ON THE USEFULNESS OF ACCOUNTING RATIOS IN EXPLAINING SECURITY RETURNS

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Many financial analysts argue that a firm's profitability is related with its stock price. Examining a sample from 1993 Annual Industrial Compustat and monthly CRSP, we find that return on total assets shows the highest correlation with stock prices among various profitability ratios. After controlling for industry classification, the average adjusted R^2 of the price-profitability regressions improves significantly. Including another profitability ratio in addition to return on total assets does not significantly increase the explanatory power of the relationship between abnormal returns and profitability ratios. The adjusted R^2 of the regressions are in general marginally significant and this study weakly supports the analysts' belief.

Research on accounting ratios has generally progressed on two fronts. The first is descriptive: to examine the properties of and correlations among the ratios available in an attempt to find a manageable set of ratios suitable for analytic purpose. There are many papers documenting the stochastic properties of these accounting ratios in this area[1]. The second approach uses ratios as inputs in specific prediction models. Most papers in this area study prediction abilities of various accounting ratios for bankruptcy, bond rating, and beta[2]. A few studies document whether each of these ratios represents a firm's market value or a firm's profitability ratios in relationship with its market value. Pinches et al. (1975) documents that there is a group of accounting ratios that signal a firm's return on investment using factor analysis. Other studies including Chen

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and Shimerda (1981) and Johnson (1979) show that the ratios documented in Pinches et al. are stable and comprehensive. Peter Easton (1985) documents that an average R^2 between the levels of stock prices and earnings is approximately 60 percent. The regressions in Peter Easton, however, have a heteroscedasticity problem inflating the coefficient of determination. (see: Footnote 19 of Peter Easton, 1985 and Jeseph Magliolo III, 1985). A more appropriate method for our study is to compute the changes of the ratios instead of the level to control for the share size effect.[3] Bowen et al. (1987) evaluates incremental information content of accrual and cash flows, running multivariate regressions of cumulative standardized abnormal returns on the growth rates of both variables. The growth rate may be biased when the prior year's value is negative. The average R^2 of the bivariate regressions is 4.5 percent. This paper evaluates changes of the financial ratios instead of the growth rates and examines accounting ratios more comprehensively, which possibly increase the correlation. Few other authors, however, test empirically any direct relationship between a group of profitability ratios based on the numbers available from financial statements and a firm's value. Although little research documents the relationship between a firm's value and its profitability ratios, numerous analysts assume a strong and positive relationship between stock prices and profitability as follows.[4]

1. When corporate earnings rise as companies' profitability increases, investors are willing to pay more for shares in hopes of reaping bigger dividends. (The Toronto Star, August 14, 1994)

2. CEO has been working on a plan to return it to profitability and boost its stock price.(USA Today, July 14, 1994)

3. [T]he profitability pushed many bank stock prices to new highs. (Business Journal-Milwaukee, June 25, 1994)

This paper tests the analysts' belief, evaluating the relationship between stock prices and profitability ratios. Since the newspaper articles do not specify which profitability ratios are closely related with stock prices, we select nine profitability ratios, which are based on the numbers available from financial statements, and examine whether a ratio or a group of ratios can explain a significant part of stock price changes.

"A knowledge of the direct relationship between a profitability ratio and a firm's value . . . enables owners to design a better compensation contract using accounting ratios even when the firm's security price data are not available."

This paper examines relative and marginal information contents of nine accounting ratios of profitability based on the accounting numbers available from financial statements to evaluate their correlations with the firm's values. The nine accounting ratios examined in this paper are net income on total assets, earnings before interest and income taxes on total assets, operating cash flow on total assets, net income on sales, operating cash flows on sales, net income on capitalization, operating cash flow on capitalization, net income on owners' equity, and operating cash flow on owners' equity. Finding out a manageable set of the ratios can be very beneficial for financial analysis as it reduces the number of ratios that must be computed and monitored. Gibson (1987) summarizes the responses of 52 chartered financial analysts (CFAs) who were asked to rank the relative importance of 60 accounting ratios. The nine profitability ratios have the same ranks according to the survey. This study empirically compares relative and incremental information contents of each profitability ratio in order to document a more parsimonious set which may have the same predictive power as the set of all nine ratios.

