THE IMPLICATIONS OF EARNINGS QUALITY FOR MARKET REACTIONS TO ANNUAL EARNINGS ANNOUNCEMENTS

By

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

in

THE FACULTY OF GRADUATE STUDIES

FACULTY OF COMMERCE AND BUSINESS ADMINISTRATION

We accept this thesis as conforming

to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

April 1989

ISBN 0-315-50678-4

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Date April 28, 1989

DE-6 (2/88)

Abstract

This paper assesses the impact of earnings quality on market responses to annual earnings announcements. Earnings quality is measured by the ratio of earnings to funds from operations. The difference in the association between forecast errors and excess returns across the high/low quality earnings subsamples is found to be statistically significant; there is a greater market response to earnings announcements of high-quality firms than to low-quality firms. Hence, earnings quality as measured by the ratio of earnings to funds from operations, is found to have pricing implications. The results are robust across two regression models: OLS on returns ordered in announcement time and SUR/GLS on returns ordered in calendar time.

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Acknowledgement

I would like to express my sincere gratitude to Dr. Jack Hughes, my thesis committee chairman, for his guidance and support through the course of this study. He gave much of his valuable time in providing guidance, encouragement and advice. Without his patient direction, extensive discussion, and many constructive comments, this work may not have been possible. I also would like to thank Dr. George Gorelik and Dr. Dan Simunic , members of my thesis committee, who provided helpful comments.

Special thanks are also to Mr. James Xie, who has made helpful suggestions and assisted me, especially in computer data processing and statistics.

I am also grateful to my family and especially to my husband for his tireless help and moral support.

Chapter 1

Introduction

The purpose of this paper is to assess the impact of earnings quality on market reactions to earnings announcements : i.e., whether a statistically significant difference exists in the price sensitivity around the annual earnings announcements across high/low quality firms. Price sensitivity is measured in terms of the association between forecast errors [1] and excess returns.

Imhoff [1987] has modeled the effect of earnings quality on stock prices with quality expressed in the form of scores assigned by analysts' opinion. He found that annual earnings released from high-quality firms have information content while those released from low-quality firms are uninformative. This paper uses another measure to proxy for earnings quality : the ratio of earnings to funds from operations.

Several prior studies have investigated issues related to the information content of earnings and funds flow measures. Rayburn [1986] found significant association of both operating cash flow (funds from operations) and aggregate accruals with excess returns. Wilson [1987] found that cash and accrual components of earnings have incremental information content beyond earnings itself, and that the accrual component of earnings has incremental information content beyond the cash component. This paper is distinct in that the ratio of earnings to funds from operations is used as a measure of earnings quality in assessing the magnitude of the price response to earnings announcements.

The remainder of this paper is organized as follows : Section 2 discusses the theory

[1] In particular, changes in fourth-quarter earnings , see appendix A

and alternative hypothesis. Section 3 describes the data and research design. Section 4 presents the empirical findings. Section 5 concludes the paper.

Chapter 2

Theory and Hypotheses

According to a survey by Siegel [1982], earnings quality is quite a popular term with accountants, security analysts and financial managers. Yet, there is no common definition for it. However, some concepts have gained wide acceptance; see Siegel [1979] and Hawkins [1986].

The choices of accounting policies are one of the major factors which affect the quality of a firm's earnings. Given the economic environment and a firm's growth, the earnings determined by more conservative accounting policies are expected to have higher quality, because they are less likely to be overstated than those determined by liberal accounting policies which take an optimistic view to the future development of the firm.

Empirical evidence has shown that a company's share price is determined primarily by sophisticated, well-informed investors, and that cash flow as well as reported earnings are considered by investors. Accordingly, the ratio of earnings to funds from operations investigated by this study is expected to have price implications. The denominator of the ratio – funds from operations (on the Statement of Changes in Financial Position) is defined as earnings after extraordinary items plus non-current accruals (i.e. discontinued operations + deferred taxes + depreciation and amortization + unremitted earnings of unconsolidated subsidiaries + adjustments for other non-current accruals used in determination of earnings) as in Wilson [1987]. Thus there are two components of funds : earnings and non-current accruals. The ratio represents the overall results of composite accounting treatments. Given the reported earnings, the more conservative accounting policies a firm chooses, the greater the accrual component (e.g. depreciation, depletion and amortization) of its financial statement is, and the lower the ratio. So, a firm with a lower ratio is grouped into the high-quality category, while a firm with a higher ratio is grouped into the low-quality category. This logic assumes that funds flows are not affected by accounting choices.

Earnings quality is said to have price implications, if accounting signals produced by high-quality firms cause a different market price reaction than signals from low-quality firms. The annual earnings announcement is used as the accounting signal of interest in testing whether there is a significant difference in the association of forecast errors and excess returns across high and low earnings quality firms. The null hypothesis is formulated as follows :

H_0 : There is no difference in the association between forecast errors and excess returns across the high/low earnings quality firms.

H_1 : There is a positive difference in the association between forecast errors and excess returns for high earnings quality firms relative to low-quality firms.

Chapter 3

Data Design

3.1 Data and Sample Selection

For a firm to initially enter the sample used in this study, it must meet the following data requirements :

1. An annual earnings announcement is available in the Wall Street Journal Index.
2. A complete set of daily returns over 120 days centered on the earnings announcement date are obtainable on CRSP.
3. The actual fourth-quarter EPS are available on Compustat.
4. Annual earnings, funds from operations and other relevant data are available on Compustat.

The sample period is the 1986 fiscal year. According to the definition on Compustat, fiscal years ending January 1 through May 31 are treated as ending in the prior calendar year; whereas those ending after May 31 are treated as ending in the current calendar year. Accordingly, the 1986 calendar year of a firm may end on any date between June 1, 1986 and May 31, 1987. However, most of firms have a December 31 fiscal year-end. So, most of firms have their 1986 earnings announced on Wall Street Journal Index over the first four months of 1987 (January 2, 1987 through April 30, 1987).

