220**
2	-0.00003891	-0.2695	0.787635
3	-0.00015437	-1.2114	0.226286
4	-0.00019032	-1.4928	0.136072
5	-0.00028709	-2.7096	0.006948**
6	-0.00041348	-3.7098	0.000229**
7	-0.00032918	-3.1194	0.001908**
8	-0.00021821	-2.2634	0.023997*
9	-0.00052705	-4.5605	0.000100**
10	-0.00046679	-4.7569	0.000100**

* Significant at the .05 level
** Significant at the .01 level

TABLE B3

SAMPLE O
1978
Residual Excess Returns

(Yearly regressions)

MV	Mean Excess Return	T	P-value
1	-0.00019433	-0.9932	0.320946
2	0.00001439	0.0868	0.930876
3	0.00004670	0.3044	0.760911
4	-0.00017415	-1.3560	0.175549
5	-0.00022930	-1.8378	0.066521
6	-0.00002611	-0.1998	0.841721
7	-0.00018123	-1.5821	0.114082
8	-0.00012726	-1.1958	0.232181
9	-0.00014217	-1.2120	0.225925
10	-0.00018512	-1.5206	0.128810

* Significant at the .05 level
** Significant at the .01 level

TABLE B4

SAMPLE 0
1979
Residual Excess Returns

(Yearly regressions)

MV	Mean Excess Return	T	P-value
1	-0.00001887	-0.1140	0.909281
2	0.00042006	2.5728	0.010259*
3	0.00019684	1.2473	0.212617
4	0.00021097	1.7644	0.078035
5	-0.00005179	-0.4507	0.652286
6	-0.00010757	-0.9102	0.362996
7	-0.00001406	-0.1316	0.895300
8	-0.00013422	-1.3760	0.169191
9	-0.00002359	-0.2391	0.811068
10	-0.00019270	-2.1543	0.031499*

* Significant at the .05 level
** Significant at the .01 level

TABLE B5

SAMPLE 0
1980
Residual Excess Returns

(Yearly regressions)

MV	Mean Excess Return	T	P-value
1	-0.00010318	-0.5403	0.589143
2	-0.00012908	-0.8223	0.411146
3	0.00001104	0.0695	0.944610
4	-0.00006572	-0.4409	0.659403
5	0.00002578	0.1833	0.854602
6	0.00016790	1.1758	0.240006
7	0.00008913	0.5960	0.551327
8	0.00009819	0.7506	0.453089
9	0.00022343	1.6648	0.096312
10	0.00037592	2.7902	0.005383**

* Significant at the .05 level
** Significant at the .01 level

TABLE B6

SAMPLE 0
1981
Residual Excess Returns

(Yearly regressions)

MV	Mean Excess Return	T	P-value
1	0.00022464	1.4028	0.161012
2	0.00001252	0.0745	0.940640
3	-0.00019363	-1.3345	0.182363
4	0.00031673	1.9827	0.047699*
5	0.00015325	1.1385	0.255209
6	0.00018548	1.3597	0.174261
7	0.00013770	1.0776	0.281500
8	0.00015411	1.3627	0.173305
9	0.00012540	1.1237	0.261419
10	-0.00015757	-1.2740	0.202977

* Significant at the .05 level
** Significant at the .01 level

TABLE B7

SAMPLE 0
1982
Residual Excess Returns

(Yearly regressions)

MV	Mean Excess Return	T	P-value
1	0.00042301	1.9529	0.051357
2	0.00016093	0.7121	0.476742
3	0.00031416	1.6174	0.106375
4	-0.00022802	-1.2939	0.196262
5	0.00003901	0.2153	0.829594
6	-0.00001711	-0.0930	0.925955
7	-0.00012393	-0.7609	0.447024
8	-0.00005936	-0.3897	0.696888
9	0.00004649	0.3377	0.735750
10	0.00010583	0.7523	0.452214

* Significant at the .05 level
** Significant at the .01 level

BIBLIOGRAPHY

Arbel, Avner, S. Carvell and P. Strebel. "Giraffes, Institutions and Neglected Firms" Financial Analysts Journal 9 (May-June 1983) 57-63.

Arbel, Avner and P. Strebel. "The Neglected and Small Firm Effects" The Financial Review 17 (1982) 201-218.

Arbel, Avner and P. Strebel. "Pay Attention to Neglected Firms!" The Journal of Portfolio Management 39 (Winter 1983) 37-42.

Ball, R. "Anomalies in Relationships Between Securities' Yields and Yield-surrogates." Journal of Financial Economics 6 (June-Sept 1978) 103-126.

Barry, Christopher B. and S. J. Brown. "Differential Information and Security Market Equilibrium" Working Paper 83-904 Edwin L. Cox School of Business, Southern Methodist University, Dallas, Texas (1983).

Barry, Christopher B. and S. J. Brown. "Differential Information and the Small Firm Effect" Working Paper 83-204 Edwin L. Cox School of Business, Southern Methodist University, Dallas, Texas (1983a)

Bart, John, and I. J. Masse. "Divergence of Opinion and Risk." Journal of Financial and Quantitative Analysis 16 (March 1981) 23-34.

