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財務比率資訊內含之實證研究

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摘要

以前的財務會計研究大部份都使用簡單迴歸分析來探討盈餘和股價的關係，因此這些研究可能會有遺漏重要自變數的問題。爲了彌補以前研究報告的不足，本篇研究使用多元迴歸分析和等級偏相關分析來探討盈餘與非盈餘財務比率的資訊內容。

兩種統計分析一致顯示：盈餘比率擁有最顯著的資訊內含。多元迴歸分析結果顯示：盈餘比率不但可預測股價調整的方向，更可以預測調整的幅度。但是個別的非盈餘財務比率則不具有資訊內含，即使所有的非盈餘財務比率一起考慮，他們也沒有提供額外的資訊內含。

但是等級偏相關分析結果則顯示：非盈餘財務比率，不論是個別考慮或整體考慮，確實都擁有顯著的資訊內含。二種統計方法結果的不一致可能來自於這二種統計方法不同的基本假設。

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An Empirical Investigation of Information Content of Financial Ratios

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Abstract

Previous financial accounting research investigating the earnings response models employed the simple regression analysis which might have committed variable omission problems. This study used multiple regression and ranked partial correlation analyses to investigate the information content of both earnings and non-earnings financial ratios. Earnings were consistently found to have possessed the greatest information content using the either analysis. The multiple regression provided evidence that not only the direction of earnings' impact could be predicted, but also its magnitude. But the multiple regression analysis found non-earnings ratios individually to have no incremental value. The partial F-test was used to examine whether or not non-earnings variables, taken as a whole, had incremental content beyond earnings. It failed to find supporting evidence. However, ranked partial correlation analysis found that non-earnings ratios, individually and jointly, possessed information content. The inconsistent results seemed to arise from the different underlying assumptions of each statistical procedure.

1. Introduction

Financial accounting is a process through which corporate management reports financial information about the economic entity to a variety of users.

Thus, if the financial statements are useful to investors, they should have information content. A piece of information possesses information content if it can affect security prices. As decisions resulting from financial reporting with information content lead to shift in users' economic resources, research efforts are warranted.

Many studies of accounting literature have investigated the information content of financial statements. Most of these market-based studies focus only on the impact of accounting earnings on security prices [Ball and Brown, 1968; Beaver, Lambert and Morse, 1980, Beaver, Lambert and Ryan, 1987; Collins and Kothari, 1989; Easton and Zmijewski, 1989; Cheng, 1991]. They have documented that the announcement of accounting earnings has influenced security prices. However, given the abundant data reported in financial statements, it is highly likely that non-earnings accounting information, such as leverage ratio and turnover ratio, may possess incremental information content beyond earnings. The Financial Accounting Standards Board (FASB) notes this issue in its discussion memorandum, "Reporting Fund Flows, Liquidity, and Financial Flexibility,"

> Concepts Statement 1 states that information about income and its components is useful in assessing future cash flows. However, that information is not expected to be sufficient in itself.

Thus, accounting earnings alone may not provide enough information for investors to assess future cash flows. In other words, non-earnings accounting information may be useful in assessing future cash flows [Ou and Penman, 1989].

From an econometrical perspective, "earnings only" studies may have model specification problem, as their simple regression models have left out non-earnings accounting variables. Consequently, the simple regression estimates may have contained bias and even an asymptotic large sample size had not been able to eliminate such bias [Kmenta, 1986; Judge et al., 1988] By including non-earnings accounting variables in the regression, this study examines not only the information content of the accounting earnings, but also the incremental information content of non-earnings variables.

Section 2 of this paper contains a review of related prior research. The hypotheses of this study are developed in Section 3. The description of data and research methodology is presented in Section 4. In Section 5, the empirical results of this study are reported and discussed. The conclusions and future extensions are summarized in Section 6, the final section.