The result of sample selection is a sample comprised of 105 firm-pair observations spread over 31 industries. The sample selection process is described as follows :

Stage 1 : The change in the fourth-quarter EPS's between 1986 and 1987 are used to measure the forecast errors in this study. Among the data, the most restrictive filter is quarter EPS only available on Quarterly Compustat. The number of firms available on the 1988 version of CRSP is 5744; on Industrial Annual Compustat is 8911; and on Quarterly Compustat is only 888. Hence, 888 firms on the 1988 version of Industrial Quarterly Compustat form the initial sample.

Stage 2 : It is expected that the sensitivity of price to earnings announcements could vary systematically by thier size and industry. Firms are, therefore, matched by size and industry to control for these two factors. All the industries from stage one are examined. The industries with too few firms are dropped. A minimum of 6 firms is imposed to ensure that an industry has enough firms to be matched by their size. In order to retain more data, an industry for purposes of this study is redefined by extending 4-digit industry code. The selected 31 industries and their corresponding industry codes on Compustat are presented on Table 3.1. 453 firms are retained after this filter.

Stage 3 : The Annual Industrial Compustat file is used to retrieve the data on earnings, total funds from operations and sales (as a measure of the firm size). The ratio of earnings to funds from operations is calculated for each firm. In each particular industry, the ratios of firms are sorted in ascending order. Firms in this industry are then partitioned into three strata by their ratios. Firms with the median third of ratios are dropped. Firms with the top one-third (smaller) of ratios are defined as high-quality firms. Firms with the bottom one-third (larger) of ratios are defined as low-quality firms. Then, each high-quality firm is matched with a low-quality firm by firm size (sales) to form a pair. Firms that either are too big or too small to be matched with other firms in the industry are dropped. Through this stage, 128 pairs are matched. Two firms of each pair are matched by industry and size.

Stage 4 : The annual earnings announcement date for each firm is collected from the Wall Street Journal Index. The equal-weighted market returns are retrieved from 1988 version of CRSP Daily Stock Index File, and the Stock Daily Returns file. Firms with insufficient data are dropped. 105 pairs (210 firms) pass this final filter.

The sample is subject to a selection bias in that only the firm with data available on Compustat and CRSP (big public companies) are included. Also, firms in certain industries are systematically excluded because the data requirements (e.g. total funds from operations is not available for bank, utilities and insurance companies). This reduces the generality of the results of this study.

3.2 OLS Regression Approach

Two approaches are employed to measure the association between forecast errors and excess returns for each firm. One is Ordinary Least Squares (OLS) and the other is Seemingly Unrelated Regression and Generalized Least Squares (SUR / GLS).

The multiple OLS regression model with dummy variables used in this study may be stated as follows :

$$R_{it} = \alpha_{1i} + \alpha_{2i}Y + \beta_{1i}R_{mt} + \beta_{2i}R_{mt}Y + \gamma_{1i}FE_{it} + \gamma_{2i}FE_{it}Y + \varepsilon_{it} \tag{3.1}$$

i = 1,... 105

t = -60,... -1, 0 ,... +59

R_{mt} : returns on the equal-weighted market portfolio during the t period

R_{it} : returns on the firm's stock during the t period for pair i

$$Y = \begin{cases} 1 & \text{for the high-quality firm of pair i} \\ 0 & \text{otherwise (for low-quality firm)} \end{cases}$$

FE_{it} : forecast error in period (-1,0) and

zero on other periods for pair i

$\alpha_i and \beta_i$: intercept and slope coefficient, respectively, of market model for pair i

γ_i : market response per unit of forecast error for pair i

ε_{it} : a stochastic disturbance term

For each pair, an OLS regression is run over 120 days centered on (-1,0). The annual earnings announcement date on Wall Street Journal Index is denoted as date 0.

3.3 SUR / GLS Approach

In addition to OLS, firms with 1986 earnings announcement dates falling January 2, 1987 through April 30,1987 were also analysed using SUR/GLS to assess the association between forecast errors and excess returns for each pair. The match in industry suggests that cross-correlations may be present in disturbances which could affect both estimates and test statistics. There are seven pairs with overlaps in announcement windows when running OLS. These pairs would be more appropriate using SUR/GLS model because of more serious cross-correlations in their disturbance. The advantage of SUR/GLS is that it provides for contemporaneous cross-correlations in excess returns. This may be important in the efficiency of estimates and unbiasedness of test statistics. 72 pairs meet the requirements (i.e. announcement date falls within the first four months of 1987). The restriction to pairs with announcement dates within these four months is to make each pair observation more comparable by eliminating those with too wide a gap between their announcement dates. The reason for selection these four months is that most of firms announced their 1986 earnings on these four months. The system of simultaneous equations of this model are stated as follows :

$$\begin{cases} R_{it}^{H} = \alpha_i^{H} + \beta_i^{H} R_{mt} + \gamma_i^{H} FE_{it}^{H} + \varepsilon_{it}^{H} \\ R_{it}^{L} = \alpha_i^{L} + \beta_i^{L} R_{mt} + \gamma_i^{L} FE_{it}^{L} + \varepsilon_{it}^{L} \end{cases} \tag{3.2}$$

i = 1,... ,72

t = 1,... ,83 [1]

R_{it}, R_{mt}, FE_{it}, α_i, β_i, γ_i, ε_{it} are defined as equation (3.1) above.

The notation H denotes the high-quality firm of pair i, and L denotes the low-quality firm.

The equations for each pair are run simultaneously. The hypothesis that the market response across the high-quality firm and low-quality firm is equal ($\gamma_i^H = \gamma_i^L$) is then tested.

