MARKET REACTION TO RESERVE RECOGNITION ACCOUNTING

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PREFACE

This study is concerned with the stock price reaction to disclosures of Reserve Recognition Accounting (RRA). The primary objective is to determine whether abnormal stock price behavior occurred contemporaneously with RRA disclosures. The secondary objective is to assess the various market-study methodologies with regard to their applicability in industry-specific analyses of reaction to subjective data.

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CHAPTER I

THE RESEARCH PROBLEM

Introduction

On August 31, 1978, the Securities and Exchange Commission (SEC) issued Accounting Series Release (ASR) No. 253 entitled "Adoption of Requirements for Financial Accounting and Reporting Practices for Oil and Gas Producing Activities." The release promulgates certain valuation and income-measurement rules heretofore avoided by accountants due to an unacceptable degree of subjectivity inherent in the procedures.

Reserve Recognition Accounting (RRA), as ASR No. 253 has come to be called, requires the reporting of, among other things, (i) cash flow and value of transfers ("net revenue") from estimated future production of proved oil and gas reserves, calculated on the basis of current economic conditions, and (ii) present value of net revenue from estimated future production of proved oil and gas reserves using a 10 percent discount rate.[1] The use of a mandatory 10 percent discount rate and the use of current price instead of estimated future prices are attempts by the SEC to ensure some degree of objectivity. However, valuation which is subjective in nature is required when estimating the rate and quantities of future production of "proved" reserves.

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[1]For detailed discussions of the reporting requirements, see Adkerson (1979), Conner (1979), and Fraser (1975).

The accounting literature is replete with arguments concerned with the inability of accounting procedures to produce information which is sufficiently reliable and relevant. Usually, one characteristic is achieved at the expense of the other. Should accountants strive for relevance and accept a high degree of subjectivity, or should objectivity be of primary concern?

At least two major studies have been conducted regarding the level of subjectivity of RRA numbers. These studies consistently conclude that RRA numbers are materially imprecise. The studies reveal that, in a predominant number of instances, revisions to initial RRA estimates are extremely large. An inadequacy of these studies is that the characteristic of relevance is ignored. The fact that an initial estimate of a future outcome is not very close to the related actual result does not preclude the initial estimate from being the most relevant measure at the time it is made. If RRA valuations are perceived by market agents as more relevant than historical cost valuations, then the high degree of subjectivity inherent in the RRA numbers will not necessarily prevent the market from using them. On the other hand, it can be argued that as the degree of subjectivity increases, a point may be reached where relevance is jeopardized. The numbers may become so unreliable that they are no longer relevant.

This study provides evidence regarding the market's assessment of the relevance of RRA numbers. Specifically, two distinct mandated disclosures were evaluated:[2]

Signal Event I: The initial RRA data disclosed in a footnote to the 1978 10-K, and

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[2]Foster (1980) and Beaver, Christie and Griffen (1980) discuss the differences between market reaction to (i) accounting policy decisions and (ii) mandated disclosures.

Signal Event II: The RRA supplemental earnings statement filed in the 1979 10-K (the second filing).

The remainder of Chapter I presents background information on the degree of reliability of Reserve Recognition Accounting. A brief history of the objectivity vs. relevance debate is also given. Chapter II discusses the sample selection techniques and statistical methodology employed. An important consideration when performing statistical analyses on individual firm disclosures is the level of aggregation of the measures being judged. The timing of price reactions to RRA data may warrant the use of individual-firm analysis vis-a-vis aggregate sample analysis. Chapter III presents the findings of the various tests and plottings followed by a summary and concluding remarks in Chapter IV. Limitations and suggested future research are also discussed in Chapter IV.

Reserve Recognition Accounting--
Reliability vs. Relevance

In an effort to determine theoretically sound income-measurement rules, the accounting profession has emphasized the need for both relevance and reliability. The AAA Committee to Prepare a Statement of Basic Accounting Theory (AAA ASOBAT, 1966) chose relevance as the primary standard for accounting information. The other three standards chosen by the committee--verifiability, freedom from bias, and quantifiability--are implicit in the notion of reliability.[3]

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[3]Feltham (1972, p. 27) states that "the most relevant information may be the least verifiable."

Alexander (1977)[4] suggests:

> To the extent that the accountant can eliminate guesses, he is substituting something else for income. That something else will be a good approximation to income in a fairly static situation when prices and business prospects are not changing very much; in a dynamic situation when prices and business prospects are fluctuating violently, the approximation will be a poor one (p. 39).

The FASB, in "Statement of Financial Accounting Concepts No. 2" (1980), recognizes the trade-off between reliability and relevance of accounting information:

> The qualities that distinguish 'better' (more useful) information from 'inferior' (less useful) information are primarily the qualities of relevance and reliability, with some other characteristics that those qualities imply . . . (para. 15).
>
> It may be possible to trade relevance for reliability or vice versa, though not to the point of dispensing with one of them altogether . . . (para. 42).

For many years, accountants have recognized the need for a relevant measure of an entity's value. As early as 1918, Paton and Stevenson (1918) advocated the use of present values for measuring the book value of assets, irrespective of whether such values were higher or lower than original costs. Hatfield (1927, p. 80) wrote that "the undervaluation of assets, with its accompanying understatement of profits and establishment of a secret reserve, if the lesser of two evils, nevertheless falls far short of the ideal standard of accounting." Anderson (1976) categorized several later writers as either subjectivity proponents--Alexander (1962), Solomons (1961, 1966)--or objectivity

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[4]Alexander's original monograph was given limited circulation as one of the Five Monographs on Business Income written for the Study Group on Business Income. The 1962 version of the monograph is a revision prepared by David Solomons.

proponents--Edwards and Bell (1961), and Sterling (1970).[5]

Until recently the use of present values as measurements of major assets has been generally avoided. One common agrument against the use of present values is given by Peasnell (1977, p. 188): "Managements are placed poorly to calculate their company's PV--to do so they would have to monitor the time and risk preferences of investors." On the other hand, it can be argued that management has a comparative advantage in estimating production timing since they are directly responsible for its ultimate occurrence.

The Subjectivity of RRA Data

The SEC, through ASR No. 253, has required the use of a measure of value which is hoped to be more relevant although it is admittedly less precise. ASR No. 253 states:

> The Commission has concluded that supplemental disclosure of valuation information on oil and gas reserves in accordance with its newly adopted rules is appropriate even though the information cannot be precisely determined (1978, p. 3691).

Criticizing the traditional historical-cost based net income, Clarence Sampson, the SEC's Chief Accountant at the time of adoption of RRA, stated, "The present net-income statements of oil and gas companies show the true results of operations only by coincidence" (Stuart, 1979, p. 72).[6]

Disagreement over the propriety of RRA's subjective valuations is clearly evidenced by the following excerpt from Kolbenschlag (1979):

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[5] Sprouse (1966) could also be categorized as a proponent of objectivity.

[6] Seidler suggests, "RRA . . . will provide the typical investor and portfolio manager with information not now provided" (Business Week, October 1, 1979, p. 56), and Fraser (1979, p. 106) states, "From the standpoint of the financial analysts, RRA makes good sense. . ."

> An unusually viscous and vicious alliance of the U.S. oil industry's producers, accountants, and analysts have tried mightily to kill the beast [RRA] after its first appearance in the supplements to 1978 oil company 10-K's filed with the SEC last June [RRA added] (p. 188).

Connor (1979) and Porter (1980) have studied:

> . . . the impact of the subjectivity factor involved in reserve estimation to determine if it is of such magnitude that it yields an imprecision that limits in any way the method or manner in which reserve information should be utilized in the financial reporting process (Porter, 1980, p. 1).

In essence, both studies conclude that RRA produces results which are materially imprecise when compared with subsequent actual results. Connor (1979, p. 94) states, "The theoretical viability of RRA is critically imparied by the reality of the inherent imprecision of initial estimates of reserves and future development and production activities."

The Porter and Connor studies found that initial estimates of proven reserves could be very unreliable. Porter (1980) analyzed the revisions of proven reserves for a sample of 26 firms. Some of the results are given below..

1. All of the 26 companies reporting changes in total company reserves reported a revision of prior reserve estimates in every year.

2. Of the revisions made to company reserves over the period 1969 through 1978, 64 percent of the annual revisions were greater than 20 percent of the companies' annual additions to proved reserved; 46 percent of the annual revisions were greater than 40 percent of the companies' annual additions to proved reserves.

3. All except five of the participating companies had revisions in at least one year in excess of 100 percent of additions. Sixteen companies had revisions in at least one year in excess of 140 percent of additions.

Connor (1979) also found discovery date estimates of proven reserves to be highly inaccurate. "Discussion with participants in the study indicate that the inaccuracy of discovery date estimates of reserves quantities frequently ranges from ±15 percent to ±85 percent or more" (p. 95). The petroleum engineers who prepare reserve estimates are quick to warn of the subjectivity involved. "It's like inventorying a warehouse," says one expert, "except that you're blind; you don't know how big or how full the warehouse is, or how much you can get out--or if any of the aisles are blocked" (Stuart, 1979, p. 71). Porter (1980) compared estimates of proved reserves made by different estimators using the same data base. For 323 comparisons of judgment, in 42 percent of the cases the estimates of the companies differed by amounts in excess of ±50 percent, and in 21 percent of the cases the differences were greater than ±100 percent.

In short, there is ample evidence suggesting that estimates of reserve quantities are highly unreliable. However, if the information is superior to other estimates available to the market, an impact on securities prices might result from RRA disclosures.

The Connor and Porter studies highlight the imprecision inherent in RRA valuations. However, the studies failed to address the question, "Is the data more relevant to investors than the currently available historical cost data?" This study investigates the stock price behavior of firms filing RRA data. Evidence of abnormal return behavior around the first two RRA filing dates would indicate that the RRA disclosures represented incremental information to investors. The methodology used to assess the return behavior of RRA firms is discussed next. Although this study does not attempt to make inferences about price reactions to information with varying degrees of subjectivity, an understanding of

the effects of subjectivity on price behavior will facilitate the construction of a methodology best suited for the data.

CHAPTER II

SAMPLE SELECTION AND METHODOLOGY

Sample Selection

In order to achieve some control over the effects of industry-specific events, two samples were drawn. A treatment sample was chosen consisting of firms that filed the RRA data for the fiscal years ended December 31, 1978 and/or 1979. A control sample consisted of firms that filed 1978 and 1979 RRA data for fiscal years ending at times other than December 31. The time lag in filing dates for the two samples permitted intersample comparisons while at the same time ensuring some degree of similarity between the two. Both samples' security returns should concurrently reflect the effects of industry-specific events other than RRA. Divergence between the returns of the two samples should represent firm-specific phenomena. The firms within the control sample were also used to construct an industry index which was included as an additional explanatory variable in the individual-firm abnormal return models. The time lag of RRA disclosures between the treatment and control samples should prevent the removal of RRA effects from the abnormal returns of treatment firms.

The samples were drawn from a listing of firms on the CRSP daily returns file which were classified under any of the following SIC Industry Codes, and filed RRA data in at least one of the two years 1978 and 1979:

1311 Crude Petroleum and Natural Gas
1321 Natural Gas Liquids
1381 Drilling Oil and Gas Wells
1382 Oil and Gas Field Services
2911 Petroleum Refining
2912 Oil Integrated Domestic
2992 Lubricating Oils and Greases
2999 Products of Petroleum and Coal, Not Elsewhere Classified
4922 Natural Gas Transmission and Storage
4923 Natural Gas Transmission and Distribution

The daily returns file was used for two reasons. The file contains firms traded on both the NYSE and AMEX (many smaller oil and gas firms are traded on AMEX). Also, use of the daily returns file for investigating stock price reactions increases the chances of detecting a short-lived reaction.

In order to ascertain the filing dates of the RRA data, the Disclosures, Inc. 10-K microfiche was used. The filing date was determined as the date the SEC stamped "Received" on the front page of the 10-K.[1] For the initial 1978 RRA filing, the SEC granted an extension of 90 days. Many firms filed the RRA data in a separate Form 8 submitted well after the initial 10-K filing for 1978. Use of these "late filers" in drawing inferences reduces the probability of confounding effects due to incremental 10-K information.[2] For the year 1979, possible incremental 10-K effects are controlled by use of an expectations model and by examining returns several days after the filing. Any 10-K information which is not as subjective as the RRA

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[1]Baskin (1972) pointed out that the date annual reports are ultimately received by regulatory organizations can lag the information release date. Analysts may be apprised of the information sometime near the date the reports are mailed, but they may not reach their destination for several days. For this reason, a range of several days is considered the filing date in some of the tests conducted. This will be discussed later in the "Methodology" section.

[2]See Foster and Vickrey (1978) for evidence regarding incremental information effects of 10-K filings.

data should be absorbed more quickly into security prices.[3]

The sample selection criteria resulted in the selection of 87 treatment firms for 1978 (51 of the firms filed a Form 8 after the 10-K filing) and 83 treatment firms for 1979. The control samples include 21 and 22 control firms for 1978 and 1979, respectively. The treatment firms are listed in Appendix A accompanied by individual firm statistics to be discussed later. The control firms are listed in Appendix B.

Methodology

The usual procedure for estimating abnormal stock returns is to use the difference between an actual return R_{it} and a predicted return $\hat{R}_{it}$. $\hat{R}_{it}$ is computed using estimators derived from a simple linear time series regression of firm returns on some index measuring movement of the entire stock market. The sole use of a market index as the explanatory variable may be appropriate when assessing the impact of some inter-industry phenomenon. Industry effects would be mitigated through diversification. When assessing the impact of an intra-industry phenomenon, inclusion of an industry index may be warranted.[4] Beaver (1981) recognized:

> . . . concern would arise where the industry composition differs considerably from that of the market portfolio. For example, consider recent studies of the oil and gas industry (Dyckman [1977] and Collins and Dent [1978]). One way to deal with industry effects is to extract R_{it} and examine only $\tilde{u}_{it}$ (p. 179).

For these reasons, a dual-index model of the following form was used to measure abnormal return behavior in this study.

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[3] A discussion of the rapidity of price adjustments, dependent on the subjectivity of information, is given later based on Verrecchia (1980).

[4] Foster (1975) included an industry index when investigating phenomena specific to the insurance industry.

$$R_{it} = \alpha + \beta_1 R_{mt} + \beta_2 \varepsilon_{It} + u_{it} \quad (1)$$

The industry index ε_{It} is orthogonal to the market index R_{mt} to ensure maximum efficiency of the ordinary least squares estimators, should the index be an irrelevant variable in the model.[5] The industry index is computed as:

$$\varepsilon_{It} = R_{It} - \hat{R}_{It} \quad (2)$$

where R_{It} = an equally weighted index of firm returns for oil and gas companies other than companies in the treatment sample, and

$\hat{R}_{It}$ = a predicted industry equally weighted index using estimators derived from a time series simple linear regression of R_{It} on R_{mt}.

The significance of including an industry index is assessed by testing the hypothesis $\beta_2 = 0$. A measure of the incremental utility of the industry index is given by the change in R^2 due to inclusion of ε_{It}. In general, the industry index was found to be significant (see Chapter III, Findings).

Scholes and Williams (1977) showed that use of daily returns may cause a bias due to non-trading days. For this reason, the multiple regression given in equation (1) was run using only days when an actual trade took place.[6] Also, non-trade days were excluded from the test

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[5]Kennedy (1979) states that if an irrelevant variable is included in the model, the vector of estimated coefficients, $\hat{\beta}$, and the estimator of its variance-covariance matrix remains unbiased. "Unless the irrelevant variable is orthogonal to the other independent variables, however, the variance-covariance matrix becomes larger: the OLS estimates are not as efficient" (p. 58).

[6]Scholes and Williams (1977) provide an instrumental variables technique designed to transform the coefficients from a regression using daily data to non-biased status. Unfortunately, the transformations only apply to α and β from a simple linear regression. It should be noted that a problem still exists when using transformed non-biased estimators. A non-trade day may occur during the test period. The

period measures of abnormal returns. If the signal (disclosure) date was a non-trade day, the first trade day following the signal date was considered the first day of the test period.

The regression period used to estimate α, β_1 and β_2 is comprised of the 150 days prior to January 15 of each year 1978 and 1979, exclusive of non-trade dates. The event period for each firm included 15 days prior to the disclosure date through 30 days after the disclosure date. Days when no trades took place were not included as elements of the 46 day event periods.

Aggregate vs. Individual Firm Analysis

Most market impact studies use an aggregated abnormal return measure to test whether a widespread market reaction occurred among the treatment firms. The period over which the test statistic is aggregated usually involves identical periods related to the phenomenon expected to cause the reaction. These trade periods are not necessarily the same calendar periods for all firms.[7] Verrecchia (1980, p. 67) has shown that, "because there is a cost involved in processing information, investors will not [necessarily] react instantaneously and/or simultaneously to the [dissemination of] information." Applying an equilibrium strategy within the context of a two-person strictly competitive

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abnormal return would be measured as the negative of the predicted return, even though no trade took place. If one argues that an abnormal return was actually experienced because a return was expected due to market movement, then the question becomes, Why does a non-trade day, when measured as a zero return, create a bias? Also, if it creates a bias, then why don't trade days where there is no price change create a bias?

[7]For example, a study using daily data might aggregate returns of N number of firms for five days including a disclosure date and four subsequent trading days. However, the firms may disclose on different days thus causing a difference in the calendar dates.

(zero sum) game, Verrecchia (1980, p. 87) concludes that "as the precision associated with information increases, the rapidity of price adjustments to the information will increase correspondingly." In addition, preliminary evidence suggests that security returns of small and large firms differ. Atiase (1979) found that the degree of security price revaluation in response to second quarter earnings reports is inversely related to the capitalized value of the firm. Banz (1979) shows that investors demand higher returns for investments in small firms than in large firms.[8] These studies suggest that highly subjective information (information which is costly to process) will not necessarily be reflected instantaneously and simultaneously in security prices and that the degree of price reaction will depend to some extent on the size of the firm. If these notions are accepted, then the usual test method of aggregating firm returns for a given trading day may not be appropriate. Simonds and Collins (1978, p. 650) recognized that much of the line of business reporting effect present in the individual returns of reporting firms "might be obfuscated when securities are combined into portfolios."

RRA data are regarded as highly imprecise, or subjective data, as previously discussed. Also, the sample of treatment firms is comprised of a wide range of firm sizes. For these reasons, aggregation of daily returns for a specific set of trade days may result in inconclusive findings. If treatment firms' security prices react to the subjective data at varying times around the information release date, and if larger firms' prices react more subtly than smaller firms' prices, aggregation by trade day will tend to obscure any widespread reaction.

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[8] See Freeman (1981) for a discussion of the "size effect" on security prices.

For these reasons an individual firm-by-firm analysis of return behavior is conducted in this study, as well as aggregate analyses.