2. Previous Research

Research on the role of accounting earnings in equity evaluation has been the mainstream of empirical financial accounting research. The study of Ball and Brown [1968] on the relationship between abnormal stock returns and unexpected accounting earnings has led the accounting research to a new era. However, only the effect of the sign of unexpected earnings on stock returns was examined, the effect of unexpected earnings magnitude on stock prices was not investigated in the study. Magee [1975] regressed abnormal returns on unexpected earnings and found a significant coefficient.

The coefficient was criticized by Beaver, Clarke, and Wright [1979] to have offered no additional insight beyond that provided by Ball and Brown. However, later research on the earnings/returns relation appeared to have taken on Magee's regression approach. Beaver, Lambert, and Morse [1980] introduced a functional form of the price-earnings relation. Their model focused on the association between percentage change in stock prices and that in earnings, and defined the simple regression coefficient of this association as "earnings response coefficient" (ERC). While they then assumed the ERC to be constant across portfolios of firms, subsequent research [Collins and Kothari, 1989; Easton and Zmijewski, 1989] have relaxed this assumption and attempted to identify the determinants of the ERC.

Earnings forecasts are another major area of financial accounting research. Patell [1976] reports a significant market reaction during the week that management earnings forecasts were reported in the *Wall Street Journal.* Han, Wild, and Ramesh [1989] also found that management forecasts have incremental information content relative to historical cost earnings.

Indeed, historical-cost accounting earnings and the accrual basis have been widely criticized. It has been suggested that accounting earnings alone may not convey all the information of the financial reports, and that non-earnings accounting variables may provide incremental (over earnings) information content that has implications in accounting disclosure regulation and accounting standard setting. Lev and Ohlson [1982] indicated that the degree of aggregation fineness in hierarchial reports such as 10-K, annual, and interim financial statements could be determined by investigating the effect of incremental information content.

Hopwood and Schaefer [1988], having analyzed and measured both earnings and non-earnings based financial rations, indicated that "the demon-

stration of incremental effects for non-earnings-based ratios opens a new set of questions regarding information content studies in general." They investigated the association of various measures with the equilibrium stock prices. The earnings-based ratios were found to have the largest marginal information content with the return on stock. Non-earnings ratios, such as turnover ratios and leverage ratios are also provided further explanatory power. However, since they converted cumulative abnormal returns and unexpected financial ratios into ranks for analysis purposes, their results did not provide any insights on the effects of financial ratios' magnitude on the security prices.

3. Hypotheses Development

The following security evaluation model provides a theoretical link between accounting ratios and security valuation.

$$V_{i,0} = \sum_{t=1}^{T} \frac{E(C_{it})}{[1 + E(r_i)]^t}$$

where

$V_{i,0}$ = value of firm i stockholder's equity at time 0,
$E(C_{it})$ = expected cash flows of firm i in period t,
$E(r_i)$ = expected rate of return for firm i.

That is, the firm's value is equal to the present value of all future expected cash flows discounted at the expected rate of return. Investors can use relevant accounting information to assess the expected future cash flows, or the expected rate of return.

Pinches, Mingo, and Caruthers [1973], and Hopwood and Schaefer [1988] found that financial statements provided seven dimensions of measure on the firm's expected future cash flows and rate of return. The following seven hypotheses, based on Hopwood and Schaefer's study, are stated in the form of partial correlation with the cumulative abnormal returns (CAR), each assuming that other measures are held constant.

3.1 Returns on Investment

This ratio represents an earnings based measure of financial performance. An unexpected increase in return on investment signals potential growth in future cash flows. Thus, the unexpected return on investment is hypothesized to have a positive relation with stock prices.

H_1 : $cor(CAR,$ Unexpected return on investment$) > 0$

3.2 Capital Turnover, Inventory Turnover, and Receivable Turnover

These turnover ratios are proxies for efficiency in cost control, which affects cash flow generation in future periods. Therefore, unexpected turnover ratios are hypothesized to have positive relations with security prices.