[1]January 2,1987 through April 30,1987, totally, 83 days

Table 3.1: Industry List

no.	Industry Code	Industry Name
1	1040	Gold and silver ores
2	1311	Crude petroleum & natural gas
3	2000	Food & beverage
4	2300	Apparel & other finished products
5	2600	Paper mills, building paper & paperboard
6	2700	Newspaper, periodical, books & printing
7	2800	Chemicals & allied products
8	2821	Plastics, resins, elastomers
9	2834	Pharmaceutical preparations
10	2840	Soap, detergent, perfume, cosmetic
11	2911	Petroleum refining
12	3079	Misc. plastics products
13	3200	Cement, hydraulic, concrete, abrasive
14	3310	Blast furnaces, steel works, rolling mills
15	3330 & 3350	Prim. smelt, refin. nonfer. metal
16	3560	General industrial machinery & equipment
17	3585	Air condition, heating, refrigerating equipment
18	3660	Radio, TV comm. eq. search, guide system
19	3670	Semiconductor, related device connectors
20	3710	Motor vehicles, car bodies, motor vehicle part,accessory
21	3720	Aircraft, and related parts, aux eq. engine, engine parts
22	3820	Measuring, controlling instruments
23	3940	Games, toys, child vehicles, dolls
24	4510	Air transportation, certified, air courier services
25	4811	Telephone comm. (wire, radio)
26	4922	Natural gas transmission
27	5311	Department stores
28	5331	Variety stores
29	5411	Grocery stores
30	7372	CMP program & software services
31	8911	Energy, architect, survey services

Chapter 4

Empirical Results

A preliminary check was made to determine whether forecast errors differed across earnings quality. Tests were performed on the difference in forecast errors across high/low quality firms. A t-test on the mean difference cannot reject the null hypothesis at the 10% level of significance. To reduce the effect of outliers, a sign test was also performed. This test reports a difference that is significant at the 5% level. Note that such a difference in forecast errors need not be important in itself. This study is mainly concerned with the difference in price sensitivity per unit of forecast error. Hence, a difference in forecast error is only a concern to the extent it raises the possibility that a bias may exist due to the systematical difference in subsamples which may be proxied for by forecast errors.

In the OLS model, the coefficient $\hat{\gamma}_{2i}$ estimates the difference in the earnings response per unit of forecast errors across high-quality and low-quality firms. A t-value of $\hat{\gamma}_{2i}$ indicates the significance of the difference. In the SUR/GLS model, the difference between $\hat{\gamma}_i^H$ and $\hat{\gamma}_i^L$ for each pair is calculated and defined as $\hat{D}_i$. That is $\hat{D}_i$ measures the difference in earnings response coefficients across high/low quality firms. A t-value on the test of hypothesis $\gamma_i^H = \gamma_i^L$ indicates the significance of the difference. The results of OLS ($\hat{\gamma}_{2i}$ and t-value of $\hat{\gamma}_{2i}$) and the results of SUR ($\hat{D}$, t-value on the difference test $\gamma_i^H = \gamma_i^L$) are summarized on Table B.7 through Table B.9.(See Appendix B).

The distributions of coefficient $\hat{\gamma}_{2i}$, t-value of cofficient $\hat{\gamma}_{2i}$, $\hat{D}$, and t-value of the test $\gamma_i^H = \gamma_i^L$ are plotted on Figure 4.1 through Figure 4.4.

Table 4.2: Sign Test for The Median of Difference in Cofficients

OLS	SUR/GLS
H_0:$\eta_{\hat{\gamma}_{2i}}$=0	H_0:$\eta_{\hat{D}_i}$ = 0
H_1:$\eta_{\hat{\gamma}_{2i}} \neq 0$	H_1:$\eta_{\hat{D}_i} \neq 0$
that is	that is
H_0:P($\frac{\# of \hat{\gamma}_{2i} > 0}{n}$)=.5	H_0:P($\frac{\# of \hat{D}_i > 0}{n}$)=.5
H_1:P($\frac{\# of \hat{\gamma}_{2i} > 0}{n}$)$\neq$ .5	H_1:P($\frac{\# of \hat{D}_i > 0}{n}$)$\neq$.5
n=105	n=75
$P = \frac{63}{105} = .6$	$P = \frac{46}{72} = .638$
S(P)=$\sqrt[2]{\frac{.5(1-.5)}{105}}$=.0488	S(P)=$\sqrt[2]{\frac{.5(1-.5)}{72}}$=.0589
$Z = \frac{.6-.5}{.0488} = 2.0494 > 1.960$	$Z = \frac{.638-.5}{.0589} = 2.357 > 2.054$
Prob.> $\|Z\|$=0.0408	Prob.> $\|Z\|$=.0186
Conclude H_0 atα=.05 level	conclude H_0 at α=.04 level

From these figures, it is quite evident that the differences are generally positive. However, the difference is small.

Recall that under the null hypothesis, the earnings response coefficients should be equal across the high/low quality firms for each matched pair. On account of the presence of outliers and the lack of sufficient knowledge about the distribution of diference in coefficients, this analysis seeks a test that places the weakest possible demands on the data. Accordingly, a non-parametric sign test is employed to test the null hypothesis that the median of differences is equal to zero. Table 4.2 presents the results of this test. The hypothesis of no difference in earnings response is rejected at less than the 5% level in both OLS and SUR/GLS models. Given that the ratio of earnings to funds from operations proxies well for earnings quality, this study interprets the results as evidence in support of a hypothesis of a greater market reaction for higher quality earnings.