"Changes in earnings before interest and income taxes on total assets has the highest association with residual returns."

A knowledge of the direct relationship between a profitability ratio and a firm's value may help management direct their efforts to manage their firm's value and enables owners to design a better compensation contract using accounting ratios even when the firm's security price data are not available. Nevertheless, financial analysts can estimate an average effect of profitability change on the firm's stock price.

We examine the extent to which various profitability ratios are related with the firm's values. We document that changes in earnings before interest and income taxes on total assets has the highest association with residual returns, followed by changes of earnings before interest and income taxes on sales. This result suggests that, if a firm's performance is to be mapped into a single accounting ratio, earnings before interest and income taxes should be considered. When these numbers are divided by owners' equity, the ratio shows the lowest prediction power. The negative values of the denominator or the extreme values of the ratio significantly decrease the association between the ratio and firm value. In general, at most two accounting ratios jointly explain a firm's valuation sufficiently because of high correlations among various ratios which share the same accounting numbers as either their numerator or denominator. Although financial analysts expect a strong relationship between profitability and stock price, our test results suggest that the average of the explanation powers of the price-profitability relationship is disappointingly low. We should be careful in interpreting analysts' articles on this price-profitability relationship.

This study is organized into five sections. In the following section, we describe our test hypotheses as well as the methodologies employed to calculate abnormal returns. Section III contains our sample construction procedure and basic descriptive statistics of the profitability ratios. Section IV explains our test results of relative and marginal information contents of the profitability ratios. We present a brief summary and conclusion in section V.

II. METHODOLOGY AND HYPOTHESES

A. The Basic Model

The basic model is a cross-sectional regression of abnormal returns on change in each ratio.

For firm *i* in period *t*:

$$CAR_{i,t}=\beta_{i,o}+\beta_{i,1}(PR_{i,t}-PR_{i,t,-1})+\varepsilon_{i,t}=\beta_{i,o}+\beta_{i,1}\Delta R_{i,t}+\varepsilon_{i,t} \quad (1)$$

where $CAR_{i,t}$ is firm *i*'s cumulative abnormal return during a period starting from nine months before and to three months after the end date of fiscal year *t*, $PR_{i,t}$ is firm *i*'s profitability ratio (to be defined)[5] . Assuming a random walk of each accounting ratio, $\Delta R_{i,t}$ is a change of accounting ratio *i* in year *t*.

B. Computing Abnormal Returns

The dependent variable in (1) is estimated based on the standard market model methodology. That is, for each firm (i) in the sample, we estimate:

$$R_{i,t}=\alpha_i+\beta_i R_{mt}+\eta_{i,t} \tag{2}$$

using 60 monthly-return observations prior to the month when residual accumulation begins, $R_{i,t}$ being the equally weighted dividend adjusted monthly market return index from the tapes constructed by the Center for Research in Security Prices (CRSP) of the University of Chicago. Abnormal returns computed as the prediction errors using parameters estimated via (2), cumulated over a 12-month period, from 9 months prior to 3 months after the fiscal year end. When a firm changes its accounting period, the year of the change was dropped.

C. Evaluating Relative Information Content

In the Compustat tapes, variables are obtained as follows:

(1) net income before extraordinary items
(2) income before interest and income taxes
(3) operating cash flow= net income before extraordinary items
  \+ depreciation expense - increase in working capital
  \+ decrease in working capital
(4) total assets at the beginning
(5) total common equity at the beginning
(6) total capitalization amount at the beginning
(7) net sales

Based on these accounting numbers, we computed nine profitability ratios by dividing earnings variables by accounting numbers from balance sheet as follows:

	(1) Net Income	(2) EBIT	(3) OCF
(4) total assets	NITA	EBTA	OCTA
(5) O.E.	NIOE	EBOE	OCOE
(6) capitalization	NICP	EBCP	OCCP
(7) net sales	NISL	EBSL	OCSL