Individual Firm Analysis

For each separate firm, the dual-index regression was run, and the resultant parameters were used to generate predicted returns for 15 days prior to the disclosure date, the disclosure date, and 30 days after the disclosure date. The daily abnormal returns were then measured as the actual daily returns minus the predicted returns. Prediction intervals were then computed around each predicted daily return from two days prior to the disclosure date through 30 days after the date. The prediction interval is similar to a confidence interval and is given by:

$$\hat{R}_{it} \pm (t_{T-3}, \lambda/2) se_i \tag{3}$$

where $\hat{R}_{it}$ = the predicted daily return computed using the dual-index estimators and actual values of the market and industry indices,

t_{T-3} = the tabular t value for T-3 degrees of freedom, where T is the number of observations in the original time series regression (150 observations were used in this study),

$1-\lambda$ = the desired confidence level (95 percent in this study), and

se_i = the estimated standard error of regression prediction errors for firm i, given by:

$$se_i = \sqrt{s^2(1 + X_0'(X'X)^{-1}X_0} \tag{4}$$

where s^2 = estimated variance of the regression,

X_0 = $[1, R_{mt}, \varepsilon_t]$, a 1x3 vector including a 1 for the intercept term, the actual market return for day t, and the actual industry return for day t, and

X = the Tx3 matrix of original observations from the regression period.

Once the prediction intervals were computed for each separate firm for each day mentioned above, the actual firm return R_{it} was compared with the interval. Any return falling outside of the prediction interval could be considered abnormally large. In this way abnormal return behavior on a firm-by-firm basis can be inspected. The quantities of returns falling outside of the respective intervals are given in Appendix A for each treatment firm and are discussed in the next chapter.

Once the ratio of returns falling outside of the prediction intervals to the total intervals covering the 33 day period is determined, a test for the significance of a proportion may be conducted. The expected proportion of returns falling outside of the related intervals is 0.05 since the prediction intervals were constructed at the 95 percent level of confidence. Possible violations of the assumptions underlying this test are discussed in the limitations section of Chapter IV. Out of 1,000 intervals investigated, 50 abnormally large returns could be expected. The null hypothesis is H_0: No significant difference between the actual proportion of returns falling outside of the confidence intervals and the expected proportion of 5 percent. The test statistic is given by:

$$Z = \frac{p - .05}{\sqrt{\frac{.05(1-.05)}{N}}} \qquad (5)$$

where p = the actual proportion of returns falling outside of the related prediction intervals to the total prediction intervals, N, covering 33 days per firm.

The results of the test for the significance of a proportion are reported in Chapter III, Findings.

The individual firm analysis allows for the detection of widespread impact even though the timing of the impacts differs across firms.

Should a small number of firms cause an aggregate measure to be significant, the individual-firm-analysis will detect such outliers.[9]

Aggregate Analyses

Several conventional aggregate analyses were conducted on the abnormal return behavior of the samples. These include visual analyses and statistical tests. The visual inspections include plottings of the average absolute residual (AAR) and the deflated average absolute residual (DAAR) for the treatment sample and control sample against (a) trade days and (b) CRSP days.

CRSP days are used as an alternative to trade days because of the possible lack of simultaneity, on a trade day basis, of market reaction to firm specific subjective data. In other words, several firms' returns might be abnormally large on a given calendar day even though that calendar day represents different trade days relative to the disclosure dates of the firms. Such a phenomenon might show up when plotting abnormal returns against calendar days (CRSP days) while not showing up in a plot of abnormal returns against trade days.

The average absolute residual (AAR) is given by:

$$AAR_{K,t} = \frac{1}{S} \sum_{i=1}^{S} |u_{it}|, \text{ and} \tag{6}$$

the deflated average absolute residual (DAAR) is given by:

$$DAAR_{k,t} = \frac{1}{S} \sum_{i=1}^{S} \frac{|u_{it}|}{E|u_{it}|} \tag{7}$$

---

[9] See Gheyara and Boatsman (1980) for an example of the effect of outliers on aggregate measures.

where k = T for treatment sample and C for control sample,

S = total number of firms in the sample,

$|u_{it}| = |R_{it} - \hat{R}_{it}|$ for each security i on day t, and

$E|u_{it}|$ = mean of all regression period absolute residuals for firm i (i.e., $\sum_{t=1}^{150} |u_{it}|/150$).

The results of the plottings are presented in Chapter III, Findings.

Tests for significant differences between $DAAR_{T,t}$ and $DAAR_{C,t}$, were conducted for t = CRSP days. The results of these t-tests are presented in the findings chapter for each year 1978 and 1979.

The Jaffe Portfolio Method

For Signal Event II (1979 disclosures), the Jaffe Portfolio Method (1974) is used, since an expectation model can be specified for the second filing of RRA data. Ohlson (1979, p. 526) suggests that the Jaffe test is powerful since "there is every reason to believe that the signals in his study are uncorrelated and, thus, firm-specific."

In order to specify an expectations model of RRA income, the predictability of the components of RRA income must be investigated. The disclosure of RRA income actually presented in most firms' 10-K's was comprised of (1) the present value of new additions to reserves, (2) the accretion of discount on past recognized reserves, (3) the effect of price changes, and (4) the effect of changes in quantities which were estimated in prior years. Consider the predictability of each of these components. Major additions to reserves (i.e., new finds) are reported by the press well before the filing of 10-K data. Analysts should be able to estimate the present value of these new finds based on some average recovery rate and current prices. The result is that

the new additions component of RRA income should be predictable with minimal error, given that estimated quantities are reported prior to RRA data. The accretion of discount components of RRA income is totally predictable.[10] The effect of price changes should be predictable to some extent since the price changes are generally announced in the national news and recovery rates can be estimated. The only component which might not be predictable is the changes to prior quantity estimates. These changes were generally lumped in the "Other" category in RRA supplemental disclosures for 1979. For these reasons, the expectation model used when applying the Jaffe method was:

$$E(Y_{RRA})_{t+1} = rRRA_t + D_{t+1} + P_{t+1} \qquad (8)$$

where $(Y_{RRA})_{t+1}$ = RRA income for 1979,

RRA_t = value of proven reserves at the end of 1978,

r = 10 percent mandated discount rate,

D_{t+1} = actual 1979 RRA income attributable to new discoveries, and

P_{t+1} = actual 1979 RRA income attributable to price changes.

This expectation model is used to determine a buy/sell short strategy for the Jaffe method.

If RRA valuations are perceived by the market to be superior, then the (rational) market will adjust previous valuations in the same direction (i.e., up or down) as the unexpected RRA gain or loss. Therefore, the following assumption is required when applying the expectation model in equation (8):

---

[10] Accretion of discount = .10 (beginning proven reserves value).

$$\text{If } (Y_{RRA})_{i,t+1} \gtreqless E(Y_{RRA})_{i,t+1} \text{ then } u_{i,t+1} \gtreqless 0 \qquad (9)$$

where $(Y_{RRA})_{i,t+1}$ = actual RRA income for firm i, 1979,

$E(Y_{RRA})_{i,t+1}$ = expected RRA income for firm i, 1979, and

$u_{i,t+1}$ = actual abnormal return for security i experienced during the information disclosure period.

The Jaffe Portfolio Method constructs portfolios of stocks which are presumed to be held on a calendar day t of an appropriate signal period. A different portfolio t is constructed for each day t to be considered. The total number of portfolios depends on the length of the signal period under consideration. An average abnormal return is computed for each portfolio t. The result of applying equations (8) and (9) is to multiply (-1) times the u_{it} for firms that disclosed a reduction in RRA under the category of "Other" and to leave unchanged the sign on u_{it} for firms that disclosed a positive amount in "Other". If the expectation model holds, the result of its application would be to increase the value of portfolio returns by changing negative returns to positive returns, based on the assumption that a negative unexpected change, had it been fully anticipated, would have resulted in a short sale. Each portfolio t average abnormal return, $\bar{u}_{it}$, is standardized by dividing by an estimated standard deviation of portfolio t abnormal returns.[11] Finally, the standardized abnormal returns for each portfolio t are averaged across all portfolios.

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[11] The estimated standard deviation is given by:

$$SD_t = \sqrt{\frac{1}{T-1} \sum_{k=1}^{T} (\tilde{\bar{u}}_{it,t-k} - \frac{1}{T} \sum_{k=1}^{T} \tilde{\bar{u}}_{it,t-k})^2}$$

where T = total number of observations (days) taken prior to day t,

$\tilde{\bar{u}}_{it,t-k}$ = abnormal performance of portfolio t on day t-k.

The standardized abnormal return for each portfolio t is a measure of the number of standard deviations contained in the mean abnormal return, $\bar{u}_{it}$. If no systematic signal effect occurs, it is reasonable to assume that some portfolio average abnormal returns will be positive and some will be negative. Moreover, the average of the standardized portfolio returns should approximately equal zero.

There is ample evidence that the residual of a security on one day is uncorrelated with the residuals of that security (or any other security) in subsequent days. Therefore, the standardized residuals can be treated as independent observations because each portfolio t contains only residuals measured on day t. So the test statistic:

$$\frac{\overline{se}}{1/\sqrt{P}} \sim t(V),\ V = (T-1)P \text{ degrees of freedom} \qquad (10)$$

where $\overline{se}$ = average standardized portfolio mean residual,

P = total number of portfolios, and

T = total number of observations used to derive each portfolio's standard deviation.

The hypothesis to be tested is:

H_0: $\overline{se} \leq 0$

H_A: $\overline{se} > 0$

The test statistic given by equation (10) will be used to determine whether the magnitude of the residuals occurring near Signal Event II (i.e., $\overline{se}$) could have arisen by chance.

The results of applying the various methodologies discussed in this chapter are presented next.

CHAPTER III

FINDINGS

Individual Firm Analysis

For each firm in the 1978 and 1979 treatment samples, two regressions were run--a time series ordinary least squares simple linear regression (using one explanatory variable--the market equally-weighted index) and a time series ordinary least squares multiple linear regression (using two explanatory variables--the market equally-weighted index and an industry equally-weighted index made orthogonal to the market index). Some of the statistics which were computed in addition to the individual-firm regressions are:

1) R^2 - market index only
2) R^2 - dual-index model
3) Increase in R^2 due to inclusion of Industry Index
4) t calc for $\hat{\beta}_i$ for testing H_0: $\beta_1 = 0$
5) t calc for $\hat{\beta}_2$ for testing H_0: $\beta_2 = 0$
6) First Order Autocorrelation of Residuals
7) Durbin-Watson d statistic for testing for significant autocorrelation of residuals
8) Number of actual firm returns falling outside of 33 prediction intervals
9) $\hat{\beta}_1$ and $\hat{\beta}_2$ for the dual index model

The firm-by-firm data are presented in Appendix A. A summary of this data appears in Table I. For the late filing firms for 1978, 17 out of

TABLE I

SUMMARY OF FIRM-SPECIFIC REGRESSION RESULTS

	Significant Industry Index		Non-Significant Industry Index		Significant[a] or Inconclusive Autocorrelation		Non-Significant Autocorrelation		Returns Falling Outside of Prediction Intervals (33 Investigated)		Returns Falling Within Prediction Intervals		Range of Increase in R^2 Resulting from Inclusion of Industry Index
	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	
1978:													
Late Filing Firms	17	33%	34	67%	14[b]	27%	37	73%	123	7%	1,560	93%	0.0 thru .076
On-Time Filing Firms	8	22%	28	78%	7[c]	19%	29	81%	68	6%	1,120	94%	0.0 thru .096
Total 1978 Sample	25	29%	62	71%	21	24%	66	76%	191	7%	2,680	93%	0.0 thru .096
1979:													
Negative Returns Expected	39	74%	14	26%	14[d]	26%	39	74%	178	10%	1,571	90%	0.0 thru .167
Positive Returns Expected	23	82%	5	18%	3[e]	11%	25	89%	83	9%	841	91%	.004 thru .199
Expectation Not Obtainable	2	100%	0	0%	0	0%	2	100%	1	2%	65	98%	.037 thru .061
Total 1979 Sample	64	77%	19	23%	17	20%	66	80%	262	10%	2,477	90%	0.0 thru .199

[a]Inconclusive Durbin-Watson d's are: 1978 Late Filers, 5; 1978 On-Time Filers, 2; 1979 Negative Returns Expected, 2; 1979 Positive Returns Expected, 1.

[b]Of the 14 significant autocorrelations, 9 were decreased and 5 were increased by inclusion of the industry index.

[c]Of the 7 significant autocorrelations, 4 were decreased and 3 were increased by inclusion of the industry index.

[d]Of the 14 significant autocorrelations, 8 were decreased and 6 were increased by inclusion of the industry index.

[e]Of the 3 significant autocorrelations, 2 were decreased and 1 was increased by inclusion of the industry index.

51 (or 33 percent) of the t-statistics relating to β_2, the coefficient on the industry index, were significant at the .05 level.

For the entire treatment sample of firms for 1979, 64 out of 83 (or 77 percent) of the t-statistics on β_2 were significant at the 5 percent level. The length of the time series used to generate the 1978 industry index was 487 returns while for 1979 the length was 800 returns. It seems that the longer time series was more useful in constructing the industry index. An alternative explanation for the superiority of the 1979 industry index is that the market index may have accounted for less of the variance of firm returns in 1979 than in 1978. The average R^2 for the market-index-only model for 1978 was .2139 compared with the 1979 R^2 of .1998. The average R^2's for the dual-index model was .2300 and .2604 for 1978 and 1979 respectively. Based on these results, it appears that part of the superiority of the 1979 industry index is due to the increase in the length of the time series used to generate of 1979 industry index, and part is due to a decrease in the explanatory power of the market index for 1979. The average increase in R^2s due to inclusion of the industry index was .0161 and .0606, or 7.5 percent and 30.3 percent for 1978 and 1979, respectively.

Inspection of Table I reveals that the maximum increase in R^2 for 1978 was .096 while for 1979 the maximum increase was .199.[1] Twenty-four percent of the 1978 regression models and 20 percent of the 1979

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[1]Lev (1979) reported that the average R^2 for oil and gas firms in his sample, using daily data, was .18. The inclusion of an industry index could conceivably double the R^2 for any given firm, and in fact did double the R^2's for several firms in this current study (see Appendix A).

models experienced significant, or inconclusive, first order autocorrelation based on the Durbin-Watson d statistic at the 5 percent significance level.[2] However, the addition of the industry index decreased the first order autocorrelation for 23 of these models while increasing the autocorrelation for the other 15 models. In summary, an industry-index can significantly add to the explanatory power of the market model, even after the index has been made orthogonal to the market index.

The firms comprising the industry index are listed in Appendix B, along with summary statistics of the regression results from creation of the index. For 1978, the market index explained .5914 of the variance in the industry index. The standard deviation of the regression was .0098, with no significant first order autocorrelation of the residuals. For 1979, the R^2 was .6582 with a standard deviation of .0103 and significant first order autocorrelation of .1909.

Test for Significance of a Proportion

As discussed in the previous chapter, individual-firm-analysis of abnormal return behavior might be warranted when the researcher has reason to believe that market reaction to some subjective information may not be instantaneous or simultaneous across firms. Table I presents the results of a comparison, on an individual-firm basis, of actual firm returns with prediction intervals covering the 33 day

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[2]The Durbin-Watson test statistic is given by:

$$d = \frac{\sum_{t=2}^{T} (\hat{u}_{it} - \hat{u}_{i,t-1})^2}{\sum_{t-1}^{t} \hat{u}_{it}^2}$$

period from 2 days prior to the RRA disclosure date through 30 days after such date. For the 51 late filing firms in 1978, 123 of the 1,683 returns (Or 7.31 percent) fell outside of the related prediction intervals. A proportion of 5 percent would be expected since each daily prediction interval was constructed using a 95 percent level of confidence. Table II contains the computed Z-statistics for tests of significance of a proportion for several subsamples and intervals. The 33 day period is divided into a disclosure date period covering the 6 days from 2 days prior to the disclosure through 3 days after, and a post-disclosure period covering the remaining 27 days. For the late filers mentioned above, the Z-statistics for each period are significant at the 1 percent level (the tabular Z value for 1 percent and two tail areas is 2.576). It can therefore be concluded that a larger-than-expected number of firm returns were abnormally large in magnitude for the late-filing firms around the 1978 disclosure dates. None of this abnormal return behavior should have been influenced by the 10-K incremental information since the Form 8's were, for the most part, filed 60 to 90 days after the 10-K's.

Closer inspection of Table II reveals highly significant Z statistics for 1979 during the 6 day disclosure period.[3] Some may argue that these results include not only RRA information, but also incremental 10-K information filed concurrently with the RRA data. (The 1978 on-time filers' proportions were not significant.) If we look at the post-disclosure period for the 1979 firms, the Z statistics

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[3]All 1979 individual firm results are presented separately for firms with negative unexpected RRA income, as discussed previously under the Jaffe Portfolio Method, and firms with positive unexpected adjustments. It is interesting that the firms disclosing negative adjustments are so highly significant.

TABLE II

PROPORTIONS OF FIRM RETURNS FALLING OUTSIDE OF RELATED PREDICTION INTERVALS AND CORRESPONDING Z STATISTICS

	6 Trade Days -2 thru 3		27 Trade Days 4 thru 30		Trade Days -2 thru 30	
	Ppns	Z calc	Ppns	Z calc	Ppns	Z calc
1978:						
Late Filers	28/306	3.331	95/1,377	3.233	123/1,683	4.345
On-Time Filers	15/216	1.311	53/ 972	.648	68/1,188	1.145
Totals	43/522	3.394	148/2,349	2.892	191/2,871	4.063
1979:						
Negative Adjustments	61/318	11.604	117/1,431	5.513	178/1,749	9.935
Positive Adjustments	27/168	6.584	56/ 756	3.037	83/ 924	5.555
Totals	88/486	13.258	173/2,187	6.245	261/2,673	11.302

are still significant at the 1 percent level, indicating a possible lag in the timing of market reaction.

Appendix C contains a frequency count of returns falling outside of prediction intervals for the 33 trade days. The frequencies appear rather uniform throughout the periods. It can be concluded from the results presented in Table II that a larger-than-expected proportion of returns fell outside of the prediction intervals for all subsamples except the on-time filers of 1978.