A binomial test is also performed to test whether the median of significant differences of market response is equal to zero. The results are reported on Table 4.3. However, now the null hypothesis cannot be rejected at the 10% significance level for either OLS and

Table 4.3: Binominal Test for The Median of Significant Difference in Cofficients

OLS	SUR/GLS
H_0:$\eta_{sig*\hat{\gamma}_{2i}}$=0	H_0:$\eta_{sig*\hat{D}_i}=0$
H_1:$\eta_{sig*\hat{\gamma}_{2i}} \neq 0$	H_1:$\eta_{sig*\hat{D}_i} \neq 0$
that is	that is
H_0:P($\frac{\#of\hat{\gamma}_{2i}sig*>0}{n}$)=.5	H_0:P($\frac{\#of\hat{D}_isig*>0}{n}$)=.5
H_1:P($\frac{\#of\hat{\gamma}_{2i}sig*>0}{n}$)$\neq$ .5	H_0:P($\frac{\#of\hat{D}_isig*>0}{n}$)$\neq$.5
n=27	n=22
$P=\frac{16}{27}=.5929$	$P=\frac{13}{22}=.5909$
S($\hat{P}$)=$\sqrt[2]{\frac{.5(1-.5)}{27}}$=.098	S($\hat{P}$)=$\sqrt[2]{\frac{.5(1-.5)}{22}}$=.1066
$Z=\frac{.5926-.5}{.098}=.9443<1.645$	$Z=\frac{.5909-.5}{.1066}=.8528<1.645$
Prob.> $\|Z\|$=0.346	Prob.> $\|Z\|$=.3944
Cannot reject H_0 atα=.10 level	Cannot reject H_0 at α=.10 level
sig*: significant at α=10% level	sig*: significant at α=10% lel
d.f.=234	d.f.=160
t(.90,233)=1.28	t(.90,159)=1.28

SUR/GLS models. The explanation for these results might be that the sample (from restricting the test to significant estimates) size is so small that the explanatory power is quite limited.

A Wilcoxon Signed Rank Test represents yet a further test on the median of difference of price reaction across high-quality and low-quality firms. The results of Table 4.4 indicate that there are significant difference in price sensitivity at the 5% level of significance (SUR/GLS), or at the 10% level of significance (OLS).

Under the assumption that the differences of earnings responses are independently, identically and normally distributed, a t-test on the mean differences are performed. While this test requires stronger distributional assumptions, it is more powerful given those assumptions are met. Table 4.5 reports the results. The null hypothesis cannot be rejected for both the OLS and SUR/GLS models. A possible explanation for this results might be the presence of outliers.

Table 4.4: Wilcoxon Signed Rank Test for The Median of Difference in Coefficients

OLS	SUR/GLS
H_0:$\eta_{\hat{\gamma}_{2i}}$=0	H_0:$\eta_{\hat{D}_i} = 0$
H_1:$\eta_{\hat{\gamma}_{2i}} \neq 0$	H_1:$\eta_{\hat{D}_i} \neq 0$
n=105	n=72
T=1101	T=714
S(T)= $\sqrt[2]{\frac{(105)(106)(211)}{6}}$=625.623	S(T)=$\sqrt[2]{\frac{(72)(73)(145)}{6}}$=356.399
$Z = \frac{1101-0}{625.623} = 1.7598 > 1.645$	$Z = \frac{714-0}{356.399} = 2.003 > 1.96$
Prob.> $\|Z\|$=0.784	Prob.> $\|Z\|$=.0456
Conclude H_0 atα=.10 level	conclude H_0 at α=.05 level

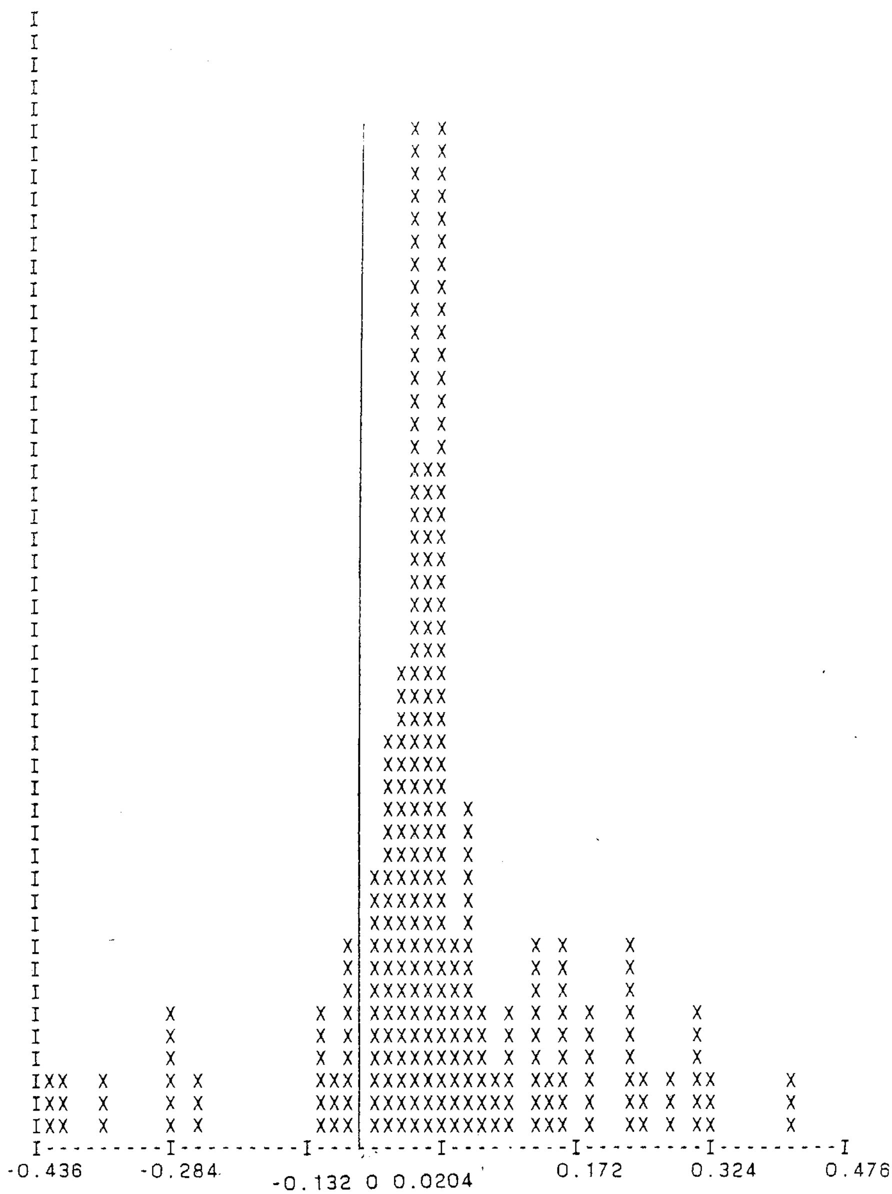
Table 4.5: T-test on The Mean Difference in Coefficients