The nine accounting ratios examined in this paper are earnings before interest and income taxes over total assets (EBTA), net income over total assets (NITA), operating cash flows divided by total assets (OCTA), net income over net sales (NISL), operating cash flows over net sales (OCSL), net income over capitalization (NICP), operating cash flows over capitalization (OCCP), net income over owners' equity (NIOE), and operating cash flows over owners' equity (OCOE). We do not compute the three ratios (EBOE, EBCP, EBSL) because no prior research suggests to use these ratios. Computing accounting ratios for profitability of a firm, Lev and Sunder (1979) noted that a major function of the denominator of financial ratio is to control for size. However, a ratio approach to factorial control often causes deviations from what it really intends to measure. For example, Foster (1986, pp.99-101) suggests two computation issues: negative denominators and 'extreme' observations. This paper examines whether they cause disparity between the profitability ratios and market value of a firm. Regarding the selection of the numerator of each accounting ratio, net income is the final operating result after interest and taxes are deducted. It is therefore affected by the proportion of debt in the capital structure and the resultant interest charges. A somewhat more meaningful result can be obtained if we eliminate both interest and taxes from the profit figure (White et al., 1994, p. 226). The earnings before interest and income taxes expresses the gross earnings power of the capital employed in the business independent of the pattern of financing that provided the capital and independent of changes in the tax laws. Operating cash flow is also examined because recent literature including Ali (1994) supports the importance of operating cash flows on valuation.

ΔR_k represents a change of the kth ratio. We estimated model (1) nine times in each period for the nine accounting ratios. And we compare the adjusted R^2s of the nine regressions.

The null hypothesis for testing relative information content is:

$$H_0 1: R^2_{\Delta R_j} - R^2_{\Delta R_k} = 0 \qquad \forall k \neq j$$

where $R^2_{\Delta Rj}$ is the adjusted R^2 of the regression using accounting ratio *j* change (ΔR_j).

D. Evaluating Incremental Information Content

For this analysis, we use a step-wise regression and check the increased adjusted R^2 going from model (1) to:

$$CAR_{i,t} = \gamma_0 + \gamma_1 (PR_{i,j,t} - PR_{i,j,t-1}) + \gamma_2 (PR_{i,k,t} - PR_{i,k,t-1}) + \ldots + \mu_{i,jk\ldots,t} \qquad (3)$$

Thus, the related null hypothesis is:

$$H_0 2: R^2_{\Delta R_k | \Delta R_j \ldots} = R^2_{\Delta R_k . \Delta R_j \ldots} - R^2_{\Delta R_j \ldots} = 0$$

where $\mathbf{R}^2_{\Delta R_k | \Delta R_j \ldots}$ denotes the increase in the adjusted R^2 due to the accounting ratio *k*'s change (ΔR_k), conditional on accounting ratio *j*'s change (ΔR_j), etc. and $R^2_{\Delta R_k . \Delta R_j ...}$ denotes the adjusted R^2 due to accounting ratios *j...k*'s changes.

E. Controlling for Intertemporal and Cross-Sectional Differences

The return-profitability relationship is estimated (i) by year and (ii) by year but with sample firms separated into several major industry categories. Production technologies, input and output markets, regulations and accounting standards change over time. Thus, one would expect the return profitability ratios relationship year by year will reduce specification errors caused by this intertemporal variation. In addition, prior research such as Collins and Kothari (1989) has shown that one could further reduce specification errors by holding constant industry effects, since firm characteristics and industrial norms tend to change over time. We therefore estimate the return-profitability relationship by major industry categories in each year. To separate the firms into industry categories, we use the first digit of each firm's SIC classification. This approach potentially results in more cross-sectional specification errors than a finer classification, such as one based on the first two digits of each firm's SIC classification. However, our approach is dictated by the need to have sufficient degrees of freedom in each industry category.

III. DATA AND DESCRIPTIVE STATISTICS

A. Data Description

The sample period spans 17 years, from 1975 to 1991. There is an average of 479 firms in each of the 17 years, giving a total of 8139 observations. The sample was selected using the following criteria: (a) that data for calculating the nine profitability measures (total assets, net sales, owners' equity, capitalization, net income, net income before interest and income taxes, operating cash flows) are available from 1993 Expanded

Annual Compustat and 1993 Research Compustat, (b) that firms did not change their fiscal ending dates during last and current years and (c) that monthly return data are available from the CRSP Monthly Return File for 69 months prior to and three months after, the fiscal year end. Since both Expanded Annual Compustat and Research Compustat are used for the sample selection, the results are free from sample survivorship bias. The number of observations each year is, however, decreasing because of the observations from Research Compustat.