Aggregate Analyses

Several aggregate analyses were conducted on the samples, as discussed in the previous chapter. The first of these analyses to be discussed here is aggregated residual inspection. The average absolute residuals (AAR) (see equation (6)) were plotted against trade days for the 1978 late filing firms and on-time filing firms. These plots are given in Figures 1 and 2. The trade days included in the plot run from 5 days prior to the disclosure date through 20 days after the disclosure date. For the late filers (Figure 1) spikes (abnormally large returns) appear to have occurred in the few days immediately prior to disclosure. It has been determined that these spikes are caused by fewer than 5 firms. More importantly, medium-sized spikes seem to have occurred during the several days after disclosure before starting to taper off somewhere near trade day 12 or 13. Caution should be exercised when interpreting these plots. First we must realize that each trade day's AAR represents an average of the absolute value of residuals of all sample firms experiencing a trade on that day. If reaction to the subjective data is not simultaneous across all firms, we could expect that a small number of firms' would account

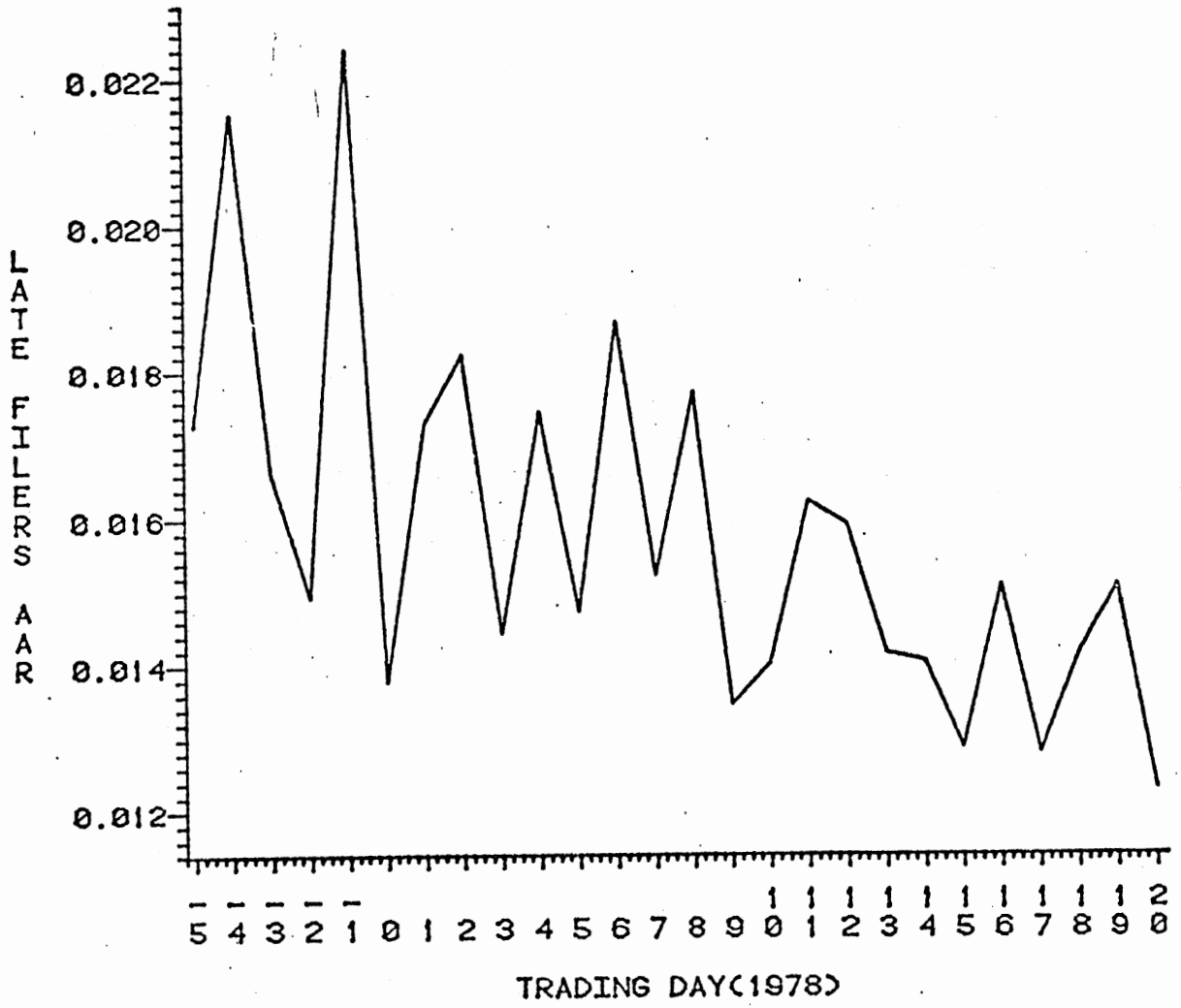

Figure 1. Plot of Late Filers' AAR Against 26 Trade Days Surrounding the Disclosure Date Zero (1978)

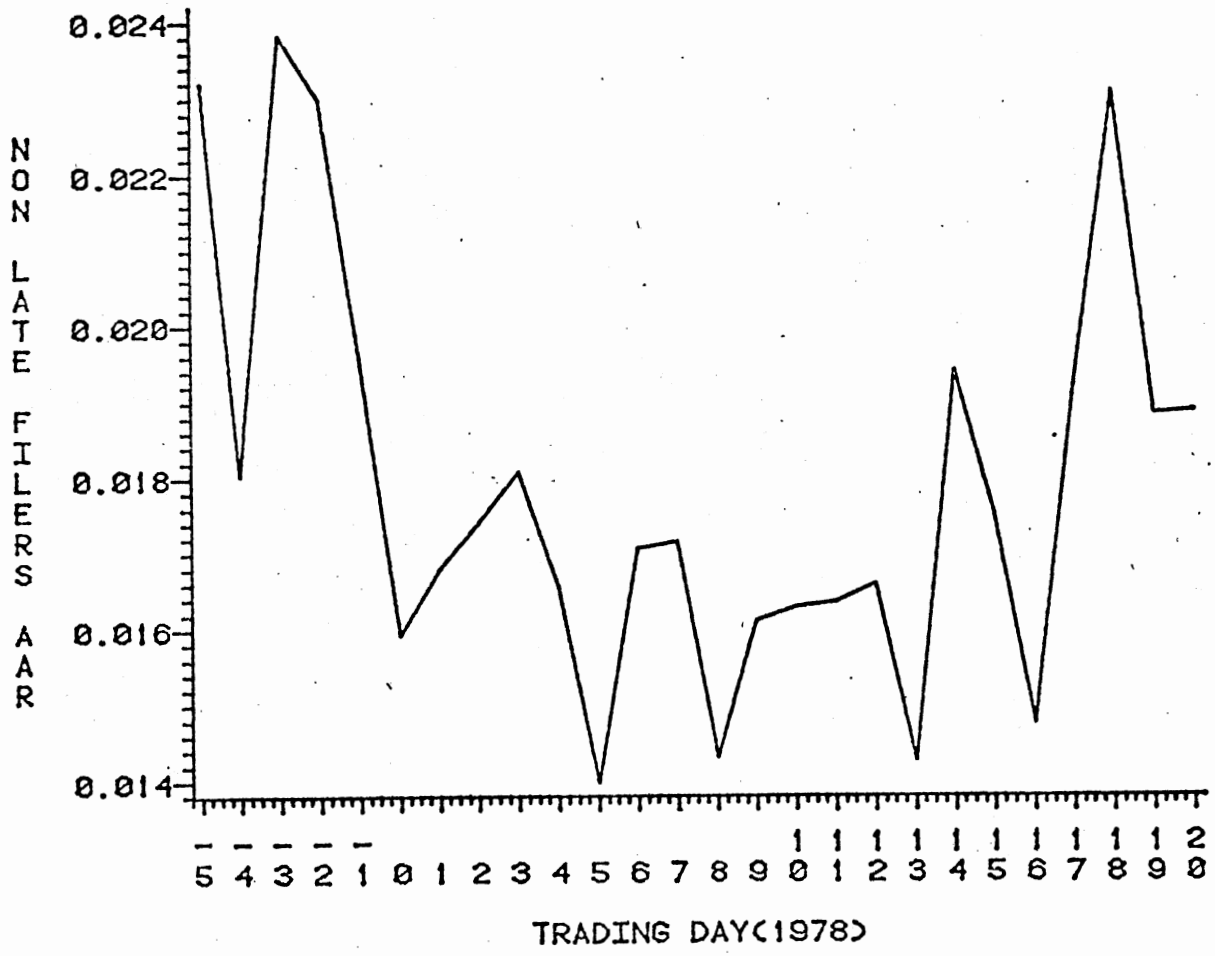

Figure 2. Plot of On-Time Filers' AAR Against 26 Trade Days Surrounding the Disclosure Date Zero (1978)

for any one trade day's magnitude. Only individual firm analysis would detect widespread non-simultaneous reaction. The comparable plotting for the on-time filers for 1978 (Figure 2) shows spikes in the few days prior to the disclosure date and a spike approximately 18 days after disclosure. For both Figures 1 and 2 the pre-disclosure date spike could have resulted from RRA data and/or, for the on-time filers, from incremental 10-K information. Baskin (1972) observed that the date a regulatory organization stamps a document as received lags the actual release date of the information. Therefore, reaction occurring a few days prior to the date a document is stamped "received" could be a result of market efficiency vis-a-vis, leakage. On-time filers were the only subsample that did not test significant with regard to the prediction interval proportion analysis.

One problem with inspecting the AAR's is the difficulty of ascertaining how the residuals compare with expected residual magnitudes. Therefore, the late filers and on-time filers AAR's were deflated by dividing by the expected value of the residuals (the mean of the regression period absolute residuals). The plots of these DAAR's appear in Figures 3 and 4. Minimal abnormal return behavior would be evidenced by a DAAR near the unit level (1) which has also been plotted in Figures 3 and 4 for reference. For the late filers, the lag in market reaction through day 10 becomes more apparent. The plot of DAAR's for on-time filers clearly depicts a lack of market reaction.

An alternative to plotting residuals against trade days is to aggregate residuals for calendar (CRSP) days. Should firms experience price reaction on the same calendar day, but different trade days, a plotting against CRSP days would reveal this occurrence. Also,

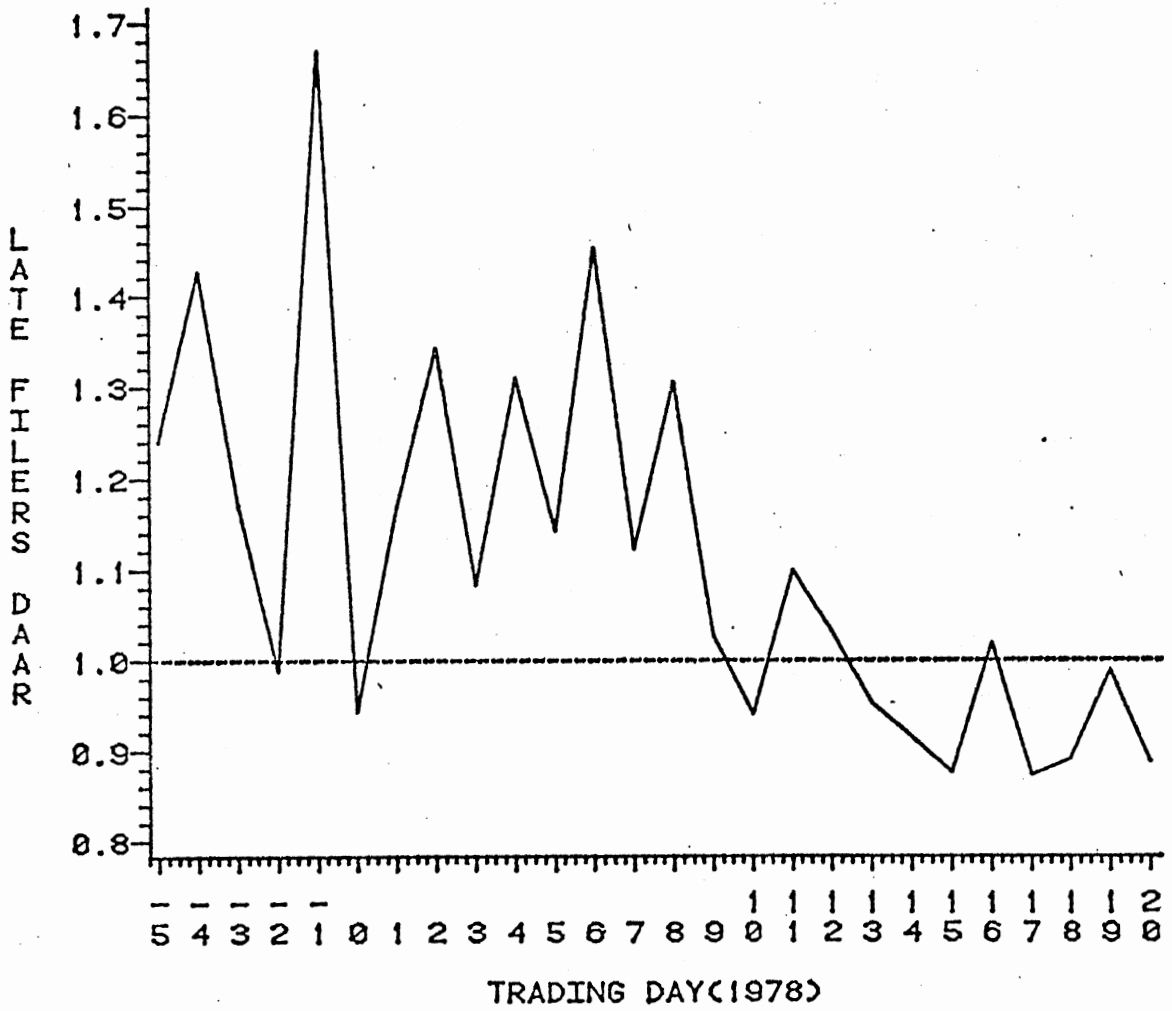

Figure 3. Plot of Late Filers' DAAR Against 26 Trade Days Surrounding the Disclosure Date Zero (1978)

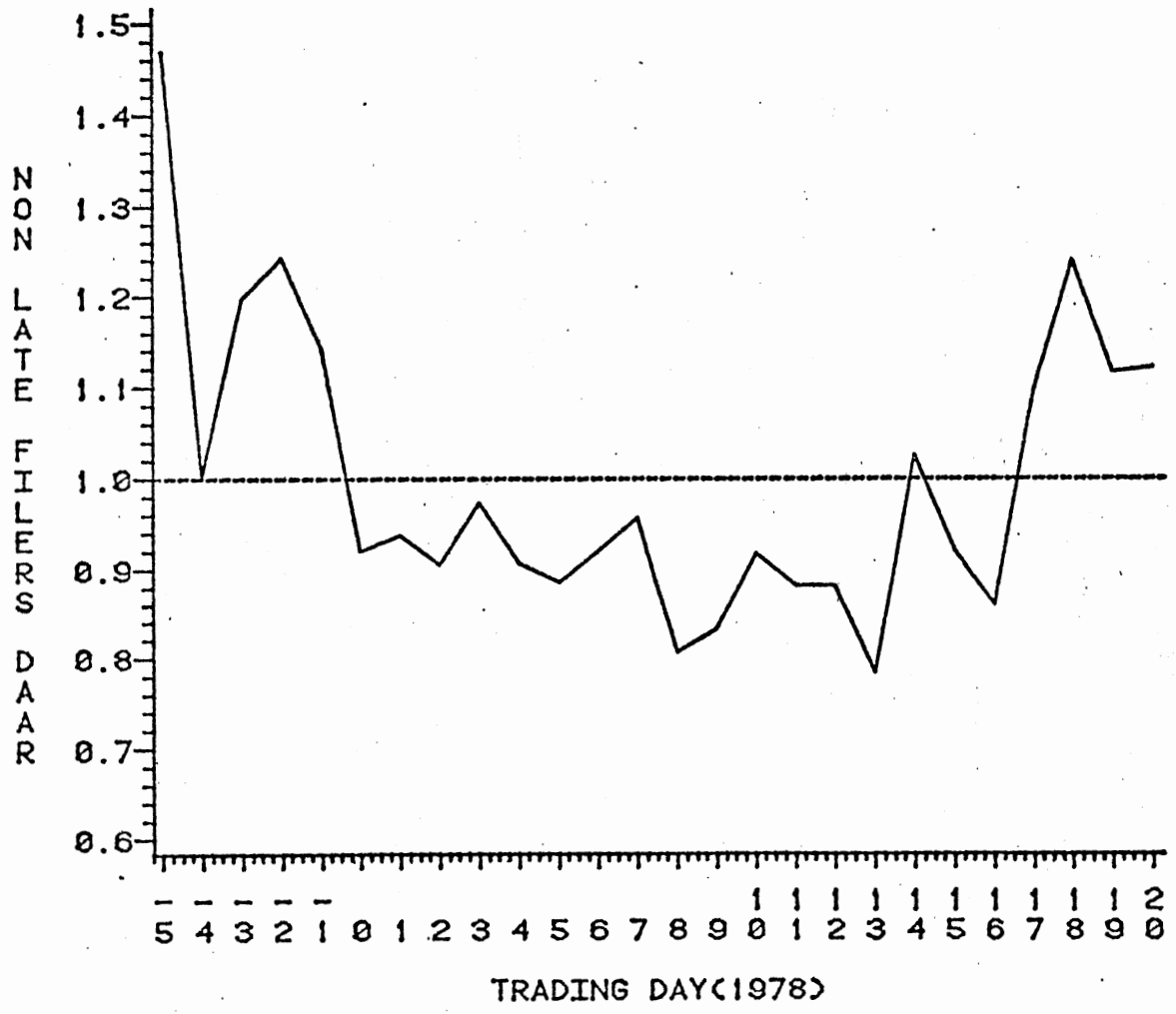

Figure 4. Plot of On-Time Filers' DAAR Against 26 Trade Days Surrounding the Disclosure Date Zero (1978)

plotting against CRSP days permits a comparison of control firms with treatment firms. Such comparisons are impossible on a trade day basis since control firms have no disclosure date.[4]

In order to decide what CRSP days should be plotted, frequency tables were prepared indicating the frequency of firms having trade days (15 days prior to, through 30 days after, the disclosure date) for given CRSP days. Based on the frequency tables, it was decided that for 1978 late filers, the period from CRSP date 4248 through 4290 would include enough firms for meaningful analysis. For on-time filers, the CRSP dates chosen were from 4180 to 4231. For 1979, the use of frequency data resulted in the choice of the interval 4441 through 4480. The intervals chosen for control firms are 4248 through 4290 for 1978 and 4441 through 4480 for 1979. All of these CRSP dates are cross-referenced with associated calendar dates in Appendix F. These choices ensured the following minimum number of firms per CRSP day:

	Minimum Frequency Per CRSP Day
1978 - Late Filers	40
1978 - On-Time Filers	18
1978 - Control Firms	12
1979 - Treatment Firms	65
1979 - Control Firms	12

For 1978, the plottings of DAAR's against CRSP days appear in Figures 5 through 7. The configurations for the two treatment sub-samples are similar to the DAAR plottings against trade days. The

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[4]The AAR for control firms is computed in the same fashion as the AAR for treatment firms. Twenty of the treatment firms were used to construct an industry index for use in control firm regressions. Upon running the dual-index models for control firms u_{ct} was determined by $u_{ct} = R_{ct} - \hat{R}_{ct}$.