H_2: $cor(CAR,$ Unexpected capital turnover$) > 0$
H_3: $cor(CAR,$ Unexpected inventory turnover$) > 0$
H_4: $cor(CAR,$ Unexpected receivable turnover$) > 0$

3.3 Financial Leverage

An unexpected increase in financial leverage implies that interest expenses would increase and negatively affect future cash flows. Accordingly, it may increase the probability of financial distress and the firm's financial risk would thus increase. The investors will thus request a higher rate of return to compensate the increase in risk. On the other hand, Ross [1977] indicates that more borrowing could be a credible signal sent out by the firms which are experiencing economic growth opportunities. Therefore, no prediction is made on the sign of the association between unexpected financial leverage and security prices.

H_5 : $cor(CAR,$ Unexpected leverage$) \neq 0$

3.4 Short-term Liquidity and Cash Position

Although greater cash and liquidity positions may enhance borrowing capacity for future investments [Liao and Chang, 1991], they also may reflect current shortage of investment opportunities. Therefore, no predictions are made on the signs of these two liquidity ratios.

H_6 : $cor(CAR,$ unexpected liquidity$) \neq 0$
H_7 : $cor(CAR,$ unexpected cash position$) \neq 0$

4. Data and Methodology

4.1 Data

Security prices were obtained from the 1988 CRSP monthly return data tape. The sample firms all had complete returns data on the CRSP tape for the period April 1981 through March 1986. Financial ratios were computed from the Industrial COMPUSTAT tapes for the period 1967 through 1985 (19 years). All sampled firms used a calendar year-end in reporting their accounting information.

In order to mitigate the heterogeneity of the financial ratios across the industries, only industrial firms with the SIC code 2000-3999 were sampled. In other words, only non-regulated manufacturing firms were examined in the study. The sample included 264 firms as reported in Table 1. The largest three industries in the sample were chemicals (15.2%), electrical components (14.8%), and machinery (11.0%). No one industry dominated the sample.

This sample had two potential limitations. First, since the sample was selected exclusively from the COMPUSTAT and the CRSP tapes, sampled firm sizes tended to be larger than average. Second, a "survivorship bias," as suggested by Foster [1986], may have existed because the sample firms must have had complete financial data for the period 1967 through 1985. Those firms which had been merged or gone bankrupt during the period had no chance of being selected.

4.2 Research Methodology

Three stages of analyses were conducted. First, we applied a simple regression of cumulative abnormal returns on unexpected return on investment to examine the earnings response coefficient. The results of the simple regression then became the benchmark in determining whether non-earnings variables had incremental information content beyond earnings. Second, a multiple regression was performed to determine the individual effects of financial ratios on cumulative abnormal returns. Finally, a partial F-test was used to examine whether non-earnings variables, as a whole, had incremental information content.

TABLE 1
Industry Classification of Sample Firms

Industry name	Code	Number of firms	Percentage
Food, soft drinks	20	9	3.4
Tobacco	21	1	0.4
Textiles	22	5	1.9
Apparel	23	1	0.4
Lumber	24	4	1.5
Furniture	25	2	0.8
Paper	26	16	6.1
Newspaper	27	10	3.8
Chemicals	28	40	15.2
Petroleum	29	22	8.3
Rubber	30	13	4.9
Footwear	31	2	0.8
Building materials	32	12	4.5
Metal manutacturing	33	15	5.7
Metal products	34	15	5.7
Machinery	35	29	11.0
Electrical components	36	39	14.8
Aircraft-ship building	37	19	7.2
Consumer electronics	38	8	3.0
Miscellaneous manufacturing	39	2	0.8
TOTAL		264	100.0

Since the specific market expectation is not observable, a surrogate market expectation was generated using two time-series forecast models. To mitigate the potential measurement error problem, both dependent and independent variables were converted into ranks. A ranked partial correlation analysis was then performed to investigate the information content of each financial ratio.