B. Descriptive Statistics

Table 1 presents some of the descriptive statistics of the changes of the nine profitability ratios assuming a random walk. For example, the first raw shows that there are 808 sample firms for 1975. In that year, average change of NISL (ΔNISL) of the 808 firms was -0.0063; ΔOCTA, 0.0549; ΔOCOE, 0.1371; ΔNITA, -0.0049; ΔNIOE, -0.0182; ΔEBTA, -0.0093; ΔOCSL, -0.0106; ΔOCCP 0.0991; and ΔNICP -0.0085.

NI, in general, seems to have smaller cross-sectional variations than EBIT comparing NITA to EBTA. Out of 17 years, the 14 sample standard deviations of NITA are smaller than those of EBTA. Other gains and losses including interest expenses seem to smooth the cross-sectional differences. Since total assets are, in general, larger than O.E., OCTA shows smaller changes than OCOE. Absolute values of 16 average changes in OCTA are smaller than those of OCOE. A comparison between NITA and NIOE also shows the same results. This may imply that OE may increase the variations and the average values of accounting ratio changes because of its negative values. When OE is used as a denominator in each ratio, the ratio shows the largest average changes and variations. This is due to the negative values of OE.[6] Since net sales are similar to total assets, NISL and NITA show a similar level of average changes.

Table I

Descriptive Statistics of Yearly Changes of Accounting Ratios

Year	NO.	ΔNISL	ΔOCTA	ΔOCOE	ΔNITA	ΔNIOE	ΔEBTA	ΔOCSL	ΔOCCP	ΔNICP
1975	808	-0.63	5.49	13.71	-0.49	-1.82	-0.93	-1.06	9.91	-0.85
		(3.88)	(12.8)	(108)	(3.07)	(28.7)	(4.92)	(4.47)	(48.2)	(5.09)
1976	761	0.31	-2.52	-7.67	0.47	1.20	0.79	0.41	-4.13	0.85
		(3.70)	(11.3)	(86.9)	(2.94)	(16.2)	(4.55)	(4.91)	(44.6)	(5.09)
1977	720	0.22	-0.92	-2.71	0.32	0.69	0.44	0.22	-2.19	0.59
		(2.78)	(10.1)	(65.3)	(2.29)	(7.16)	(3.29)	(4.09)	(26.5)	(3.49)
1978	657	0.47	-0.72	-3.94	-0.12	0.46	0.13	0.71	-0.85	0.60
		(4.74)	(15.8)	(48.2)	(13.7)	(16.7)	(14.3)	(5.71)	(15.6)	(9.21)
1979	617	0.27	0.28	-10.9	0.30	-5.17	0.23	0.27	-4.44	-4.97
		(3.92)	(9.15)	(204)	(3.71)	(132)	(4.84)	(5.52)	(133)	(132)
1980	554	-0.52	1.46	9.96	-0.79	-2.12	-1.04	-0.68	-1.92	-4.79
		(6.70)	(10.8)	(224)	(2.99)	(114)	(4.50)	(6.58)	(87.5)	(83.4)
1981	514	-0.64	-0.11	7.10	-0.46	-0.21	-0.65	-0.90	6.23	3.61
		(5.35)	(12.3)	(208)	(4.44)	(124)	(6.46)	(7.64)	(115)	(101)
1982	465	-0.22	0.93	-6.42	-1.74	-13.5	-2.90	-2.79	-7.81	-11.6
		(11.7)	(11.0)	(193)	(5.89)	(171)	(7.06)	(12.2)	(173)	(170)
1983	446	1.04	-0.78	-0.41	-0.25	-3.12	-0.17	0.89	-2.27	-0.84
		(13.6)	(16.8)	(75.1)	(15.1)	(82.2)	(15.5)	(13.8)	(65.6)	(69.5)
1984	423	1.31	-0.53	1.79	0.95	6.12	1.39	2.07	0.30	4.95
		(13.4)	(10.6)	(91.8)	(4.64)	(104)	(5.45)	(20.9)	(38.9)	(98.9)
1985	387	-1.52	-0.41	-25.1	-0.85	-6.63	-1.56	-2.39	9.04	-10.3
		(15.3)	(13.8)	(365)	(4.78)	(119)	(6.11)	(20.8)	(249)	(113)
1986	355	-3.26	-0.59	-0.65	-0.47	-2.53	-0.53	-2.49	-11.2	3.47
		(53.6)	(11.1)	(48.1)	(5.10)	(37.8)	(5.63)	(53.9)	(251)	(78.8)
1987	320	-1.07	1.17	6.02	0.39	4.31	0.66	-0.46	0.58	1.35
		(17.3)	(9.96)	(89.2)	(3.87)	(66.9)	(4.78)	(16.9)	(26.4)	(22.4)
1988	293	2.11	-2.77	-19.6	0.68	-1.32	0.54	1.84	-18.7	-7.37
		(21.0)	(14.6)	(142)	(3.98)	(32.0)	(4.72)	(18.4)	(187)	(143)
1989	279	-2.73	3.12	22.83	-0.44	67.23	-0.37	-1.96	20.25	9.22
		(32.1)	(14.1)	(146)	(5.39)	(1077)	(4.75)	(25.9)	(201)	(154)
1990	268	-0.31	0.69	138.3	-0.37	14.43	-0.53	-0.83	2.02	-0.10
		(22.0)	(12.0)	(2071)	(7.64)	(280)	(7.20)	(17.9)	(24.7)	(11.3)
1991	272	1.90	0.46	-16.4	-0.26	-28.8	-0.91	0.95	-0.51	-2.07
		(34.6)	(10.9)	(231)	(5.76)	(337)	(5.18)	(31.2)	(23.2)	(10.8)
mean	479	-0.19	0.25	6.23	-0.18	1.718	-0.318	-0.37	-0.34	-1.07