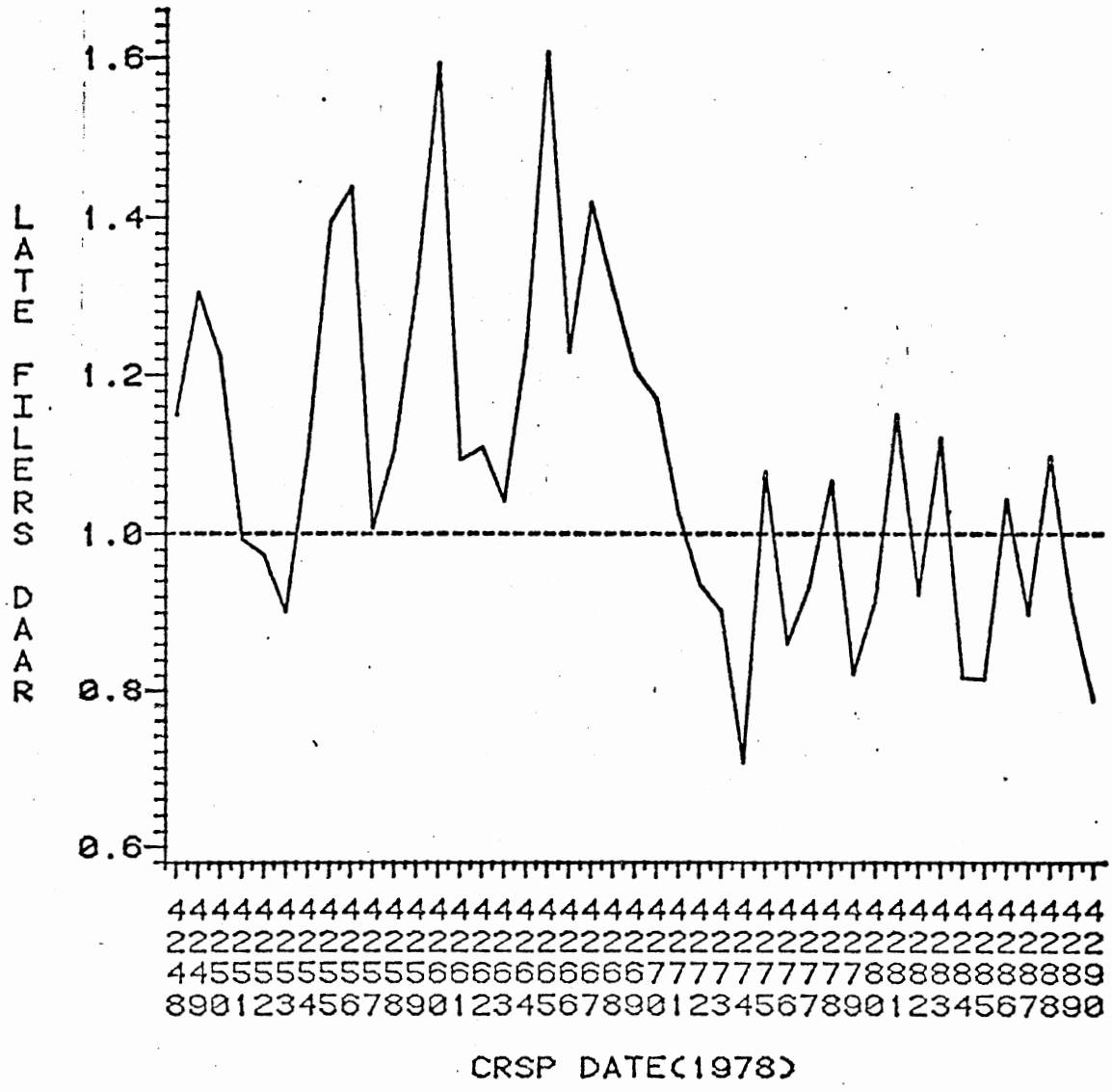

Figure 5. Plot of Late Filers' DAAR Against 43 Consecutive CRSP (Calendar) Days Around Disclosure Dates (1978)

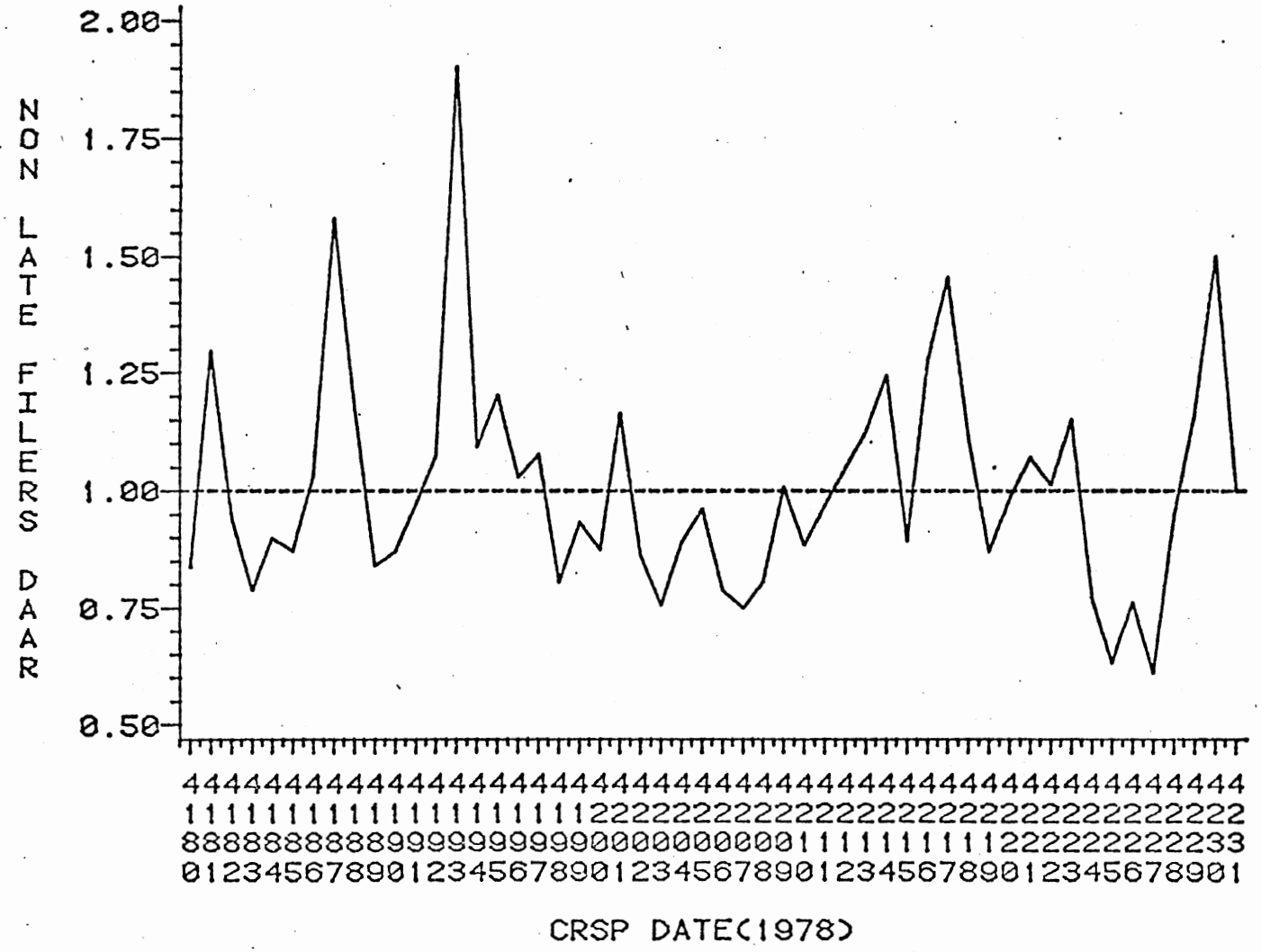

Figure 6. Plot of On-Time Filers' DAAR Against 52 Consecutive CRSP (Calendar) Days Around Disclosure Dates (1978)

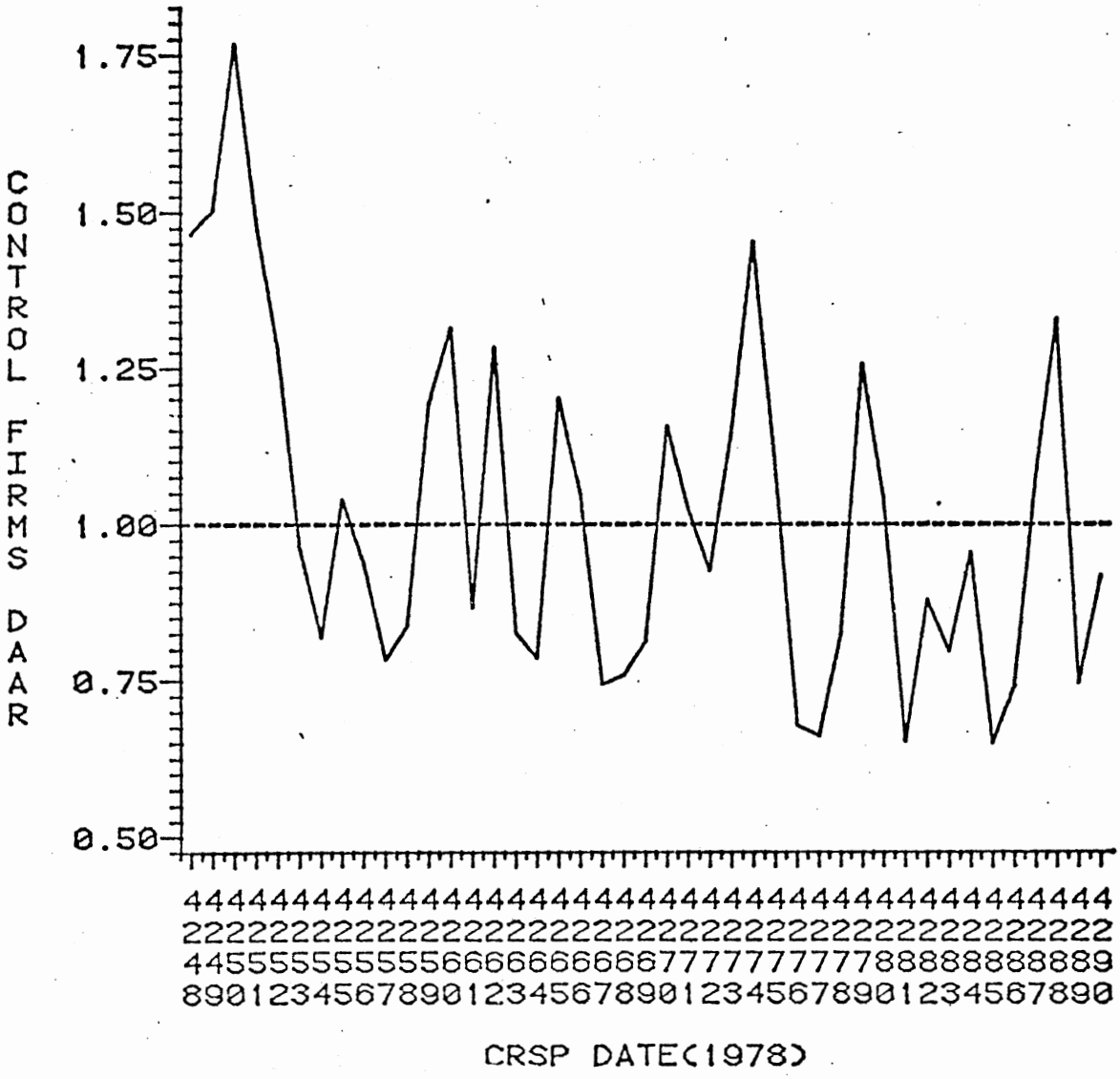

Figure 7. Plot of Control Firms' DAAR Against 42 Consecutive CRSP (Calendar) Days Corresponding to the Late-Filers' Plot in Figure 5

late filers experienced spikes from dat 4248 through day 4267 while the on-time filers experienced some early spikes and some late spikes. The plot for control firms in Figure 7 reveals a mostly random series of residuals around the unit level.[5]

A comparison of the late filers treatment subsample and the control firms sample DAAR's is given in Figure 8. CRSP day 4250 should be ignored (see footnote 5). Evidence of treatment sample market reaction comes in the form of divergence of the two series plotted. Divergence occurs on days 4267, 4268, 4269, 4274, 4278, and 4281.

In an effort to ascertain the significance of the various divergences of late-filers DAAR's from Control Firms' DAAR's, t-tests for equality of the treatment and control means were conducted for each CRSP day using firm deflated absolute residuals as observations. Table III contains the six days the null hypothesis of equality of means is rejected at the 10 percent significance level.[6] Other days where probabilities of greater $|t|$ were close to 10 percent are 4256 ($p = 0.1260$), 4274 ($p = 0.1418$), 4283 ($p = 0.1469$), and 4286 ($p = 0.1752$). These t-tests provide more rigorous evidence than the plot in Figure 8 regarding the divergence of the DAAR's for treatment vs. control firms. Based on these plottings of 1978 residuals, it appears as though the late filing firms did experience widespread abnormal return behavior around the RRA disclosure dates, whereas the

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[5]The spike on day 4250 is the result of one control firm's extremely high abnormal return--Consolidated Oil and Gas experienced a return on this day in excess of 0.10.

[6]For some of the CRSP days the null hypothesis of equality of variances of the two samples was rejected at the 10 percent level of significance. (An F (folded) statistic was computed to test for equality of variances.) For these days the t-statistic was approximated, using Satterthwaite's approximation of the degrees of freedom.

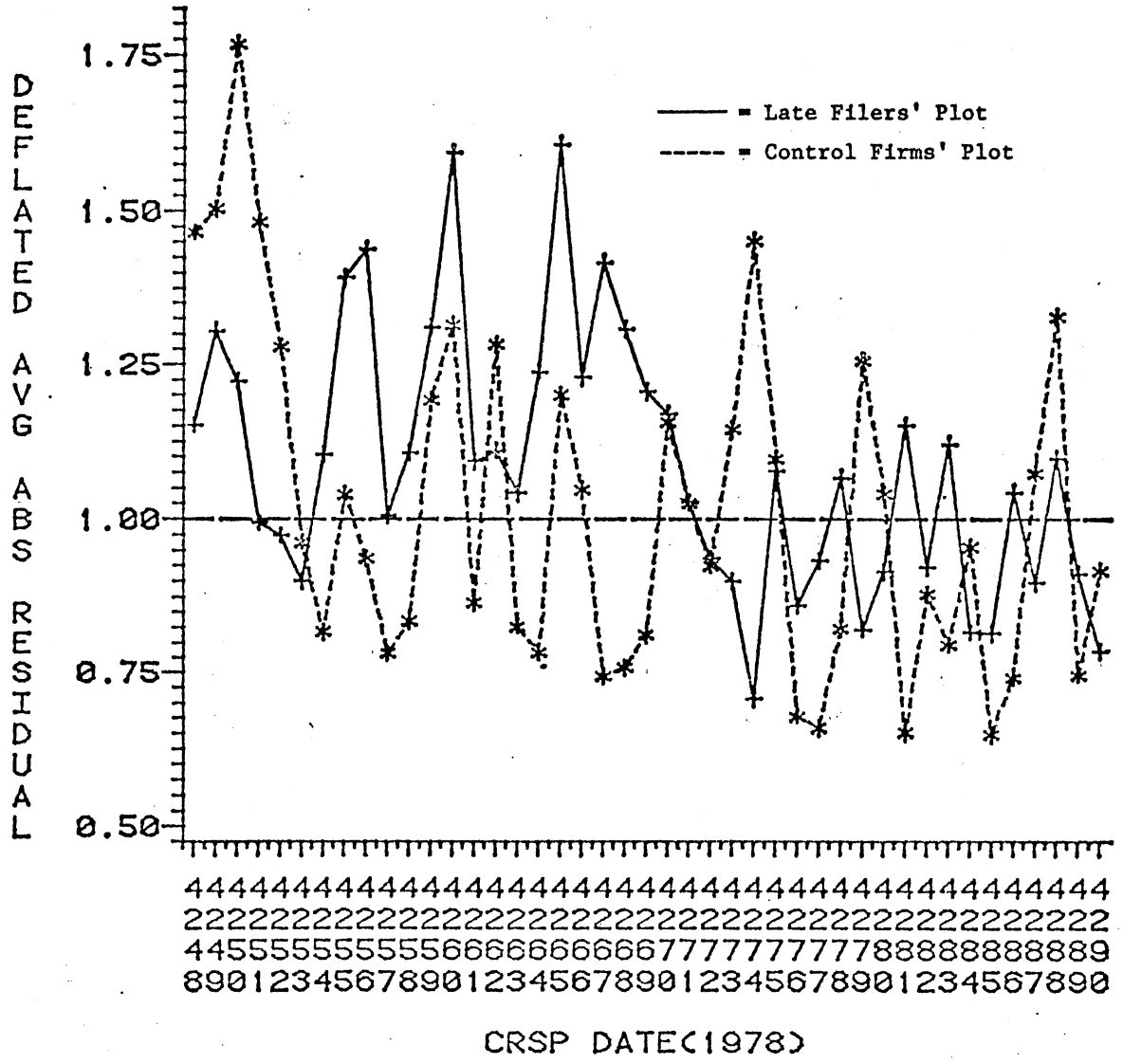

Figure 8. Plot of Late Filers' vs. Control Firms' DAAR Against CRSP Days 4248 through 4290 (1978)

firms that filed on-time (the 10-K included RRA data) did not experience such widespread behavior.

TABLE III

SIX SIGNIFICANT CALENDAR DAY TREATMENT MEANS FOR 1978

CRSP Day	t-calc	Prob > |t|
4264	2.2101	0.0322
4267	2.6637	0.0098
4268	2.4230	0.0213
4269	1.8993	0.0642
4279	2.2060	0.0319
4281	2.5248	0.0146

Comparable plottings were prepared for the treatment and control samples for 1979 and the plots appear in Figures 9 through 13. The configurations are not that different from the 1978 plots. The treatment firms experienced spikes for the two trade days prior to disclosure date zero and some lingering up through the seventh day after such date. The plot of the treatment firms' DAAR against CRSP days (Figure 11) displays a spike around day 4449 and the deflated residuals remain above the unit level for the most part through day 4480. In contrast, the control firms deflated residuals (see Figure 12) appear to fluctuate randomly around the unit level. It can be concluded from Figures 11, 12, and 13 that the general tendency was for the treatment firms DAAR's to stay above the unit level while the control firms DAAR's were predominantly below the unit level.