4.2.1. Dependent Variable

Cumulative abnormal returns were used as the dependent variable in the analysis. A 48-month period (April 1981 through March 1985) prior to the test period was used in estimating the model parameters. A model adjusted for market factors (national events) was used to provide estimates of expected returns.

$$log(1 + R_{it}) = \alpha_i + \beta_i[log(1 + R_{mt})] + e_{it}$$

where

R_{it} = equity security return for firm i in month t
α_i = intercept term for firm i
β_i = systematic risk coefficient for firm i
R_{mt} = return on a market index for month t (CRSP-value weighted)
e = error term or abnormal return, $E(e) = 0$.

Since this study investigated the information content of 1985 financial statement, a 12-month window from April 1985 through March 1986 was the basis of computation for the cumulative abnormal returns. There were two reasons for this window period. First, financial statements of the firms with a calendar end are usually released during the first quarter of the following year. Second, predictions from the time-series of annual financial ratios were used as the surrogates for market expectation. The prediction errors thus reflected a 12-month lapse from expectation formation to subsequent realization.

4.2.2. Independent Variables

Assuming the stock market to be semi-strong efficient, the security prices would reflect all publicly available information. Only the expected

portion of new information would then influence security prices. Although Ball and Brown [1968], Ball and Watts [1972], and Foster [1986], indicated that annual reported earnings, on the average, followed the random-walk model empirically, Hopwood and Schaefer [1988] suggested that the first-order autoregression model best described the behavior of financial ratios. This study thus adopted both time-series forecast models to generate market expectation. Table 2 describes how these financial ratios were calculated.

The random-walk model based on 1984 actual financial ratios was used as a surrogate for market expectation of 1985 financial statement. Eighteen-year data (1967 through 1984) were used to fit a first-order autoregression model. A second surrogate of the 1985 market expectation was then derived from the 1985 forecast values of this model.

5. Empirical Results

5.1 Simple Regression (Earnings Response Model)

The results of the simple regression are presented in Table 3. They are consistent with prior research [Ball and Brown, 1968; Cheng, 1991; Collins and Kothari, 1989; Easton and Zmijewski, 1989]. The simple regression coefficients (earnings response coefficients) were significantly positive for both models of market expectation. The random-walk model seemed to have been a better proxy for market expectation as it generated a higher R^2. The magnitude of earnings response coefficient was .527, which predicted a 1% increase in unexpected return on investment yielded an associated .527% increase in cumulative abnormal returns on the average.

5.2 Multiple Regression

The results of the multiple regression are reported in Table 4. The random-walk model was found to have been a better proxy for market expectation than the first-order autoregression model in terms of R^2. For the random-walk model, the multiple regression was significant at the .01 level. The coefficient of unexpected return on investment was .588 and significant at the .01 level, suggesting that a 1% increase in unexpected return on investment resulted in a .588% magnitude increase in the cumulative abnormal returns, on the average.

TABLE 2
The Definitions of Independent Variables

1. Return on investment (ROI).

$$\frac{\text{Net Income (Item 18 + Item 48)*}}{\text{Total Assets(Item 6)}}$$

2. Capital turnover (CAPITAL).

$$\frac{\text{Sales (Item 12)}}{\text{Total Assets (Item 6)}}$$

3. Inventory turnover (INVENTORY).

$$\frac{\text{Inventory (Item 3)}}{\text{Sales (Item 12)}}$$

4. Receivable turnover (RECEIVABLE).

$$\frac{\text{Accounts Receivable (Item 2)}}{\text{Sales (Item 12)}}$$

5. Financial leverage (LEVERAGE).

$$\frac{\text{Long-term Debt (Item 9)}}{\text{Total Assets (Item 6)}}$$

6. Short-term liquidity (LIQUIDITY).

$$\frac{\text{Current Assets (Item 4)}}{\text{Current Liabilities(Item 5)}}$$

7. Cash position (CASH).

$$\frac{\text{Cash (Item 1)}}{\text{Current Liabilities(Item 5)}}$$

* The COMPUSTAT data item number.