OLS	SUR/GLS
H_0:$\mu_{\hat{\gamma}_{2i}}$=0	H_0:$\mu_{\hat{D}_i} = 0$
H_1:$\mu_{\hat{\gamma}_{2i}} \neq 0$	H_1:$\mu_{\hat{D}_i} \neq 0$
n=102*	n=70**
$\bar{\gamma}_{2i}$=.088437	$\bar{\gamma}_{2i}$=.017794
S=.85317	S=.21949
S($\hat{\gamma}_{2i}$)=$\frac{.85317}{\sqrt[2]{102}}$=.0844	S($\hat{D}$)=$\frac{.21949}{\sqrt[2]{70}}$=.02623
$t = \frac{.088437-0}{.0844} = 1.047 < 1.67$	$t = \frac{.017794-0}{.02623} = .6782 < 1.67$
Prob.> $\|t\|$=0.30	Prob.> $\|t\|$=.50
Cannot reject H_0 atα=.10 level	Cannot reject H_0 at α=.05 level
Three outliers are discarded.	**Two outliers are discarded.
(see table B.7-B.9 @)	(see table B.7-B.9 @)

Table 4.6: T-test on The Mean Standardized Difference in Coefficients

OLS	SUR/GLS
$\hat{\lambda} = \frac{\hat{\gamma}_{2i}}{S(\hat{\gamma}_{2i})}$=t-value of $\hat{\gamma}_{2i}$	$\hat{\lambda}$=t-value of $\gamma_H \neq \gamma_L$
H_0:$\mu_{\hat{\lambda}_i}=0$	H_0:$\mu_{\hat{\lambda}_i} = 0$
H_1:$\mu_{\hat{\lambda}_i} \neq 0$	H_1:$\mu_{\hat{\lambda}_i} \neq 0$
n=105	n=72
$\bar{\lambda}$=.33054	$\bar{\lambda}$=.38598
S=1.4788	S=1.4898
$S(\hat{\lambda})=\frac{1.4788}{\sqrt[2]{105}}=.14432$	$S(\hat{\lambda})=\frac{1.4898}{\sqrt[2]{72}}=.1756$
$t = \frac{.33054-0}{.14432} = 2.2904 > 1.98$	$t = \frac{.38598-0}{.1756} = 2.1984 > 1.99$
Conclude H_0 atα=.05 level	Conclude H_0 at α=.05 level

To reduce the effect of the outliers, this analysis standardized the coefficients by their standard errors, and then performed a t-test on the mean difference in standardized coefficients under the assumption that standardized coefficients are independently and identically distributed within each group. The results on Table 4.6 imply that the null hypothesis can be rejected at less than the 5% level of significance.



5 outliers (-9712.3, -65.078, -144.27, -1.3856,8.3706) are deleted for plot purpose.

Figure 4.1: A Distribution of Coefficient $\hat{\gamma}_{2i}$ (OLS)