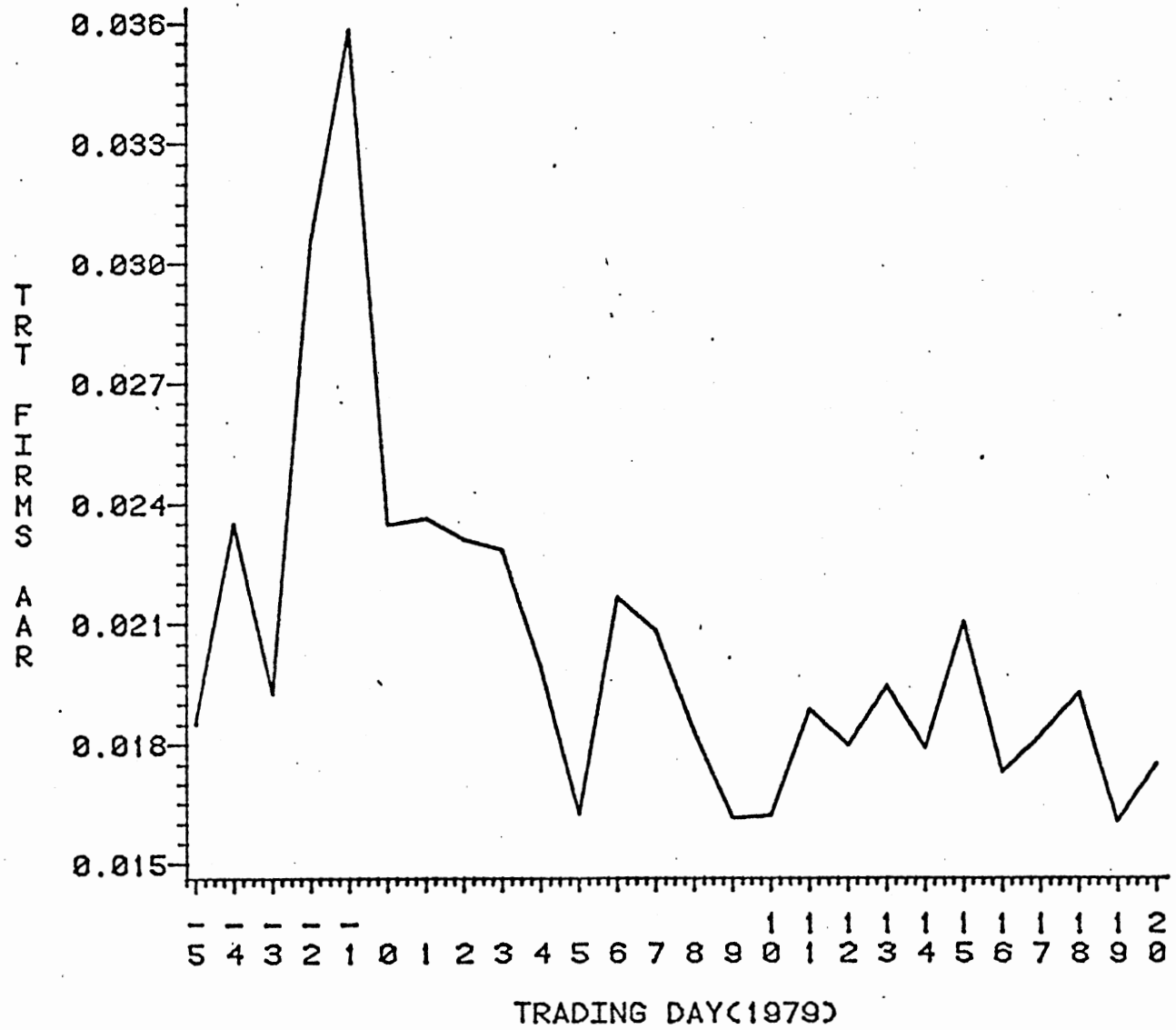

Figure 9. Plot of Treatment Firms' AAR Against 26 Trade Days Surrounding the Disclosure Date Zero (1979)

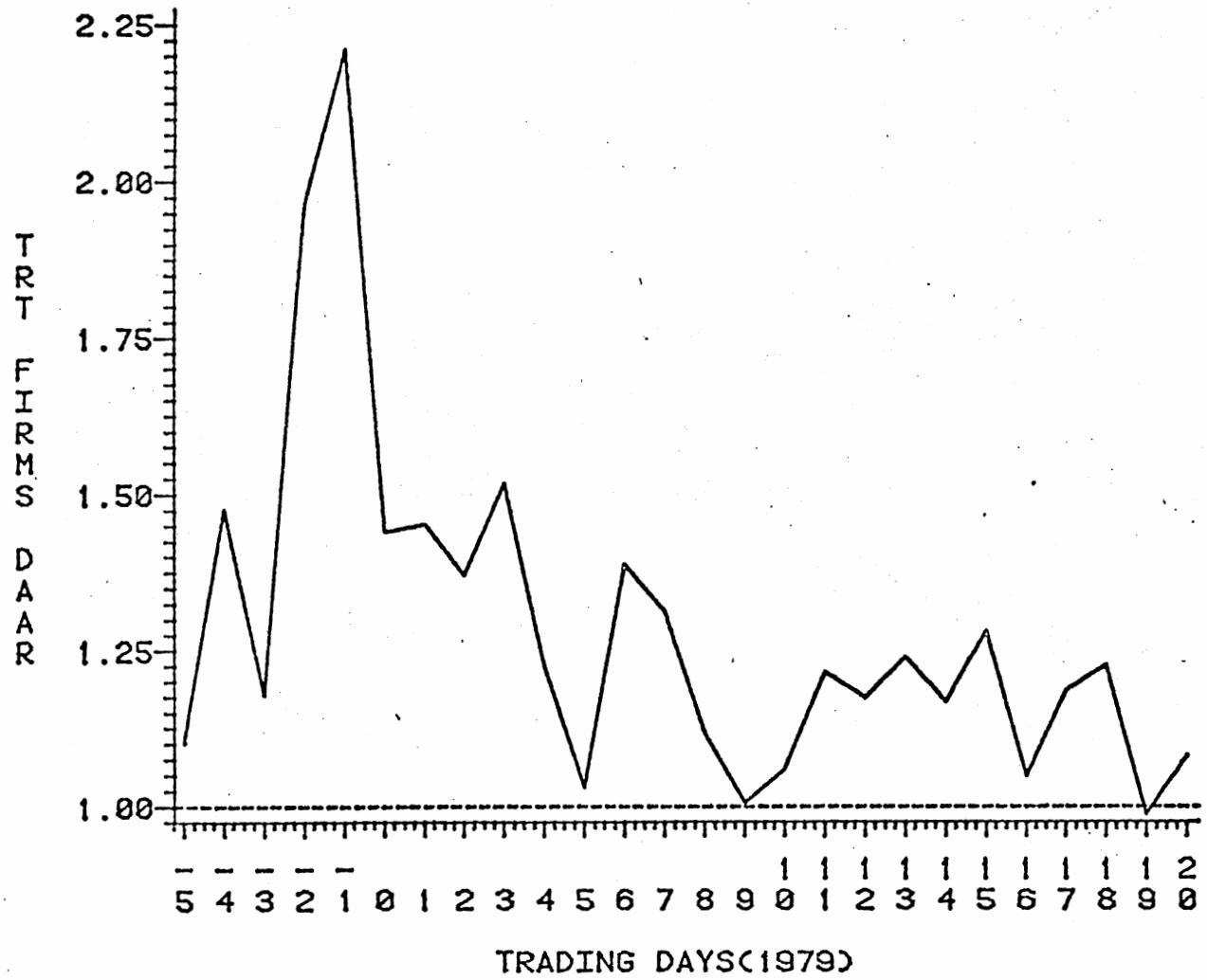

Figure 10. Plot of Treatment Firms' DAAR Against 26 Trade Days Surrounding the Disclosure Date Zero (1979)

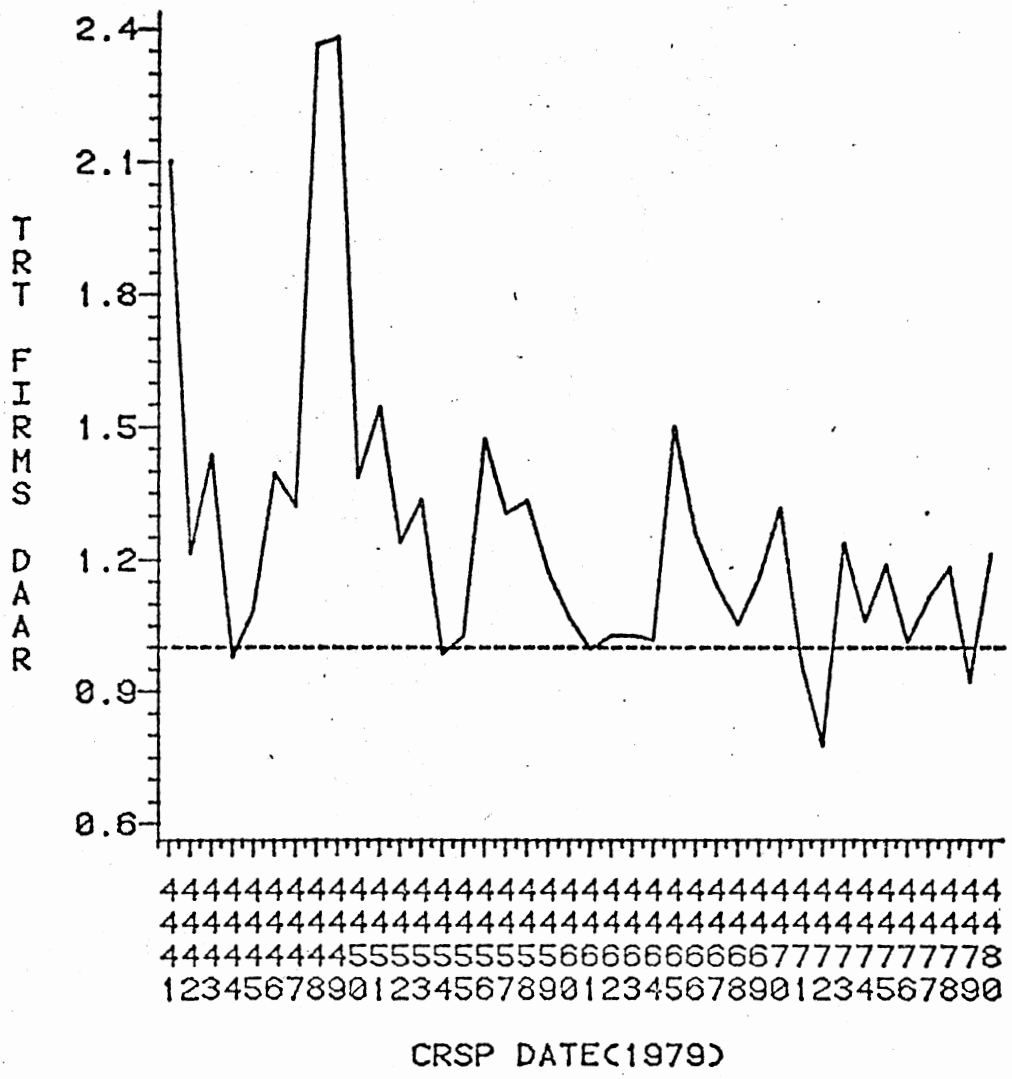

Figure 11. Plot of Treatment Firms' DAAR Against 40 Consecutive CRSP (Calendar) Days Around Disclosure Dates (1979)

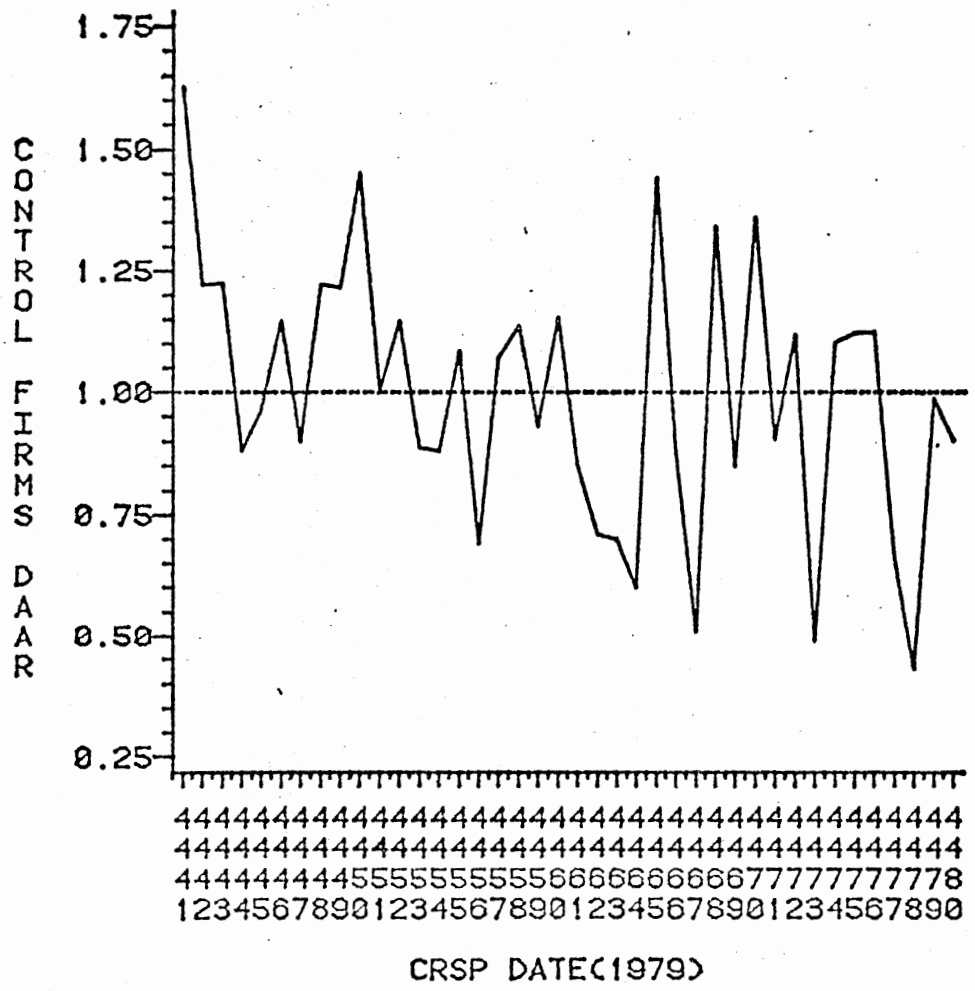

Figure 12. Plot of Control Firms' DAAR Against 40 Consecutive CRSP (Calendar) Days Corresponding to the Treatment Firms' Plot in Figure 11 (1979)

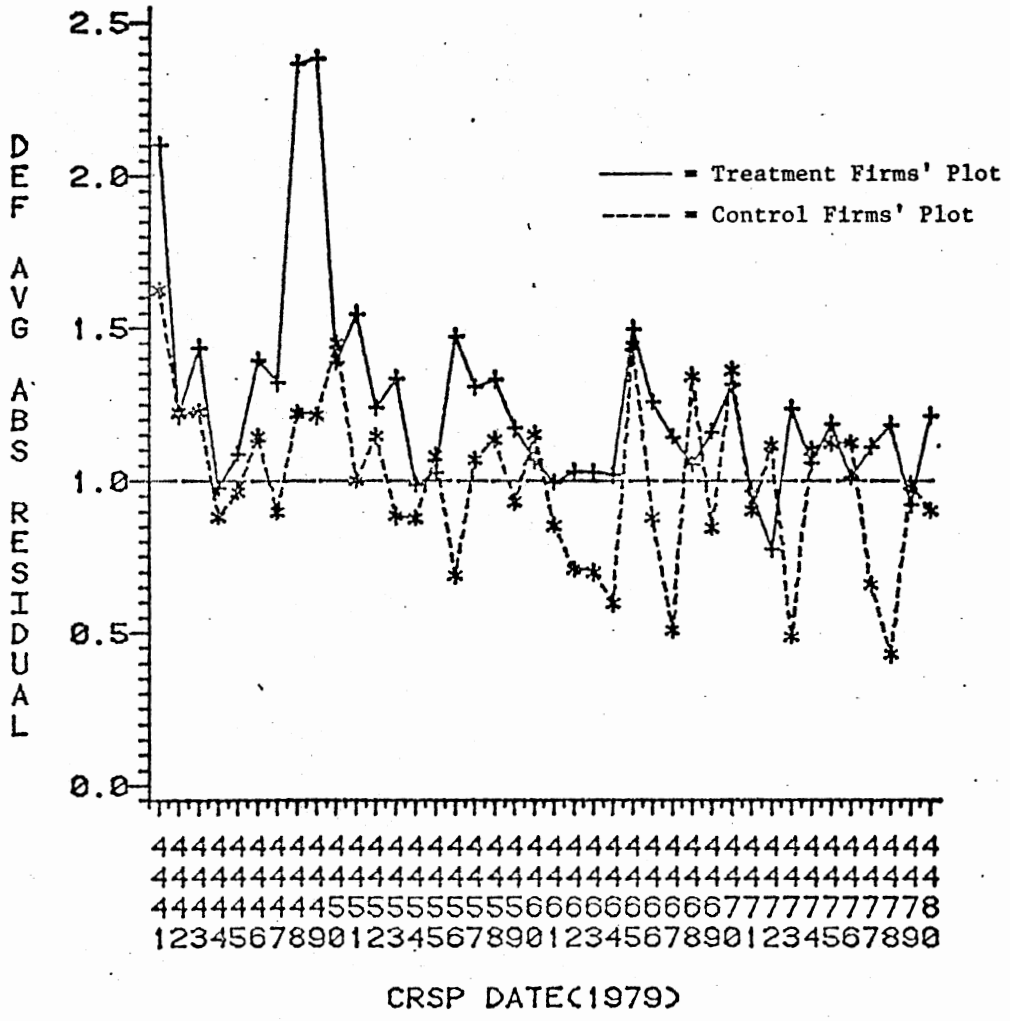

Figure 13. Plot of Treatment Firms' and Control Firms' DAAR Against CRSP Days 4441 through 4480 (1979)

As with 1978, t-tests of the null hypothesis of equal means were conducted for each CRSP day 4441 through 4480. Deflated firm absolute residuals were used as observations for the tests. Table IV contains 11 CRSP days where there was a significant difference between the mean treatment deflated absolute residual and the mean control deflated absolute residual at the 10 percent significance level.[7]

TABLE IV

ELEVEN SIGNIFICANT CALENDAR DAY TREATMENT MEANS FOR 1979

CRSP Day	t-calc	Prob > |t|
4441	1.6868	0.0985
4448	2.9454	0.0048
4449	3.5184	0.0021
4451	2.1683	0.0383
4453	1.8465	0.0756
4456	2.9800	0.0054
4464	2.6036	0.0111
4467	4.1387	0.0001
4473	4.1384	0.0002
4477	2.4258	0.0194
4478	4.9475	0.0001

In addition to these significant days, some other days where the probability of a greater absolute value of t are near 10 percent are days 4462 ($p = 0.1351$) and 4463 ($p = 0.1419$). It can be concluded that even if some incremental 10-K effect was experienced near the disclosure

[7]Again, where the Folded F statistic indicated unequal variances, an approximate t-calc was used.

dates, the treatment sample experienced a lingering effect when compared with the control sample.

Test for Joint Occurrences

The t-tests conducted above indicate some abnormal return behavior on a daily basis. However, a number of significant t-statistics should be expected to occur randomly. In order to determine if the number of significant t-statistics across the disclosure periods is larger than expected, inferences involving the probability of joint occurrence of the t's over the periods should be made. Simonds and Collins (1978)[8] have utilized a joint probability calculation based on the premise that the sample mean of individual firm F scores computed for n firms is well approximated by $\chi^2(n)/n$. Gheyara and Boatsman (1980) adopted this procedure using t-statistics as opposed to F scores. The sampling distribution of the mean of t^2's is approximated by $\chi^2(n)/n$ for n individual t-statistics. An underlying assumption required by this approximation is that the individual t-statistics be independent observations. Gheyara and Boatsman (1980) discussed a possible lack of independence in their t-statistics due to cross-sectional correlation of returns. In contrast, the t-statistics computed above relate to individual days instead of individual firms. Ample prior evidence has indicated that returns are serially uncorrelated. The results of individual firm regressions which were presented in this study indicated a minor number of firms experienced first order autocorrelation in the

[8]Simonds and Collins (1978) adopted the method based on Merrington and Thompson (1943).

residuals. Therefore, the t-statistics reported above should be relatively independent.