TABLE 3
Simple Regression Estimates of The Cumulated Abnormal Return Model With Random-Walk and Autoregression Market Expectations
(Sample year: 1985, n = 264)

Independent Variables	Hypothetic Signs	Random-walk Expectation Estimated Coefficients (t-statistics)	Autoregression Expectation Estimated Coefficients (t-statistics)
Intercept		-.029	-.033
		(-1.565)	(-1.793)
ROI	+	.527	.397
		(3.739)*	(2.519)*
	R-square	5.07%	3.32%
	F-ratio	13.981*	8.667*

* Significant at .01, one-tailed tests.

The coefficient of unexpected inventory was positive and marginally significant. The coefficient of unexpected receivable turnover was in the hypothesized direction but insignificant. The results of the first-order autoregression were similar to those of the random-walk model. In sum, the results of Table 5 indicated that non-earnings accounting information, individually, does not provide incremental information beyond earnings.

The partial F-test was used to investigate whether the non-earnings accounting variables, as a whole, provided incremental information content beyond earnings. For the random-walk model, the partial F-statistic was .8604 and was not significant at any conventional level. Neither was the partial F-statistics of the first-order autoregression model significant. In sum, these results failed to provide support to the incremental information content of non-earnings variables, taken as a whole.

5.3 Effects of Coefficient Magnitude

Since Magee [1975] and Beaver, Clark and Wright [1979] were inconsis-

TABLE 4
Multiple Regression Estimates of the Cumulated Abnormal Return Model With Random-Walk and Autoregression Market Expectations
(Sample year: 1985, n = 264)

Independent Variables	Hypothetic Signs	Random-walk Expectation Estimated Coefficients (t-statistics)	Autoregression Expectation Estimated Coefficients (t-statistics)
Intercept		-.059 (-1.286)	-.020 (-.946)
ROI	+	.588 (3.756)*	.364 (2.519)*
CAPITAL	+	-.010 (-.082)	.011 (.091)
INVENTORY	+	.953 (1.556)**	.741 (1.239)
RECEIVABLE	+	.145 (.231)	-.668 (-.993)
LEVERAGE	?	-.104 (-.390)	-.143 (-.564)
LIQUIDITY	?	-.056 (-1.006)	.029 (.657)
CASH	?	.057 (.721)	-.056 (-.795)
	R-square	6.83%	4.46%
	F-ratio	2.680*	1.706**

*(**) Significant at .01 (.06), one-tailed tests.

tent as to whether the magnitude of earnings coefficient provided additional insight, this issue was examined. The signs of the unexpected earnings were controlled by partitioning the sample into two groups: positive and negative unexpected earnings. Both parametric and non-parametric methods were then applied to each group. The hypothesis was that the larger the magnitude of unexpected earnings, the larger the stock response. Table 5 summarizes the results of the tests. While the results from the group with positive unexpected earnings were mixed, those from the other group had singificantly positive coefficents using both statistical methods and provided strong support to the hypothesis. It is thus concluded that the magnitude of unexpected earnings provide additional information content beyond its sign.

5.4 Rank Partial Correlations

The results of the rank partial correlation analysis are summarized in Table 6. For the random-walk model, the ranked partial correlation between cumulative abnormal returns and unexpected return on investment was the greatest among all financial ratios. This finding was consistent with that of the multiple regression.

The partial correlation coefficients of unexpected inventory turnover and receivable turnover were both significantly positive. The unexpected liquidity ratio was significant and negatively correlated with the cumulative abnormal returns, while the unexpected cash position was significant but positively correlated with the cumulative abnormal returns. These results seemed to be reasonable and consistent with the belief that investors normally prefer cash to non-cash liquid assets. While the positive sign of the partial correlation of the unexpected leverage with the cumulative abnormal returns may be explained by Ross's [1977] signalling theory, is inconsistent with that of multiple regression. In summary, the rank partial correlation analysis provided support to that non-earnings variables, individually and jointly, had incremental information content. Similar conclusions could be drawn for the first-order autoregression model.