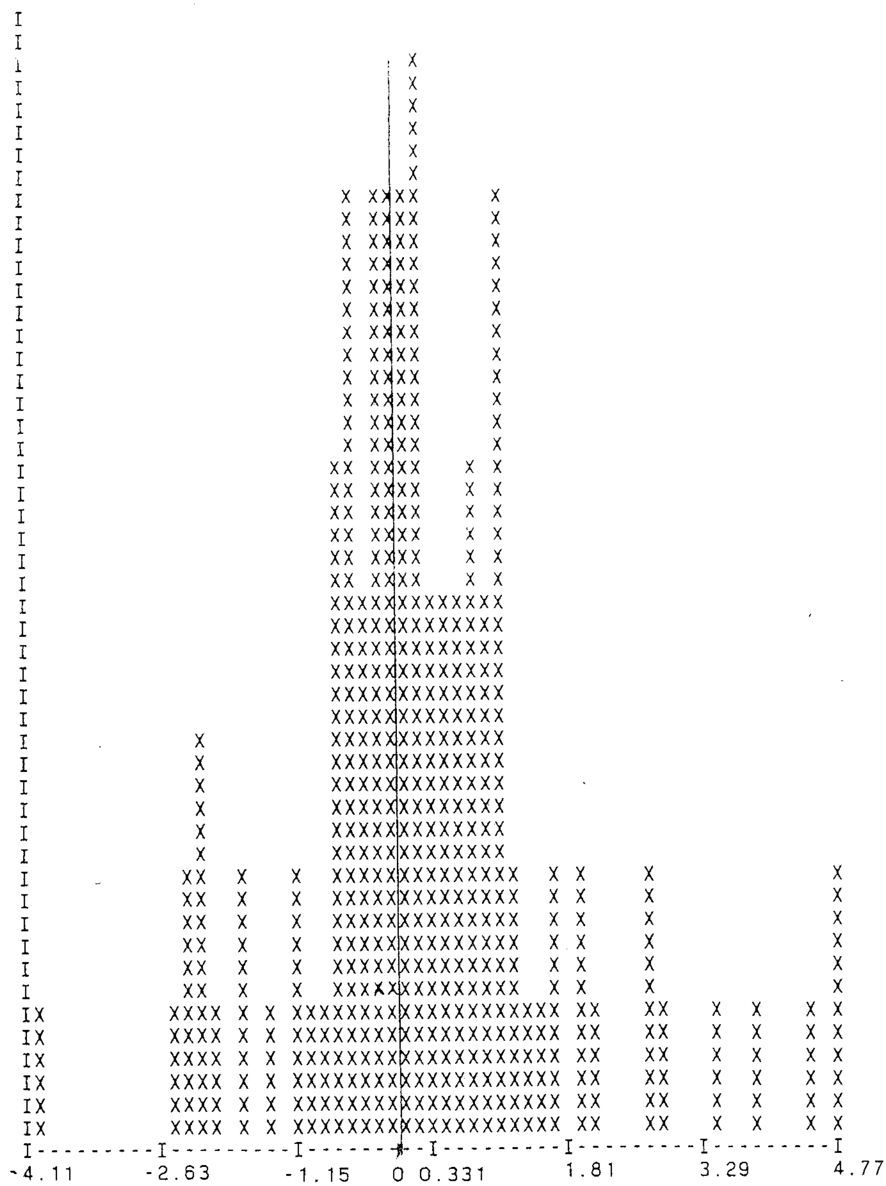
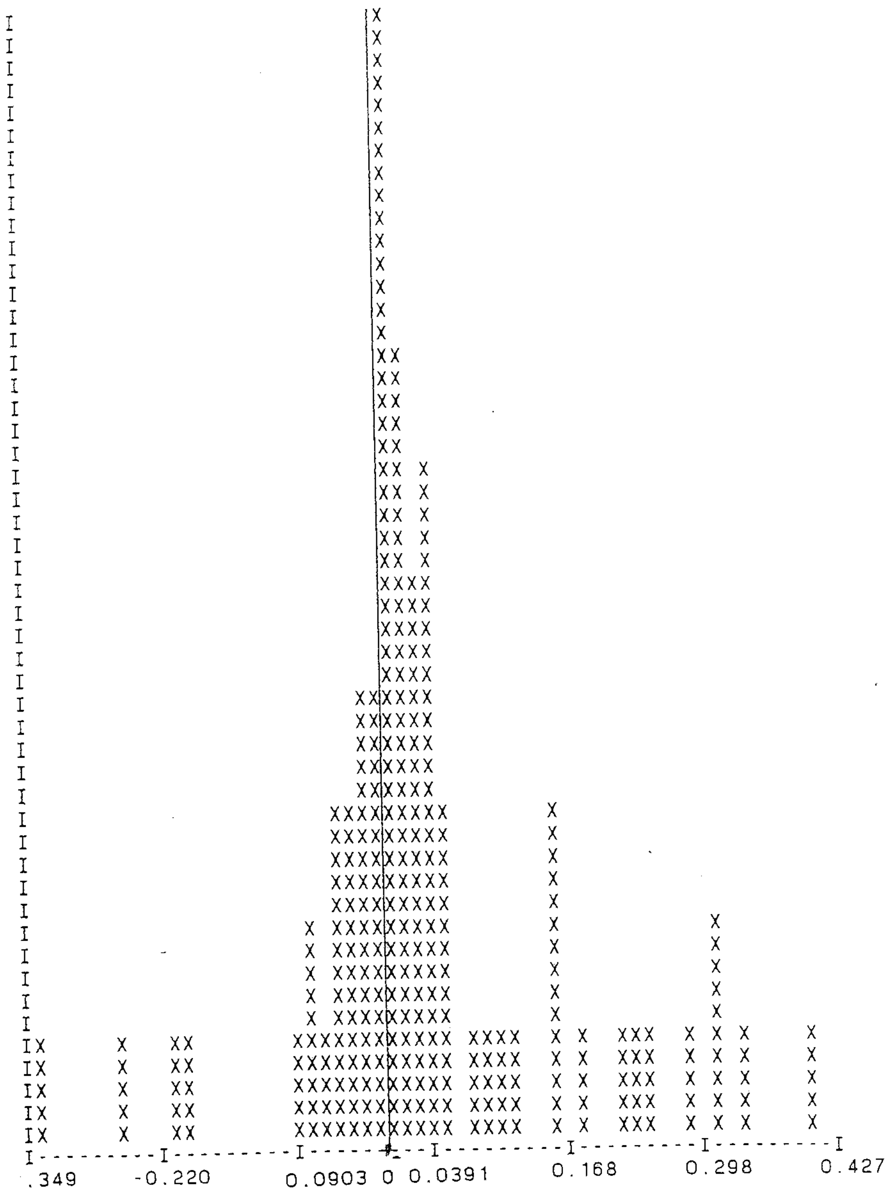


Figure 4.2: A Distribution of t-value of $\hat{\gamma}_{2i}$ (OLS)



3 outliers (-9722.5, -54.529, -1.4504) are deleted for plot purpose.

Figure 4.3: A Distribution of Coefficient $\hat{D}_i$ (SUR/GLS)