The test statistics and critical values (.05 significance level) are given below for the joint probability assessments:

	1978	1979
Mean of Squared t-statistics (43 obsns. for 1978; 40 obsns. for 1979)	1.507	3.266
Critical Value (.05 significance level)[9]	1.373	1.387

The probability of drawing samples of 43 or 40 t^2's with means greater than 1.373 and 1.387, respectively, given that the t-statistics are independent, is .05. It can therefore be concluded that the observed mean t^2's of 1.507 and 3.266 are significantly larger-than-expected, indicating the joint occurrence of significant abnormal return behavior across the periods investigated.

Jaffe Portfolio Method

As mentioned previously, one of the more powerful methodologies for assessing abnormal return behavior is the Jaffe (1974) portfolio method. Under the Jaffe method, daily portfolios of individual firm returns which are signed based on an expectations model are constructed. The standardized mean return for any portfolio should be independent of other portfolio standardized means since the returns comprising any daily portfolio are serially uncorrelated with the returns of a different day's portfolio.

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[9] The formula for the critical value is

$$\frac{\chi^2_\alpha(n)}{n} = \frac{1}{2n}\left(Z_\alpha + \sqrt{2n-1}\right)^2.$$

n = 43 and 40 for 1978 and 1979 respectively and $Z_{.05} = 1.645$.

Two decisions requiring researcher judgment are necessary prior to conducting the Jaffe test. The first is development of an expectation model. Discussion of the expectation model to be applied in the current study was given in the previous chapter.

The second decision requiring researcher judgment involves choosing an appropriate portfolio holding strategy. Initially it was assumed that stocks were purchased (or sold short) four days prior to, and liquidated 20 days after the disclosure date. The long holding period was chosen in an effort to capture price reactions which might have been lagged (i.e., not instantaneous) due to the high degree of imprecision inherent in the RRA estimates. For each firm the 25 CRSP (calendar) days associated with this holding period were identified. A frequency count of the total number of firms in each CRSP (calendar)-day portfolio revealed that, of 53 total portfolios, 24 contained 11 securities or less (see Appendix D). In order to ensure a satisfactory sample size for each portfolio, these 24 days (and corresponding portfolios) were dropped. The result of dropping these days was to adopt a holding strategy of slightly less than 25 trading days around the disclosure date for 23 of the 81 firms in the treatment sample.[10] The remaining 29 portfolios contained an average of 65 firms each, with the smallest portfolio containing 22 firms. These 29 portfolios are related to CRSP dates 4445 through 4473 (see Appendix F for associated calendar dates).

The expectation model discussed in Chapter II was applied to all firm returns in each of the 29 portfolios. The result of its application was to change the sign of each return when the unexpected RRA

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[10]Firms experiencing non-trade days were excluded from corresponding daily portfolios. This contributed to the problem of sparse portfolios.

income ("Other") was negative. If market reaction was widespread across treatment firms, and if the expectation model predicts well, the effect of applying the model would be to significantly increase the total value of the portfolios. The mean of the 29 untreated portfolios was .00064 while the mean of the treated portfolios was .00106, or 65 percent higher than the untreated portfolios. The change in the mean of the portfolios was in the predicted direction. Appendix E contains the portfolio mean returns before and after standardization. After each portfolio had been divided by related portfolio standard deviations, the effect of the expectation model was to increase the overall standardized mean by 247 percent (from -.1075 to .1584). Of the 1,894 total untreated firm returns in all portfolios, 1,013 were negative and 881 were positive. After treating all returns with the expectation model, 916 returns were negative and 978 were positive. Of the 29 total untreated portfolio means, 16 were negative and 13 were positive. After application of the model 12 were negative and 17 were positive.

In order to test for significance, a Wilcoxon Matched-Pairs Signed-Ranks Test was conducted. The resulting observed Z-statistic was -1.049 which is associated with a one-tailed probability of occurrence under H_0: No difference in treated vs. untreated portfolio means of p = .147. Although the change in the mean value of the portfolios was in the right direction, the significance of the application of the expectation model is weak as measured by the Wilcoxon test. In order to inspect visually the results of applying the expectation model to firm returns, the untreated and treated portfolio means were plotted in Figure 14 and the respective standardized portfolio means were plotted in Figure 15. Inspection of both figures reveals that the effect of applying the expectation model was to eliminate the large negative portfolio returns thereby increasing the overall mean.

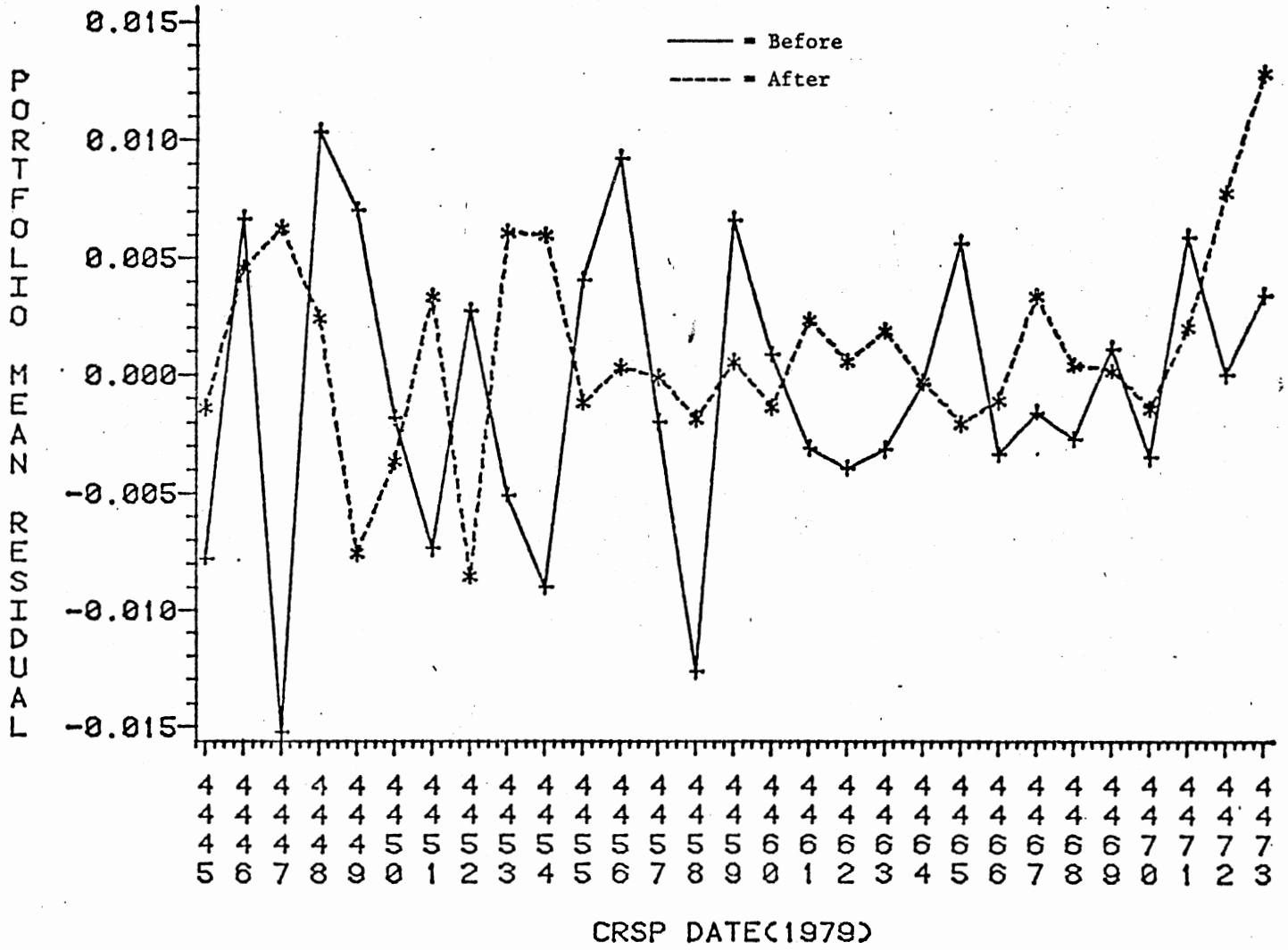

Figure 14. Plot of the Portfolio Daily Means Before and After the Application of the Expectation Model Used for the Jaffe Test

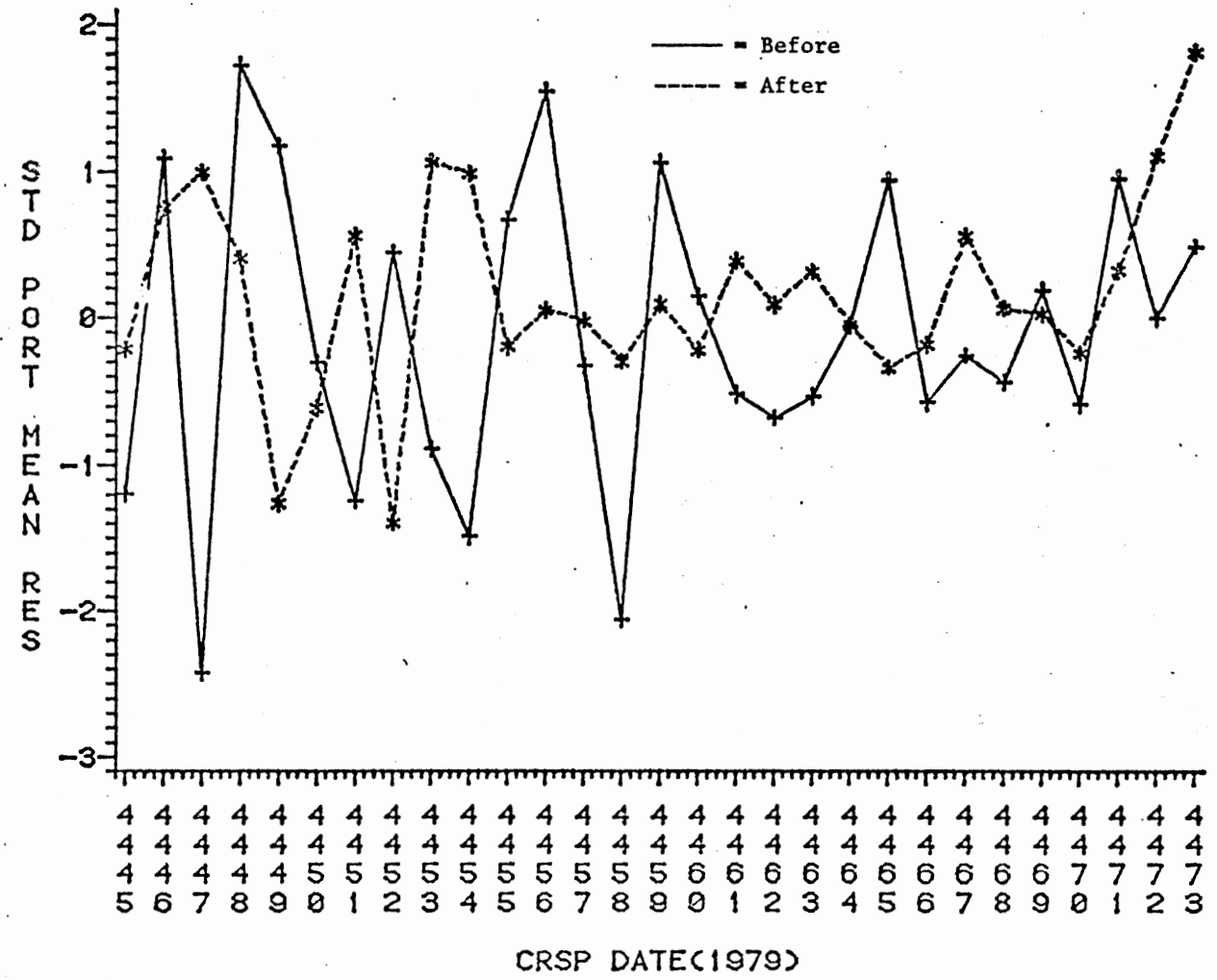

Figure 15. Plot of the Standardized Portfolio Daily Means Before and After the Application of the Expectation Model Used for the Jaffe Test

Once the expectation model was applied, and each of the 29 portfolios were constructed, 29 portfolio standard deviations were computed for use in standardizing the portfolio means. In order to compute a portfolio standard deviation, the residuals of all firms which are members of a portfolio are averaged for each day of a regression period. Eighty consecutive regression period residuals were used. The mean daily residuals are portfolio returns for each of the 80 days. These 80 observations were then used to compute a standard deviation for the portfolio. Appendix E contains the portfolio means before and after standardization. The overall mean of the standardized portfolio means was 0.1584. The resulting computed t-value was 0.853 with 2,291 associated degrees of freedom. The related tabular t-value is .842 at the 0.20 level of significance and 1.036 at the 0.15 level of significance. The probability of observing a larger t value, given that the mean portfolio standardized return is really less-than-or-equal-to-zero is approximately 20 percent. These results should be interpreted cautiously. Of the 29 portfolios, 25 contained at least 64 firms. If reaction to the RRA data was not simultaneous across calendar days, the smaller firm-returns would tend to bring down the larger returns resulting in daily mean portfolio returns which are small. The Jaffe test may not be an appropriate test when many portfolios are considered.

Since the early CRSP-day portfolios contain firm returns on or near the 10-K filing dates, the Jaffe test was applied to a subset of the 29 portfolios. Portfolios were chosen which contained firm trade days of not less than 3 days after the 10-K filings. Portfolios 4453 through 4473 comprised the 21 members subset for the additional test. Contrary to the notion of incremental 10-K effects, the computed

t-statistic increased to 1.17 which is significant at the 0.15 level. The increased significance resulting from the subset of portfolios indicates that (1) the original results based on 29 portfolios was not due solely to incremental 10-K information, and (2) the subset of portfolios in the post-filing period were more singificant than all 29 portfolios. In fact, the portfolio with the largest positive standardized mean was the latest portfolio corresponding to CRSP day 4473 (the standardized mean was 1.8079). The related trade days of firms in portfolio 4473 were primarily in the range of 16 to 20 days subsequent to the 10-K filing.

In summary, the Jaffe test produced results which were inconclusive. However, when the notion of RRA subjectivity and possible lack of simultaneity of market reaction is considered, the observed significance levels of the two tests become more palatable.

CHAPTER IV

SUMMARY AND CONCLUSIONS

Based on the research conducted, at least two observations can be made. First, inclusion of the industry index in the market model significantly contributed to the predictability of firm-specific abnormal returns. Seventy-seven percent of the industry index coefficients from firm-specific models for 1979 tested significant at the 0.05 level of significance. The industry index was related in a linear fashion to the corresponding individual-firm returns of 64 companies for 1979.

Second, the research indicated that widespread abnormal return behavior occurred contemporaneously with the treatment firm disclosures. Almost every treatment-sample firm experienced actual returns falling outside of 5 percent prediction intervals near the disclosure dates for both 1978 and 1979. Should this contemporaneous occurrence be construed as a cause-effect relationship, it can be concluded that the market found RRA disclosures useful even in the light of its inherent subjectivity. Tests for the significance of proportions indicated that the frequency of occurrence of actual returns falling outside of the related 5 percent prediction intervals was indeed abnormally high.

Various aggregate analyses were conducted for the disclosure periods and all but the Jaffe method indicated that significant abnormal return behavior occurred during the test periods. Perhaps the most revealing results come from the plottings of the average prediction

errors. The comparative plottings of treatment and control sample deflated average absolute residuals for 1978 and 1979 clearly depict the occurrence of some phenomenon in the treatment sample residuals that was absent from the control sample residuals. Tests of H_0: No difference between treatment sample vs. control sample means for given calendar days resulted in rejection of H_0 for an abnormally high number of days. Even though the Jaffe method produced inconclusive results, possible lack of simultaneity of market reaction across firms provides a rationale for explaining the tempered results.

Assuming that the contemporaneous occurrence of RRA disclosure and abnormal return behavior is due to a cause-effect relationship, an explanation as to why RRA might provide superior information is needed. As discussed previously, most of the data provided by the RRA supplemental disclosures is available to the investing public prior to its formal disclosure in the 10-K. Significant discoveries of oil are reported in the financial press as they occur. Price changes usually are reported in both financial periodicals and on nationwide news broadcasts. Accretion of discount is totally predictable. The sole element of RRA disclosures which seems to be unpredictable is the "revision of prior estimates" component. Two sources of information would be contained in this component--revision of estimated quantities of proved reserves and revision of management's estimated rate of future production. These elements would be of use to both short-run and long-run investors. Of course, this information could be provided via quantity disclosures only. This study is not concerned with seeking the appropriate mode of disclosure. Management would seem to have a comparative advantage over financial analysts and the investing public at estimating production rates and reserve quantities. Therefore

the information could be perceived as superior even though it is highly imprecise when compared with ultimate actual amounts.

Limitations

The results discussed above are subject to the following limitations. The control sample used in the numerous plottings and in the t tests of equality of treatment vs. control sample means contained a smaller number of observations than did the treatment sample. As a result, the levels of confidence associated with the control sample means as estimates of population means of daily returns is lower than the levels of confidence corresponding to the treatment sample means. However, this effect should be mitigated by an increase in the estimated (pooled) variances which were computed for the t tests.

Many of the statistical tests applied in this study require (1) cross-sectional independence of prediction errors, and (2) the normal distribution of daily returns. Smith and Dyckman (1981) criticized Lev's (1979) use of confidence intervals to make inferences regarding abnormal stock return behavior due to possible violation of these two assumptions:

> Due to the influence of an industry factor or other relevant variables omitted from the market model, it is highly unlikely that return prediction errors for a given day are independent (p. 963).
>
> Daily returns have been shown to conform to a fat-tailed leptokurtic distribution, departing substantially from the normal distribution (pp. 963-964).

Violation of the independence assumption should be less likely in the current study since (1) an industry factor was included in the individual-firm regression models and (2) 33 consecutive prediction intervals (each daily return should be serially uncorrelated with all

other daily returns for a given firm) were computed for each firm. Lev (1979) computed only 7 intervals per firm and found a larger than expected-by-chance number of deviations from the confidence intervals for only two days. The prediction errors for these two days would not be cross-sectionally independent, and due to the insufficient number of days, Lev did not take advantage of the absence of serial correlation among daily returns.

Regarding the violation of the normality assumption, it has been shown that the distribution of the t statistic is relatively stable for populations that are non-normal but possess a mound-shaped probability distribution (see Mendenhall (1975), p. 217). Also, significant results were observed consistently across the many tests applied in this study.