6. Conclusions and Future Extensions

This study employed multiple regression analyses to investigate the information content of both earnings and non-earnings financial ratios in

TABLE 5
The Impact of Unexpected Earnings Magnitude On The Cumulated Abnormal Returns (CAR)
(With Signs Controlled)
(Sample year : 1985, n = 264)

	N		Coefficient	P-value
First-Order Autocorrelation Model				
Negative	159	P	.761	.0001*
		NP	.283	.0003*
Positive	105	P	-.414	.0591
		NP	-.030	.7612
Random-Walk Model				
Negative	184	P	.826	.0001*
		NP	.297	.0001*
Positive	80	P	-.423	.0964
		NP	.066	.5599

P : Parametric method (t-test of the slope coefficients from CAR on unexpected earnings)
NP : Non-parametric method (Mann-Whitney Rank Partial Correlation)
* : Significant at .01 level, two-tailed test.

TABLE 6
Ranked Partial Correlation Between Cumulated Abnormal Returns and Financial Ratios With Random-Walk and Autoregression Market Expectations
(Sample year : 1985, n = 264)

Financial Ratio Variables	Hypothetic Signs	Random-walk Expectation: Estimated Partial Correlation Coefficients (t-statistics)	Autoregression Expectation: Estimated Partial Correlation Coefficients (t-statistics)
ROI	+	.470 (7.778)*	.353 (5.455)*
CAPITAL	+	.047 (.862)	.150 (2.689)*
INVENTORY	+	.154 (2.896)*	.128 (2.320)*
RECEIVABLE	+	.125 (2.315)*	.101 (1.846)**
LEVERAGE	?	.145 (2.631)*	.133 (2.358)*
LIQUIDITY	?	-.209 (-2.780)#	-.135 (-1.939)##
CASH	?	.257# (3.869)	.256# (4.094)

*(**) Significant at .01 (.06), one-tailed tests.
#(##) Significant at .01 (.06), two-tailed tests.

search of a better resolution to the possible omitted problems of previous studies using only simple regression models. Consistent with previous research, the ranked partial correlation analysis suggested that both earnings and non-earnings (such as inventory turnover, receivable turnover, liquidity, and cash position) financial ratios had information content.

In each stage of analysis, earnings was consistently found to have possessed the greatest information content. However, the partial F-test failed to provide support to the hypothesis that non-earnings variables, as a whole, had incremental content beyond earnings. The results of multiple regression analysis and ranked partial correlation analysis were inconsistent.

This inconsistency might have arisen from the underlying assumptions of both statistical procedures. Multiple regression analysis requires a normal distribution and homogeneity of error terms. It is also sensitive to measurement errors in independent variables. The ranked partial correlation analysis is distribution free and less sensitive to measurement errors in independent variables. The conversion of independent variables into ranks forces each independent variable to be equally weighted when the partial correlation analysis is used. If earnings were indeed the most influential variable, the ranked partial correlation analysis would have understated earnings' impact on returns, and overstated non-earnings variables' impact on returns.

This study is a further research beyond Hopwood and Schaefer [1988] in two dimensions. First, non-earnings accounting information was found to have no incremental value with a multiple regression model. Second, there was evidence of the impact magnitude of financial information disclosures on security prices, in addition to the directionality of resultant changes.

As Brown et al. [1987a, 1987b] indicated, the security analyst forecast was a superior proxy for market expectation to univariate time-series models. Future study may use the security analyst forecast as the market expectation to reduce measurement errors of independent variables. Moreover, Cheng, Hopwood, and McKeown [1989] performed a specification analysis of earnings response model, which showed that most studies in this area misspecified the model due to the lack of consideration in non-linearity, heteroscedascity, residual non-normality, omitted variables, and coefficient variation across firms. Therefore, the development of a properly specified model also seems to be a promising future research area.

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