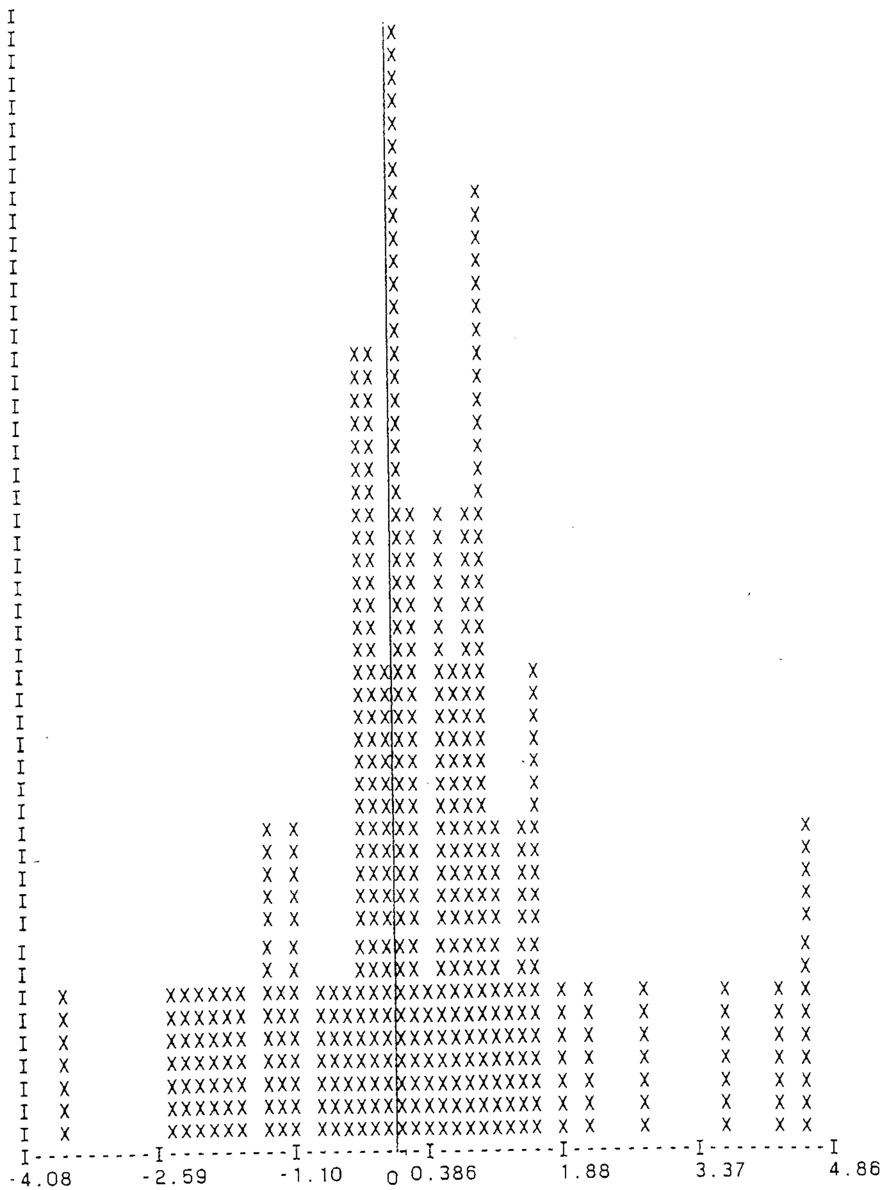


Figure 4.4: A Distribution of t-value of the test $\gamma_i^H = \gamma_i^L$(SUR/GLS)

Chapter 5

Summary and Conclusions

The differences in the association between forecast errors and excess returns across the high/low earnings quality are addressed in this study. For purposes of this study, earnings quality is defined by the magnitude of the ratio of earnings to funds flow. The greater the funds flow content, the higher the quality. Generally, the results tend to support statistically significant differences in the markets responses to earnings announcements classified by earnings quality. The results are robust across two regression models of OLS and SUR/GLS. The robustness of results OLS and SUR/GLS is expected given Bernard [1987]. Two instances of different results might be explained by the large outlier observations, or small sample size which limited the explanatory power.

Interpreting these results, the characterization of earnings quality as the ratio of earnings to funds flow from operations suggests that a prediction of greater price sensitivity to forecast errors of firms with lower ratios is not surprising.

First, given the earnings, a lower ratio means a higher funds flows. A firm with higher funds flow is expected to have potentially more cash which can be used to distribute dividends, to finance new assets or to reduce the debt obligations. So, the security market participants might give stronger price response to annual earnings announcemnets released by low-ratio (or high-quality) firms.

Second, a lower-ratio relates to more conservative accounting treatments. Earnings determined by more conservative accounting methods are lower than those determined by more liberal accounting methods. If two firms are similar in all respects except for their choices of accounting policies, the investors will see through the reported accounting figures and give similar price values to both securities according to the market efficiency theory. If it is so, the arithematic shows that the lower are the earnings, the lower are the changes in them (forecast errors), resulting in greater changes in price response than higher earnings determined by more liberal accounting. [1]

Two other approaches were tried to proxy the earnings quality in the earlier stage of this study but were not used afterwards. The first approach uses a quality index calculated by weighing accounting choice value by book values of related items for each firm. Each of three accounting choices, inventory valuation, investment tax credit and depreciation methods available on Compustat, was set a value between one (liberal methods) to zero (conservative methods) respectively. Firms with high-value index are grouped into low-quality category. Firms with low-value index are classified as high-quality category. Because of the weakness of weighing schedule, which often raises more questions than it answers, this study discarded this approach. The other approach was tried to classify firms by their accounting choices (including inventory valuation, investment tax credit and depreciation methods). Firms with totally conservative accounting choices (three of the choices are conservative) are grouped into high-quality category. Firms with totally liberal accounting choices are grouped into low-quality category. The failure in using this approach is because too small a sample could be selected.

The result of this study may or may not extend to other measures of earnings quality. In addition, since the firms in this sample are large due to the sample selection criteria, the results may not be generalizable to small firms.

[1] The concept of these two points comes from Hawkins [1986].

Appendix A

The Forecast Error

The fourth-quarter changes is used to proxy the forecast errors in this study. Specifically, the forecast error is calculated as follows:

$$FE_{it} = \frac{EPS_{i,qt} - EPS_{i,qt-1}}{EPS_{i,qt-1}}$$

FE_{it} :the forecast error of firm i at year t

$EPS_{i,qt}$: the fourth-quarter earnings per share (primary, excluding extraordinary items and discountinued operations) of firm i at year t

$EPS_{i,qt-1}$: the fourth-quarter EPS of firm i at year t-1

An alternative measure for the forecast error is analyst forecast error:

$$FE = \frac{actual - forecast}{forecast}$$

Hughes and Rick [1987] found that the associations between forcast errors and excess returns are slightly stronger using mechanical forecast (fourth-quarter changes) than they are using analyst forecasts.