Another limitation of the study involves the inability of the expectation model to significantly increase the values of the Jaffe portfolios, even though the model did produce changes in the predicted direction. The lack of significance could be attributed to (1) mis-specification of the model, (2) lack of simultaneity of market reaction, and/or (3) the long holding period adopted for the test.

Additionally the R^2's for the individual firm models were in most cases below 0.40 indicating the notorious inability to predict a daily "normal" return. The average R^2's across firms was 0.2300 and 0.2604 for 1978 and 1979 respectively.

Finally, none of the applied methodologies explicitly incorporated the notion of subjectivity. Although lack of instantaneous and simultaneous reaction was discussed, none of the tests included expectations of lagged reactions due to expected degrees of subjectivity of the firm specific RRA data.

Future Research

The results of this study highlight the need for important future research. An explicit theory of the relationship between the degree of subjectivity inherent in data and possible lagged market reactions upon its disclosure needs to be formulated into a practically applicable methodology. Continued research is needed to improve the "normal return" measurement process, thereby improving the reliability of the abnormal return measure. Also, additional research is needed regarding the appropriate use of individual-firm analyses vis-a-vis aggregate analyses in information content studies.

In summary, on-going research should be conducted in an effort to improve the reliability of the market test methodologies currently in use. The researcher's inability to specify an appropriate measure of normal returns would ultimately lead to incorrect inferences regarding abnormal return behavior. The results of this research illustrate that inclusion of an additional parameter in the "market model" can lead to significant improvement in the measurement of firm-specific abnormal returns. For some firms the precision of normal return measurement nearly doubled. It might be appropriate for researchers to abandon the general use of the market model and use different firm-specific normal return models across sample firms. Use of the market model in this study for the years 1978 and 1979 resulted in R^2's of less than 0.10 for 19 different firms' daily returns. For these firms all but 10 percent of any daily return would, on average, be measured as an abnormal return. Should the same model be used for all firms when, for one firm the R^2 is 0.50 and for another firm the R^2 is 0.003? Future research should address this question.

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APPENDICES

APPENDIX A

REGRESSION RESULTS FOR EACH FIRM IN THE 1978 AND 1979 TREATMENT SAMPLES

For 1978, the late filing firms (filing Form 8 amendments) are listed separately from the on-time filers. For 1979, the sample is divided dependent on the sign of the unexpected RRA income, based on the expectation model adopted for the Jaffe Portfolio Method. Significant, or inconclusive autocorrelation, determined by application of the Durbin-Watson d statistical test, is indicated by (S+) or (S-). A plus means inclusion of the industry index increased the first order autocorrelation whereas a minus indicates a reduction in autocorrelation resulting from inclusion of the industry index. The number of returns falling outside of prediction intervals was determined by inspecting the 33 returns and intervals covering the period from two days prior to the disclosure date through 30 days after that date.

TABLE V

SUMMARY STATISTICS FROM INDIVIDUAL-FIRM REGRESSIONS--1978

1978 Late Filing Firms	R^2			Market Index t-Statistic		Industry Index t-Statistic		Dual Index Model				
	Market Index Only	Market and Industry Indexes	Increase	t-value	Significant (5%)	t-value	Significant (5%)	Durbin-Watson d Statistic	First Order Auto-correlation of Residuals	Number of Returns Falling Outside of 95% Prediction Intervals	$\hat{\beta}_1$	$\hat{\beta}_2$
Adobe Oil and Gas	.232	.281	.049	7.274	S	3.151	S	2.244	-.1467	3	1.7219	.8054
Amerada Hess	.379	.432	.053	9.506	S	3.714	S	1.920	.0312	5	1.4112	.5406
American Petrofina	.044	.046	.002	2.614	NS	.537	NS	2.089	-.0464	4	.3316	.0709
Aquitaine Co. of Canada LTD	.048	.049	.001	2.723	NS	-.364	NS	1.973	.0113	0	.5721	-.0850
Arkansas-Louisiana Gas	.203	.247	.044	6.141	S	2.944	S	1.989	.003	2	.6528	.3033
Baruch-Foster	.008	.009	.001	1.097	NS	.461	NS	2.780(S+)	-.3961	1	.5990	.2434
Belco Petroleum	.297	.298	.001	7.916	S	.295	NS	1.946	.0247	11	.9925	.0393
Bow Valley Inds.	.243	.280	.037	6.888	S	2.751	S	2.063	-.0385	2	2.0275	.8077
Buttes Gas and Oil	.332	.387	.055	8.577	S	3.637	S	2.349(I+)	-.2228	3	2.1359	.9497
Canadian Merrill LTD	.147	.149	.002	5.049	S	.524	NS	2.095	-.0493	0	1.1606	.1292
Canadian Superior Oil	.038	.099	.061	2.420	S	3.146	S	1.443(S-)	.2767	0	.3931	.4523
Chieftain Development Co.	.234	.260	.026	6.723	S	2.255	S	1.840	.0753	3	1.8321	.6558
Cities Service	.238	.244	.006	6.780	S	-1.064	NS	1.925	.0343	4	.5108	-.0911
Conoco	.318	.353	.035	8.311	S	2.813	S	1.922	.0255	2	1.0701	.3665
Crown Central Petroleum	.084	.084	--	3.677	S	-.302	NS	1.945	.0253	7	.8104	-.0717
Damson Oil	.166	.166	--	5.426	S	-.155	NS	2.409(S-)	-.2159	1	1.7157	-.0527
Dome Petroleum	.151	.166	.015	5.135	S	1.600	NS	1.821	.0876	6	1.1848	.3807
Exxon	.339	.351	.012	8.709	S	1.647	NS	2.255	-.1321	2	.7336	.1439
Felmont Oil	.286	.287	.001	7.705	S	.241	NS	1.896	.0363	1	1.3469	.0460
Getty Oil	.221	.246	.025	6.472	S	2.211	S	1.953	.0192	5	1.0151	.3509
Gulf Oil	.199	.218	.019	6.069	S	1.892	NS	2.173	-.0966	1	.6662	.2133
Hudsons Bay Oil and Gas	.040	.041	.001	2.491	S	-.310	NS	2.252	-.1270	2	.3712	-.0499
Imperial Oil	.139	.157	.018	4.886	S	1.794	NS	2.222	-.1161	2	.7833	.2748
Inexco Oil	.377	.453	.076	9.473	S	4.516	S	2.592(S-)	-.2973	3	2.1596	.9878
Louisiana Land & Exploration	.266	.270	.004	7.331	S	.851	NS	2.312(I-)	-.1579	4	.9205	.1146
Marathon Oil	.234	.237	.003	6.725	S	.775	NS	1.585(S-)	.2059	6	.7709	.0947
Mesa Petroleum	.256	.281	.025	7.140	S	2.256	S	1.840	.0800	4	1.0174	.3381
Mobil Corp.	.288	.289	.001	7.736	S	.475	NS	2.257	-.1289	4	.6544	.0439
Mountain Fuel Supply	.308	.318	.010	8.125	S	1.411	NS	2.053	-.0270	2	.9680	.1775
Murphy Oil	.247	.253	.006	6.976	S	1.008	NS	1.971	.0135	0	1.4862	.2346
Natomas	.447	.488	.041	10.945	S	3.403	S	2.041	-.0230	4	1.5891	.5028
Newmont Mining	.180	.194	.014	5.690	S	-1.602	NS	2.151	-.0851	1	.8992	-.2836
Occidental Petroleum	.279	.300	.021	7.572	S	2.105	S	1.916	.0348	4	1.1375	.3489
Phillips Petroleum	.173	.174	.001	5.558	S	.475	NS	1.855	.0696	2	.0641	.0568
Pioneer Corp-Texas	.254	.254	--	7.095	S	-.108	NS	2.131	-.0606	3	.7740	-.0120

TABLE V (Continued)

1978 Late Filing Firms	R^2 Market Index Only	R^2 Market and Industry Indexes	R^2 Increase	Market Index t-Statistic t-value	Market Index t-Statistic Significant (5%)	Industry Index t-Statistic t-value	Industry Index t-Statistic Significant (5%)	Dual Index Model Durbin-Watson d Statistic	Dual Index Model First Order Auto-correlation of Residuals	Dual Index Model Number of Returns Falling Outside of 95% Prediction Intervals	Dual Index Model $\hat{\beta}_1$	Dual Index Model $\hat{\beta}_2$
Quaker State Oil Refining	.288	.295	.007	7.741	S	1.185	NS	1.935	.0305	3	1.2558	.2058
Ranger Oil Canada	.336	.355	.019	8.660	S	2.054	S	2.122	-.0641	2	1.7019	.4175
Shell Oil	.160	.160	--	5.304	S	.023	NS	1.912	.0429	2	.6479	.0028
Southern Natural Resources	.118	.136	.018	4.439	S	-1.793	NS	2.256	-.1321	0	.4958	-.2283
Standard Oil of California	.346	.346	--	8.842	S	.218	NS	2.053	-.0293	3	.8179	.0205
Standard Oil of Indiana	.239	.244	.005	6.827	S	.909	NS	1.618(S-)	.1878	0	.5288	.0811
Standard Oil of Ohio	.231	.249	.018	6.674	S	1.878	NS	1.862	.0668	0	1.0168	.2967
Sun Oil	.172	.172	.001	5.538	S	.553	NS	1.946	.0208	1	.5434	.0584
Sundance Oil	.173	.218	.045	5.580	S	2.891	S	2.430(S-)	-.2189	0	1.6973	.8625
Superior Oil	.258	.276	.018	7.175	S	1.928	NS	1.580(S-)	.2062	1	.6960	.1992
Tenneco	.155	.158	.003	5.212	S	-.759	NS	2.004	-.0060	1	.4538	-.0716
Texaco	.142	.173	.031	4.943	S	2.344	S	2.331(I+)	-.1664	1	.6378	.3088
Texas Gas Transmission	.109	.112	.003	4.254	S	-.656	NS	2.017	-.0098	1	.4131	-.0712
Texas International	.239	.270	.031	6.823	S	2.503	S	2.368(I+)	-.1943	0	2.0529	.7653
Union Oil of California	.253	.259	.006	7.088	S	1.074	NS	1.658(I-)	.1684	5	.6185	.0998
Wichita Industries	.258	.258	--	7.169	S	.296	NS	2.375(S+)	-.1899	1	2.9576	.1201
1978 On-Time Filing Firms												
American Natural Resources	.073	.076	.003	3.414	S	-.696	NS	2.057	-.0361	1	.3501	-.0774
Apache	.260	.262	.002	7.209	S	.689	NS	2.274	-.1372	2	1.2781	.1370
Atlantic Richfield	.266	.302	.036	7.325	S	2.740	S	2.091	-.0484	0	.7990	.2993
Barber Oil	.117	.117	--	4.431	S	-.248	NS	1.940	.0244	4	.5376	-.0341
British Petroleum	.003	.005	.002	-.6223	NS	-.6225	NS	1.831	.0825	5	-.0865	-.0724
C & K Petroleum	.346	.442	.096	8.856	S	5.021	S	2.145	-.0763	1	2.2798	1.2664
Canadian Homestead Oils LTD	.133	.222	.089	4.769	S	4.083	S	2.176	-.0890	1	1.4769	1.1825
Charter	.255	.260	.005	7.119	S	.965	NS	2.279	-.1439	8	2.0541	.2903
Clark Oil and Refining	.229	.232	.003	6.624	S	.763	NS	1.787	.1048	3	1.3814	.1720
Coastal	.288	.299	.011	7.740	S	1.510	NS	2.224	-.1134	1	1.7156	.3623
Consolidated Natural Gas	.143	.146	.003	4.970	S	.750	NS	1.881	.0586	0	.4233	.0648
Crystal Oil	.220	.235	.015	6.454	S	1.724	NS	2.098	-.0542	2	1.4600	.4213
Delhi International	.225	.225	--	6.547	S	.2115	NS	2.356(I-)	-.1868	2	1.6483	.0594
Diamond Shamrock	.226	.229	.003	6.574	S	-.691	NS	2.088	-.0464	0	1.1552	-.1406
Florida Gas	.192	.196	.004	5.937	S	-.776	NS	2.188	-.0965	11	.7052	-.1051
General Exploration	.131	.153	.022	4.713	S	1.993	S	2.593(S+)	-.2982	1	1.8618	.7951

TABLE V (Continued)

1978 On-Time Filing Firms	R^2 Market Index Only	R^2 Market and Industry Indexes	R^2 Increase	Market Index t-Statistic t-value	Market Index t-Statistic Significant (5%)	Industry Index t-Statistic t-value	Industry Index t-Statistic Significant (5%)	Dual Index Model Durbin-Watson d Statistic	Dual Index Model First Order Auto-correlation of Residuals	Dual Index Model Number of Returns Falling Outside of 95% Prediction Intervals	Dual Index Model $\hat{\beta}_1$	Dual Index Model $\hat{\beta}_2$
Houston Oil and Minerals	.183	.201	.018	5.757	S	1.799	NS	2.497(S+)	-.2541	0	1.5943	.4988
Husky Oil	.022	.032	.010	1.819	NS	1.223	NS	2.066	-.0332	0	.8483	.5681
Juniper Petroleum	.121	.121	--	4.508	S	.117	NS	2.502(S+)	-.2597	0	2.0147	.0525
Kerr-McGee	.243	.245	.011	6.887	S	1.460	NS	1.902	.0487	4	.8651	.1893
Kirby Exploration	.320	.320	--	8.349	S	-.145	NS	1.874	.0582	0	1.7122	-.0332
Northwest Energy	.226	.234	.008	6.579	S	1.182	NS	1.845	.0714	5	.7120	.1391
Numac Oil and Gas LTD	.181	.214	.033	5.718	S	2.475	S	1.823	.0816	1	1.6110	.7097
Panhandle Eastern Pipeline	.223	.224	.001	6.522	S	.261	NS	2.057	-.0288	1	.5752	.0249
Pennzoil	.307	.308	.001	8.105	S	.228	NS	1.959	.0183	0	.8770	.0262
Reading and Bates	.383	.386	.003	9.578	S	.866	NS	2.004	-.0035	0	1.5246	.1504
Reserve Oil and Gas	.290	.327	.037	7.771	S	2.842	S	2.187	-.1213	1	1.4530	.5455
Santa Fe International	.272	.272	--	7.431	S	.285	NS	1.897	.0502	6	1.2037	.0519
Southern Union	.045	.046	.001	2.640	S	-.399	NS	2.292(I-)	-.1512	0	.4098	-.0690
Texas Eastern	.238	.132	.005	6.792	S	1.003	NS	1.779	.1025	2	.7908	.1246
Total Petroleum North America LTD	.294	.343	.049	7.860	S	3.291	S	2.096	-.0520	1	2.2187	.9355
Transco Companies	.251	.254	.003	7.047	S	.708	NS	2.101	-.0928	1	1.3441	.1325
United Energy Resources	.240	.245	.005	6.841	S	.963	NS	1.614(S-)	.1838	0	.8092	.1216
Wainco Oil	.173	.173	--	5.561	S	.235	NS	2.178	-.0928	1	1.3848	.0598
Wilshire Oil of Texas	.200	.226	.026	6.085	S	2.224	S	2.597(S-)	-.3078	2	1.7242	.6534
Woods Petroleum	.122	.139	.017	4.540	S	1.709	NS	1.797	.0859	1	1.0511	.4028

TABLE VI

SUMMARY STATISTICS FROM INDIVIDUAL-FIRM REGRESSIONS--1979

1979 Firms (Expectations = Negative)	R^2 Market Index Only	R^2 Market and Industry Indexes	R^2 Increase	Market Index t-Statistic t-value	Market Index t-Statistic Significant (5%)	Industry Index t-Statistic t-value	Industry Index t-Statistic Significant (5%)	Dual Index Model: Durbin-Watson d Statistic	Dual Index Model: First Order Auto-correlation of Residuals	Dual Index Model: Number of Returns Falling Outside of 95% Prediction Intervals	Dual Index Model: $\hat{\beta}_1$	Dual Index Model: $\hat{\beta}_2$
Adobe Oil and Gas	.093	.095	.002	3.884	S	.663	NS	2.396(S+)	-.2088	4	.9503	.1106
Amerada Hess	.197	.264	.967	6.022	S	3.661	S	2.016	-.0109	0	1.3998	.5742
American Petrofina	.156	.177	.021	5.235	S	-1.916	NS	1.619(S+)	.1865	3	1.0772	-.2675
Apache	.248	.331	.083	6.980	S	4.271	S	1.973	.0100	2	1.8229	.7312
Arkansas Louisiana Gas	.229	.233	.004	6.631	S	.887	NS	1.564(S+)	.2148	12	.9427	.0842
Belco Petroleum	.189	.314	.125	5.848	S	5.201	S	1.817	.0876	1	1.3550	.7453
Bow Valley Inds LTD	.144	.158	.014	4.982	S	1.583	NS	2.147	-.0755	4	1.5132	.3259
C & K Petroleum	.135	.189	.054	4.808	S	3.125	S	2.001	-.0047	0	1.7786	.7726
Chieftain Development LTD	.216	.259	.043	6.391	S	2.920	S	2.121	-.0732	6	1.9606	.6197
Cities Service	.180	.258	.078	5.697	S	3.939	S	1.906	.0403	4	.8924	.3774
Consolidated Natural Gas	.220	.220	--	6.454	S	.324	NS	1.817	.0907	4	.7799	.0267
Crown Central Petroleum	.165	.202	.037	5.410	S	2.625	S	1.858	.0682	3	1.6762	.5335
Crystal Oil	.275	.347	.072	7.485	S	4.039	S	2.056	-.0336	0	2.0133	.6994
Dome Petroleum LTD	.051	.103	.052	2.825	S	2.917	S	2.039	-.0307	0	1.1108	.7665
Exxon	.221	.306	.085	6.477	S	4.233	S	1.758	.1170	3	.7414	.3054
Felmont Oil	.353	.409	.056	8.981	S	3.727	S	1.867	.0484	3	1.8555	.5105
Getty Oil	.205	.312	.107	6.180	S	4.777	S	1.621(S-)	.1805	2	1.1112	.5475
Hudsons Bay Oil and Gas LTD	.139	.243	.104	4.888	S	4.487	S	1.749	.1207	6	.9271	.5403
Imperial Oil LTD	.248	.283	--	6.987	S	2.680	S	1.488(S-)	.2477	4	1.3229	.3411
Juniper Petroleum	.296	.387	.091	7.880	S	4.687	S	2.065	-.0357	1	2.5067	.9651
Kansas-Nebraska Natural Gas	.078	.082	.004	3.538	S	.772	NS	1.812	.0906	1	.6550	.0906
Kerr-McGee	.273	.322	.049	7.458	S	3.242	S	1.992	.0013	11	.9636	.2849
Louisiana Land & Exploration	.094	.132	.038	3.919	S	2.530	S	2.050	-.0470	1	1.0144	.4368
Marathon Oil	.257	.406	.149	7.154	S	6.075	S	1.984	-.0018	2	1.3621	.7102
Mesa Petroleum	.071	.238	.167	3.352	S	5.678	S	1.989	-.0031	3	.8447	.8603
Mobil	.181	.335	.143	5.726	S	5.837	S	2.068	-.0462	7	1.2274	.7558
Mountain Fuel Supply	.129	.136	.017	4.685	S	1.717	NS	2.044	-.0229	1	1.0292	.2637
Murphy Oil	.277	.326	.049	7.531	S	3.270	S	1.983	.0041	2	1.3209	.3689
Occidental Petroleum	.161	.263	.102	5.325	S	4.509	S	2.125	-.0670	4	1.2599	.7005
Panhandle Eastern Pipeline	.176	.191	.015	5.613	S	1.656	NS	1.503(S-)	.2458	2	.6151	.1194
Pennzoil	.173	.269	.096	5.563	S	4.398	S	2.125	-.0651	4	1.1620	.5870
Phillips Petroleum	.228	.354	.126	6.612	S	5.367	S	1.992	-.0006	7	.9591	.5054
Pioneer Corp-Texas	.230	.246	.016	6.656	S	1.761	NS	1.619(S-)	.1890	2	1.1436	.2072
Ranger Oil Canada LTD	.261	.331	.070	7.235	S	3.919	S	1.778	.1108	2	1.8733	.6585
Reading and Bates	.234	.263	.029	6.730	S	2.372	S	1.640(I-)	.1627	2	1.4228	.3366