Banz, Rolf. "Limited Diversification and Market Equilibrium: An Empirical Analysis". PhD. Dissertation, University of Chicago, Chicago, Illinois (1978).

Banz, Rolf. "The Relationship Between Return and Market Value of Common Stocks." Journal of Financial Economics 9 (March 1981): 3-18.

Basu, S. "Investment Performance of Common Stocks in Relation to Their Price-Earnings Ratios: A Test of Market Efficiency." Journal of Finance 32 (June 1977) 663-682.

Basu, Sanjoy. "The Relationship Between Earnings' Yield, Market Value and Return for NYSE Common Stocks: Further Evidence" _Journal of Financial Economics_ 12 (1983) 129-156.

Berges, Angel, J. McConnell, and G. Schlarbaum. "An Investigation of the turn-of-the-year Effect, the Small Firm Effect, and the Tax-loss-selling-pressure Hypothesis in Canadian Stock Returns" Manuscript Purdue University, West Lafayette, In. (1982).

Black, Fischer. "Capital Market Equilibrium with Restricted Borrowing" _Journal of Business_ 45 (July 1972) 444-454.

Black, Fischer and M. Scholes. "The Effects of Dividend Yeild and Dividend Policy on Common Stock Prices and Returns" _Journal of Financial Economics_ 1 (May 1974) 1-22.

Black, Fisher, Michael C. Jensen, and Myron Scholes. "The Capital Asset Pricing Model: Some Empirical Tests." in _Studies in the Theories of Capital Markets_. Michael C. Jensen (editor). Praeger, New York (1972).

Blume, M. E. and R. F. Stambaugh. "Biases in Computed Returns: An Application to the Size Effect." _Journal of Financial Economics_, 12 (November 1983) 387-404.

Brown, Philip, A. W. Kleidon, and T. A. Marsh. "New Evidence on the Nature of Size-related Anomalies in Stock Prices" _Journal of Financial Economics_ 12 (1983) 33-56.

Brown, Philip, D. B. Keim, A. W. Kleidon, and T. A. Marsh. "Stock Return Seasonalities and the Tax-loss Selling Hypothesis: Analysis of the Arguments and Australian Evidence" _Journal of Financial Economics_ 12 (1983) 105-127.

Chan, K. C., N. Chen, and D. Hsieh. "An Exploratory Investigation of the Firm Size Effect" Working Paper 99 Graduate School of Business University of Chicago (July 1983).

Chen, N., R. Roll and S. Ross. "Economic Forces and the Stock Market" Manuscript, Yale University, New Haven Ct. (1983).

Constantinides, George M. "Optimal Stock Trading with Personal Taxes: Implications for Prices and the Abnormal January Returns" Working Paper 75, Graduate School of Business, University of Chicago, (June 1983).

Cragg, John G. and B. Malkiel. Expectations and the Valuation of Shares The Univeristy of Chicago Press, Chicago, Ill. (1982).

Dimson, Elroy. "Risk Measurement When Shares are Subject to Infrequent Trading" Journal of Financial Economics 7 (1979) 197-226.

Dyl, Edward A. "Capital Gains Taxation and Year-end Stock Market Behavior" Journal of Finance 32 (March 1977) 165-175.

Elton, E. J., M. J. Gruber and M. N. Gultekin. "Capital Market Efficiency and Expectational Data." Unpublished manuscript New York University, N. Y. (May 1979).

Fama, Eugene F and J. D. MacBeth. "Risk, Return and Equilibrium: Some Empirical Tests" Journal of Political Economy 71 (1973) 607-636.

French, Kenneth R. "Stock Returns and the Weekend Effect." Journal of Financial Economics, 8 (1980) 55-70.

Friend, Irwin, R. Westerfield and M. Granito. "New Evidence on the Capital Asset Pricing Model." Journal of Finance 33 (June 1978) 903-920.

Gibbons, Mustafa N. and P. J. Hess. "Day of the Week Effects and Asset Returns." Journal of Business, 54 (1981) 579-596.

Givoly, Dan and A. Ovadia. "Year-End Tax Induced Sales and Stock Market Seasonality" Journal of Finance 37 (1983) 171-185.

Givoly, Dan, Kumar, R., Mandelker, G. N., and Rhee, S. G. "The Small Firm Effect: Some Evidence on the Price-level Factor." Working Paper University of Pittsburgh, Pittsburgh, Pennsylvania (July 1983).

Gonedes, Nicholas J. "Capital Market Equilibrium for a Class of Heterogeneous Expectations in a Two-parameter World" Journal of Finance 31 (March 1976) 1-15.

Jarrow, Robert. "Heterogeneous Expectations, Restrictions on Short Sales, and Equilibrium Asset Prices." Journal of Finance 35 (December 1980) 1105-1113.

Joy, C. M., R. H. Litzenberger, and R. W. McEnally. "The Adjustment of Stock Prices to Announcements of Unanticipated Changes in Quarterly Earnings." Journal of Accounting Research 15 (Autumn 1977) 207-225.

Keim, Donald B. "Size Related Anomalies and Stock Return Seasonality: Further Empirical Evidence" Journal of Financial Economics 12 (1983) 13-32.