Appendix B

Results of OLS & SUR/GLS

The results of OLS ($\hat{\gamma}_{2i}$ and t-value of $\hat{\gamma}_{2i}$) and the results of SUR ($\hat{D}$, t-value on the difference test $\gamma_i^H = \gamma_i^L$) are summarized on Table B.7 through Table B.9.

Notations on these tables are as follows:

@ : outlier

- : This sample did not run SUR/GLS.

* : significant at the 10% level of significance. There are 234(160) degrees of freedom for the t-value of these means and 1.28(1.28) is the critical value at the 10% level of significance for OLS (SUR/GLS).

Table B.7: Results of OLS & SUR/GLS (part 1)

No.	$\hat{\gamma}_{2i}$(OLS)	t-value of $\hat{\gamma}_{2i}$(OLS)	$\hat{D}_i$(SUR/GLS)	t-value of $\hat{D}_i$
1	.0043	.199	.0040	.216
2	*.0303	1.397	.0016	1.129
3	.0252	.617	-	-
4	.2389	1.137	.2544	1.201
5	.0067	.326	.0209	1.007
6	@ *-9712.3000	-4.064	@ *-9722.5000	-3.519
7	.0042	.067	.0065	.088
8	.0345	.488	.1615	.173
9	.0114	.769	.0058	.197
10	.0742	1.117	-	-
11	.0396	.374	-	-
12	-.0336	-2.239	-	-
13	.0237	-.334	-	-
14	.0061	.209	-	-
15	-.0030	-.029	-	-
16	-.0527	-.634	*.1867	4.661
17	*.0209	1.572	.4140	1.089
18	*.2344	2.865	-.1927	-1.569
19	*.2015	5.190	.0084	.155
20	.4273	1.215	-	-
21	*-.2695	-2.050	-	-
22	-.0124	-.246	-	-
23	.0092	.139	.0186	.266
24	.0240	.037	.0240	.596
25	.0300	.763	*.0508	1.339
26	@ -65.0780	-.685	@ -54.529	-.490
27	-.0528	-.170	-.0370	-.243
28	.0410	.709	.0433	.844
29	.1348	.872	.1101	.712
30	-.0005	-.219	-.0056	-.275
31	*-.0842	-1.328	-.0869	-1.101
32	*.2894	5.204	*.2921	4.568
33	-.0119	-.299	.0180	.648
34	-.0085	-.509	-.0095	-.532
35	*-.2406	-2.342	*-.2526	-2.241

Table B.8: Results of OLS & SUR/GLS (part 2)

No.	$\hat{\gamma}_{2i}$(OLS)	t-value of $\hat{\gamma}_{2i}$(OLS)	$\hat{D}_i$(SUR/GLS)	t-value of $\hat{D}_i$
36	-.0404	-.509	-.0181	-.232
37	.0196	.296	.0247	.327
38	*-.1140	-1.677	-.0696	-1.134
39	.1093	1.171	.0996	1.097
40	.0534	.043	*.0514	1.610
41	.0392	-.673	-	-
42	@ -144.2700	-.460	-	-
43	.0123	.961	.0370	.888
44	.0072	.026	.0148	.043
45	.0020	.109	.0026	.119
46	.0022	.120	-.0024	-.121
47	.0219	.243	.0607	.604
48	.0027	.834	-.0006	-.161
49	*.0320	2.812	*.0298	4.276
50	-.0180	-.421	.0397	1.007
51	.0745	.969	.0371	.480
52	.0069	-.054	-.0154	-.196
53	*.1599	4.559	*.1615	3.791
54	.0350	.023	*.0371	1.450
55	.2574	1.360	.2275	1.046
56	-.0351	-.646	-.0444	-.800
57	-.0043	-.160	-	-
58	.0218	.457	-	-
59	-.0001	-.002	.0014	.204
60	.0278	1.104	.0166	.594
61	.0521	.934	.0472	.834
62	.1607	.792	.0865	.328
63	.1669	1.026	.1675	1.169
64	*-1.3856	-1.919	*-1.4504	-2.416
65	*.3209	3.200	*.3110	2.799
66	.0243	.259	-	-
67	-.0777	-.955	-	-
68	.3109	1.239	*.3228	1.643
69	*.1400	2.013	-	-
70	.0167	.394	-	-

Table B.9: Results of OLS & SUR/GLS (part 3)

No.	$\hat{\gamma}_{2i}$(OLS)	t-value of $\hat{\gamma}_{2i}$(OLS)	$\hat{D}_i$(SUR/GLS)	t-value of $\hat{D}_i$
71	.0230	.577	-	-
72	.0457	-.540	.0430	.826
73	.0946	.630	-.0384	-.313
74	-.0350	-1.114	-	-
75	*.2438	1.665	-	-
76	-.0240	-.461	*.1254	1.919
77	*.0331	2.750	-	-
78	.1116	-1.052	-	-
79	*-.3990	-1.676	*-.0404	-1.910
80	.0600	.863	.0574	.795
81	-.0168	-.464	*-.3561	-1.305
82	*.3325	1.673	*.3409	1.432
83	*-.2778	-2.326	-	-
84	-.0506	-.302	-	-
85	.0484	1.088	-	-
86	-.0017	-.147	-.0002	-.024
87	*.0328	2.156	*.0355	2.321
88	.0118	.593	.0116	.892
89	*-.7989	-2.052	-	-
90	*.1092	2.076	-	-
91	.0546	.305	.0661	.242
92	.0007	.068	.0007	.670
93	8.3706	.045	-	-
94	-.3483	-.590	-	-
95	-.0023	-.017	-.0246	-.180
96	*-.0782	-2.085	*-.0730	-1.841
97	.0017	.010	-.0217	-.157
98	-.0242	-.371	-.0320	-.998
99	-.0906	-.176	-.1978	-.309
100	*-.0572	3.505	*-.0459	-2.071
101	-.0380	-.797	*-.0626	-1.347
102	.2005	1.210	*.2446	1.582
103	.0137	.438	-	-
104	.1430	.850	-	-
105	.1319	.233	-	-

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