TABLE VI (Continued)

1979 Firms (Expectations = Negative)	R^2 Market Index Only	R^2 Market and Industry Indexes	R^2 Increase	Market Index t-Statistic t-value	Market Index t-Statistic Significant (5%)	Industry Index t-Statistic t-value	Industry Index t-Statistic Significant (5%)	Dual Index Model Durbin-Watson d Statistic	Dual Index Model First Order Auto-correlation of Residuals	Dual Index Model Number of Returns Falling Outside of 95% Prediction Intervals	$\hat{\beta}_1$	$\hat{\beta}_2$
Scurry Rainbow Oil LTD	.102	.124	.022	4.098	S	1.913	NS	1.826	.0854	0	1.4321	.4027
Southern Natural Resources	.161	.171	.010	5.320	S	1.347	NS	1.765	.1100	9	.7979	.1369
Southern Union	.147	.160	.013	5.056	S	1.513	NS	2.416(S+)	-.2196	6	.9206	.1854
Standard Oil of Indiana	.305	.400	.095	8.064	S	4.816	S	1.346(S-)	.3252	6	.7876	.2882
Sun Oil	.304	.374	.070	8.040	S	4.051	S	1.689(I-)	.1508	2	1.1087	.3692
Sundance Oil	.173	.205	.032	5.573	S	2.410	S	1.969	.0117	4	1.8661	.5631
Superior Oil	.213	.304	.091	6.333	S	4.376	S	1.565(S-)	.2059	5	1.2629	.5386
Supron Energy	.226	.276	.050	6.572	S	3.181	S	2.153	-.0910	2	1.6818	.5381
Tenneco	.423	.448	.025	10.410	S	2.608	S	1.911	.0381	1	1.1570	.2049
Texaco	.271	.350	.079	7.422	S	4.214	S	1.878	.0206	5	.9941	.3839
Texas Gas Transmission	.150	.183	.033	5.115	S	2.413	S	1.939	-.0002	5	.8754	.2685
Texas International	.072	.075	.003	3.377	S	.703	NS	2.157	-.0877	0	1.2677	.1839
Transcontinental Oil	.191	.247	.056	5.913	S	3.296	S	2.429(S+)	-.2262	2	2.0292	.8057
Union Oil of California	.249	.321	.072	7.007	S	3.959	S	1.616(S+)	.1911	3	1.2892	.4872
United Energy Resources	.238	.276	.038	6.805	S	2.752	S	1.822	.0865	12	1.0464	.2782
Wainco Oil	.070	.159	.089	3.346	S	3.941	S	2.083	-.0466	1	1.4124	1.0881
Wilshire Oil Co. of Texas	.305	.317	.012	8.057	S	1.644	NS	2.271	-.1582	1	2.4524	.3748
Woods Petroleum	.211	.257	.046	6.289	S	3.035	S	2.212	-.1098	3	1.3803	.4381
1979 Firms (Expectations = Positive)												
American Natural Resources	.145	.155	.010	5.009	S	1.341	NS	1.874	.0553	4	.6839	.1265
Aquitaine Co. of Canada LTD	.181	.234	.053	5.715	S	3.208	S	1.746	.1224	1	1.6452	.5891
Atlantic Richfield	.222	.388	.166	6.504	S	6.305	S	1.857	.0657	6	.7872	.4628
Barber Oil	.045	.049	.004	2.645	S	.757	NS	1.999	-.0004	0	.7214	.1503
Buttes Gas and Oil	.176	.216	.040	5.618	S	2.748	S	2.375(S+)	-.2018	0	1.9620	.6797
Charter	.080	.124	.041	3.595	S	2.614	S	1.959	.0207	0	2.0113	.9524
Coastal	.336	.425	.089	8.652	S	4.788	S	1.836	.0631	11	1.7259	.6149
Conoco	.250	.339	.089	7.023	S	4.459	S	1.894	.0453	3	.9697	.3951
Delhi International Oil	.174	.201	.027	5.588	S	2.222	S	1.809	.0904	4	1.9001	.5101
Diamond Shamrock	.301	.326	.025	7.981	S	2.330	S	2.329(I-)	-.1655	2	1.4257	.2817
Gulf Oil	.197	.309	.112	6.016	S	4.899	S	2.0830	-.0419	7	1.0692	.5248
Houston Oil & Minerals	.188	.264	.076	5.849	S	3.903	S	2.157	-.0853	1	1.5234	.6765
Husky Oil	.218	.235	.017	6.425	S	1.818	NS	2.143	-.0792	2	1.1449	.2208

TABLE VI (Continued)

1979 Firms (Expectations = Positive)	R^2 Market Index Only	R^2 Market and Industry Indexes	R^2 Increase	Market Index t-Statistic t-value	Market Index t-Statistic Significant (5%)	Industry Index t-Statistic t-value	Industry Index t-Statistic Significant (5%)	Dual Index Model: Durbin-Watson d Statistic	Dual Index Model: First Order Auto-correlation of Residuals	Dual Index Model: Number of Returns Falling Outside of 95% Prediction Intervals	Dual Index Model: $\hat{\beta}_1$	Dual Index Model: $\hat{\beta}_2$
Inexco Oil	.238	.393	.155	6.793	S	6.139	S	2.209	-.1056	1	1.6904	.9273
Kirby Exploration	.133	.177	.044	4.770	S	2.791	S	1.998	.0002	4	1.3473	.5350
Natomas	.240	.412	.172	6.842	S	6.555	S	2.084	-.0496	3	1.5305	.8479
Newmont Mining	.174	.182	.008	5.580	S	1.176	NS	1.943	.0151	4	1.1979	.1684
Northwest Energy	.252	.278	.026	7.069	S	2.286	S	2.022	-.0108	6	1.6121	.3475
Pogo Producing	.209	.248	.039	6.250	S	2.783	S	2.084	-.0444	5	1.4903	.4844
Quaker State Oil Refining	.232	.245	.013	6.684	S	1.577	NS	2.174	-.0903	2	2.0813	.3264
Sante Fe International	.234	.280	.046	6.732	S	3.043	S	1.965	.0067	4	1.4265	.4397
Shell Oil	.254	.315	.061	7.094	S	3.637	S	1.598(S-)	.1883	1	1.0862	.3621
Standard Oil of California	.159	.299	.140	5.282	S	5.437	S	1.954	.0201	1	.8347	.5309
Standard Oil of Ohio	.234	.433	.199	6.726	S	7.181	S	1.782	.1074	5	1.1556	.7172
Texas Eastern	.179	.231	.052	5.677	S	3.156	S	1.923	.0313	3	.7350	.2888
Total Petroleum North America LTD	.190	.279	.089	5.890	S	4.257	S	2.059	-.0462	1	1.7576	.7962
Transco	.264	.296	.032	7.281	S	2.574	S	1.833	.0801	1	1.4762	.3481
Wichita Industries	.109	.162	.053	4.253	S	3.040	2	2.215	-.1144	1	1.7934	.9023
1979 Firms (Expectations = Unobtainable)												
Baruch-Foster	.160	.221	.061	5.304	S	3.388	S	2.078	-.0429	0	2.6081	1.1406
Crestmont Oil and Gas	.217	.254	.037	6.402	S	2.710	S	1.848	.0730	1	2.7227	.7513

APPENDIX B

COMPOSITION OF INDUSTRY INDEX

TABLE VII

COMPOSITION OF INDUSTRY INDEX

Firms Used to Derive Industry Average:	Fiscal Year End
Asamera Oil LTD	3-31
Ashland Oil	9-30
Barnwell Industries	9-30
Burns (R.L.)	7-31
Consolidated Oil and Gas	11-30
Damson Oil (1979 Only)	9-30
Dorchester Gas	8-31
General American Oil of Texas	6-30
Great Basins Petroleum	7-31
Helmerich & Payne	9-30
Holly	7-31
Houston Natural Gas	7-31
Lear Petroleum	9-30
McMoran Oil and Gas	6-30
Mitchell Energy & Development	1-31
OKC	9-30
Patrick Petroleum	4-30
Petro-Lewis	6-30
Tesoro	9-30
Texas Oil and Gas	8-31
Triton Oil and Gas	5-31
Universal Resources	10-31

Industry Index Summary Statistics:

1978	
Coefficient of Determination (R^2 from Industry Average Regression on Market Index)	.5914
Standard Deviation	.0098
Durbin-Watson d (Not significant at 5 percent)	1.6937
First Order Autocorrelation of Residuals	.1532
1979	
Coefficient of Determination (R^2 from Industry Average Regression on Market Index)	.6582
Standard Deviation	.0103
Durbin-Watson d (Significant at 5 percent)	1.6175
First Order Autocorrelation of Residuals	.1909

APPENDIX C

TRADE DATES FOR RETURNS FALLING OUTSIDE OF PREDICTION INTERVALS

TABLE VIII

TRADE DATES FOR RETURNS FALLING OUTSIDE OF PREDICTION INTERVALS

Trade Date	Total	1978 Late Filers	1978 On-Time Filers	1979 Negative Adjustments	1979 Positive Adjustments	1979 No Adjustments
-2	24	4	3	13	4	
-1	36	9	2	17	8	
0	15	2	1	9	2	1
1	20	4	3	9	4	
2	17	5	3	6	3	
3	20	4	3	7	6	
4	16	7	1	3	5	
5	14	5	2	4	3	
6	19	8	1	9	1	
7	20	6	3	7	4	
8	12	4	1	5	2	
9	10	4	2	4	0	
10	11	4	2	4	1	
11	11	3	1	3	4	
12	10	3	0	3	4	
13	13	5	0	6	2	
14	14	2	3	7	2	
15	10	1	3	3	3	
16	13	5	1	4	3	
17	12	1	4	6	1	
18	9	1	3	4	1	
19	9	4	1	2	2	
20	10	2	3	2	3	
21	9	2	3	1	3	
22	9	2	3	3	1	
23	11	4	3	1	3	
24	9	1	1	3	4	
25	7	0	2	5	0	
26	13	5	0	7	1	
27	13	7	2	3	1	
28	14	3	2	7	2	
29	7	1	2	4	0	
30	16	5	4	7	0	
Totals	453	123	68	178	83	1

APPENDIX D

FREQUENCY TABLE FOR FIRMS IN JAFFE PORTFOLIO

TABLE IX

FREQUENCY TABLE OF FIRMS WITH -4 THROUGH 20 TRADE DAYS
ACCUMULATED ON A CRSP DAY BASIS

CRSP Day	Frequency of Firms (with Trade Days -4 through 20)	Cumulative Frequency	Percent	Cumulative Present
4433	1	1	0.051	0.051
4434	1	2	0.051	0.101
4435	1	3	0.051	0.152
4436	1	4	0.051	0.202
4437	1	5	0.051	0.253
4438	1	6	0.051	0.303
4439	2	8	0.101	0.405
4440	3	11	0.152	0.556
4441	4	15	0.202	0.759
4442	4	19	0.202	0.961
4443	6	25	0.303	1.265
4444	11	36	0.556	1.821
4445	31	67	1.568	3.389
4446	72	139	3.642	7.031
4447	69	208	3.490	10.521
4448	75	283	3.794	14.315
4449	76	359	3.844	18.159
4450	74	433	3.743	21.902
4451	69	502	3.490	25.392
4452	69	571	3.490	28.882
4453	70	641	3.541	32.423
4454	77	718	3.895	36.318
4455	77	795	3.895	40.212
4456	78	873	3.945	44.158
4457	71	944	3.591	47.749
4458	68	1,012	3.440	51.189
4459	69	1,081	3.490	54.679
4460	69	1,150	3.490	58.169
4461	74	1,224	3.743	61.912
4462	71	1,295	3.591	65.503
4463	71	1,298	3.591	69.095
4464	70	1,436	3.541	72.635
4465	76	1,512	3.844	76.480
4466	68	1,580	3.440	79.919
4467	67	1,647	3.389	83.308
4468	66	1,713	3.336	86.646
4469	64	1,777	3.237	89.884
4470	59	1,836	2.984	92.868
4471	41	1,877	2.074	94.942
4472	31	1,908	1.568	96.510
4473	22	1,920	1.113	97.623
4474	7	1,937	0.354	97.977

TABLE IX (Continued)

CRSP Day	Frequency of Firms (with Trade Days -4 through 20)	Cumulative Frequency	Percent	Cumulative Present
4475	8	1,945	0.405	98.381
4476	8	1,953	0.405	98.786
4477	2	1,955	0.101	98.887
4478	3	1,958	0.152	99.039
4479	5	1,963	0.253	99.292
4480	3	1,966	0.152	99.444
4481	2	1,968	0.101	99.545
4482	3	1,971	0.152	99.697
4483	2	1,973	0.101	99.798
4484	2	1,975	0.101	99.899
4485	2	1,977	0.101	100.000

APPENDIX E

SUMMARY PORTFOLIO STATISTICS FOR JAFFE PORTFOLIO

TABLE X

SUMMARY PORTFOLIO STATISTICS FOR JAFFE PORTFOLIO

Portfolio Number	CRSP Date	Means Before Expectations Model	Means After Expectations Model	Standardized Portfolio Means			
				Before Expectations Model	After Expectations Model	Increase (Decrease)	Cumulative Increase (Decrease)
1	4445	-0.007766	-0.001401	-1.1964	-0.2158	0.9806	0.9806
2	4446	0.006678	0.004577	1.0960	0.7511	(0.3449)	0.6357
3	4447	-0.015252	0.006263	-2.4262	0.9962	3.4224	4.0581
4	4448	0.010363	0.002442	1.7193	0.4051	(1.3142)	2.7439
5	4449	0.007039	-0.007553	1.1750	-1.2610	(2.4360)	0.3079
6	4450	-0.001820	-0.003654	-0.3048	-0.6120	(2.3072)	0.0007
7	4451	-0.007358	0.003329	-1.2444	0.5630	1.8074	1.8081
8	4452	0.002723	-0.008423	0.4455	-1.3945	(1.8400)	(0.0319)
9	4453	-0.005102	0.006097	-0.8894	1.0629	1.9523	1.9204
10	4454	-0.008988	0.005974	-1.4841	0.9865	2.4706	4.3910
11	4455	0.004084	-0.001176	0.6741	-0.1941	(0.8682)	3.5228
12	4456	0.009263	0.000321	1.5494	0.0537	(1.4957)	2.0271
13	4457	-0.001985	-0.000136	-0.3259	-0.0223	0.3036	2.3307
14	4458	-0.012657	-0.001839	-2.0616	-0.2995	1.7621	4.0928
15	4459	0.006645	0.000578	1.0641	0.0925	(0.9716)	3.1212
16	4460	0.000879	-0.001339	0.1455	-0.2217	(0.3672)	2.7540
17	4461	-0.003078	0.002361	-0.5122	0.3930	0.9052	3.6592
18	4462	-0.003936	0.000554	-0.6807	0.0958	0.7765	4.4357
19	4463	-0.003130	0.001886	-0.5318	0.3204	0.8522	5.2879
20	4464	-0.000332	-0.000289	-0.0549	-0.0479	0.0070	5.2949
21	4465	0.005667	-0.002047	0.9447	-0.3412	(1.2859)	4.0090
22	4466	-0.003350	-0.001066	-0.5740	-0.1827	0.3913	4.4003
23	4467	-0.001572	0.003416	-0.2595	0.5640	0.8235	5.2238
24	4468	-0.002706	0.000412	-0.4396	0.0669	0.5065	5.7303
25	4469	0.001136	0.000182	0.1922	0.0307	(0.1615)	5.5688

TABLE X (Continued)

Portfolio Number	CRSP Date	Means Before Expectations Model	Means After Expectations Model	Standardized Portfolio Means: Before Expectations Model	Standardized Portfolio Means: After Expectations Model	Increase (Decrease)	Cumulative Increase (Decrease)
26	4470	-0.003459	-0.001409	-0.5843	-0.2380	0.3463	5.9151
27	4471	0.005963	0.002055	0.9554	0.3293	(0.6261)	5.2890
28	4472	0.000016	0.007798	0.0023	1.1048	1.1025	6.3915
29	4473	0.003463	0.012816	0.4885	1.8079	1.3194	7.7109
Totals				(3.1178)	4.5931	7.7109	
Means				(.1075)	.1584	.2609	

APPENDIX F

CROSS REFERENCE OF CRSP DATES WITH ASSOCIATED CALENDAR DATES

TABLE XI

CROSS REFERENCE OF CRSP DATES WITH ASSOCIATED CALENDAR DATES

Dates or Intervals Relating to:	CRSP Dates (or Intervals)	Associated Calendar Dates (or Intervals)
1978 On-Time Filing Firms	4180-4231	March 7, 1979 through May 18, 1979
1978 Late Filing Firms	4248-4290	June 13, 1979 through August 13, 1979
1979 Firms	4441-4480	March 18, 1980 through May 13, 1980
Jaffe Portfolios	4445-4473	March 24, 1980 through May 2, 1980
Single Dates Specifically Discussed in the Study--1978	4250	June 15, 1979
	4256	June 25, 1979
	4264	July 6, 1979
	4267	July 11, 1979
	4268	July 12, 1979
	4269	July 13, 1979
	4274	July 20, 1979
	4278	July 26, 1979
	4279	July 27, 1979
	4281	July 31, 1979
	4283	August 2, 1979
	4286	August 7, 1979
--1979	4441	March 18, 1980
	4448	March 27, 1980
	4449	March 28, 1980
	4451	April 1, 1980
	4453	April 3, 1980
	4456	April 9, 1980
	4462	April 17, 1980
	4463	April 18, 1980
	4464	April 21, 1980
	4467	April 24, 1980
	4473	May 2, 1980
	4477	May 8, 1980
	4478	May 9, 1980

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VITA

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