King, Benjamin F. "Market and Industry Factors in Stock Price Behavior." Journal of Business 39 (January 1966) 139-190.

Klein, Roger W. and V. S. Bawa. "The Effect of Estimation Risk on Optimal Portfolio Choice" Journal of Financial Economics 3 (June 1976) 215-231.

Klein, Roger W. and V. S. Bawa. "The Effect of Limited Information and Estimation Risk on Optimal Portfolio Diversification" Journal of Financial Economics 5 (August 1977) 89-111.

Latane, H. A., and C. P. Jones. "Standardized Unexpected Earnings - 1971-77." Journal of Finance 34 (June 1979) 717-724.

Lintner, John. "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets." Review of Economics and Statistics 47 (February 1965) 13-37.

Lintner, John. "The Aggregation of Investor's Diverse Judgements and Preferences in Purely Competitive Security Markets" Journal of Financial and Quantitative Analysis 4 (December 1969) 347-400.

Little, I. M. D. "Higgledy Piggledy Growth." Oxford Institute of Statistics Bulletin 24 (November 1962) 387-412.

Malkiel, Burton and J. G. Cragg. "Expectations and the Structure of Share Prices." American Economic Review 60 (Sept. 1970) 601-617.

Malkiel, Burton and J. G. Cragg. "Expectations and the Valuation of Shares" Working Paper 471 National Bureau of Economic Research (April 1980).

Malkiel, Burton. "Risk and Return: A New Look." Princeton, New Jersey. Address to National Bureau of Economic Research and Princeton University. (April 1981)

Miller, Edward M. "Risk, Uncertainty, and Divergence of Opinion." Journal of Finance 32 (Sept. 1977) 1151-1168.

Mossin, J. "Equilibrium in a Capital Asset Market." Econometrica. 34 (1966): 768-783.

Mossin, J. Theory of Financial Markets. Prentice-Hall, Englewood Cliffs, New Jersey (1973).

Muth, John F. "Rational Expectations and the Theory of Price Movements." Econometrica 29 (July 1961) 315-335.

Peterson, David and P. Peterson. "The Effect of Changing Expectations upon Stock Returns" Journal of Financial and Quantitative Analysis 17 (1982) 799-813.

Reinganum, Marc R. "Misspecification of Capital Asset Pricing: Empirical anomalies Based on Earnings, Yields and Market Values" Journal of Financial Economics 9 (1981a) 19-46.

Reinganum, Marc R. "Empirical Tests of Multi-factor Pricing Model The Arbitrage Pricing Theory: Some Empirical Results." Journal of Finance 36 (May 1981) 313-321.

Reinganum, Marc R. "A Direct Test of Roll's Conjecture on the Firm Size Effect." Journal of Finance. 37 (March 1982) 27-35.

Reinganum, Marc R. "The Anomalous Stock Market Behavior of Small Firms in January: Empirical Tests for Tax-loss Selling Effects" Journal of Financial Economics 12 (1983) 89-104.

Roll, Richard. "A Critique of the Asset Pricing Theory's Tests: Part I: On Past and Potential Testability of the Theory," Journal of Financial Economics, 4 (March 1977) 129-176.

Roll, Richard. "A Possible Explanation of the Small Firm Effect." Journal of Finance, 9 (September 1981) 879-888.

Roll, Richard. "Vas ist das? The Turn-of-the-year Effect and the Return Premia of Small Firms" The Journal of Portfolio Management, 9 (Winter 1983) 18-28.

Roll, Richard. "On Computing Mean Returns and the Small Firm Premium." Journal of Financial Economics, 12 (November 1983a) 371-386.

Ross, S. A. "The Arbitrage Theory of Capital Asset Pricing." Journal of Economic Theory 13 (December 1976) 341-360.

Rozeff, M. S. and W. R. Kinney Jr. "Capital Market Seasonality: The Case of Stock Returns" Journal of Financial Economics 3 (1976) 379-402.

Scholes, Myron and J. Williams. "Estimating Betas from Nonsynchronous Data" Journal of Financial Economics 5 (1977) 309-327.

Schultz, Paul. "Transaction Costs and the Small Firm Effect: A Comment" Journal of Financial Economics 12 (1983) 81-88.

Schwert, G. William. "Size and Stock Returns, and Other Empirical Regularities" Journal of Financial Economics 12 (1983) 3-12.

Seligman, Daniel. "Can You Beat the Stock Market?" Fortune 108 (December 26, 1983) 82-96.

Sharpe, William F. "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk." Journal of Finance. 19 (September 1964) 425-442.

Stigler, George J. "The Economics of Information" The Journal of Political Economy 69 (June 1961) 213-225.

Stoll, Hans R. and R. E. Whaley. "Transaction Costs and the Small Firm Effect" Journal of Financial Economics 12 (1983) 57-79.

Theil, Henri. Applied Economic Forecasting North Holland Publishing Company, Amsterdam (1966).

Williams, Joseph T. "Capital Asset Prices with Heterogeneous Beliefs." Journal of Financial Economics 5 (November 1977) 219-239.

The vita has been removed from the scanned document