* In parentheses are sample standard deviations of changes of the respective ratios.

Table 2 presents the median values of the 17 yearly product-moment correlations of profitability ratio changes, with data pooled across firms. When two ratios have a common denominator or a common numerator, their correlation values are high such as the correlations between NISL and OCSL; NITA and EBTA; NICP and NIOE; and OCOE and OCTA. Since capitalization amounts are similar to total assets, NICP has a high correlation with NITA. These high correlations are consistent with Foster (1986, pp. 113-118).

Table 2

Median Values of Product-Moment Correlations

ΔNISL	1.000								
ΔNITA	0.721	1.000							
ΔNIOE	0.419	0.584	1.000						
ΔNICP	0.597	0.885	0.758	1.000					
ΔEBTA	0.573	0.881	0.426	0.733	1.000				
ΔOCSL	0.879	0.605	0.311	0.497	0.672	1.000			
ΔOCTA	0.196	0.280	0.095	0.205	0.263	0.158	1.000		
ΔOCOE	0.082	0.105	0.366	0.190	0.087	0.067	0.717	1.000	
ΔOCCP	0.149	0.256	0.169	0.310	0.246	0.139	0.944	0.759	1.000
	ΔNISL	ΔNITA	ΔNIOE	ΔNICP	ΔEBTA	ΔOCSL	ΔOCTA	ΔOCOE	ΔOCCP

Consequently, the related slope coefficients in multiple regressions using more than one accounting ratio having a common denominator or numerator should be interpreted with care. These high correlations may imply that the marginal information content of an additional ratio is not significant.

IV. TEST RESULTS

A. Relative Information Content

Model (1) is estimated in two ways, producing two sets of adjusted R^2s. First, they are estimated year by year, pooling all sample firms available for each year. This results in 17 adjusted R^2s, which are presented in Panel A of Table 3. Second, for each year we separate the sample firms into seven major industry categories using the first digit (from one to seven) of each firm's SIC classification and regressions are run by industry category.[7]

This is done for each of the 17 years, resulting in a total of 119 regressions for each profitability ratio. We then average the adjusted R^2 over time for each industry category. This gives seven adjusted R^2 averages for each ratio. The averages of the seven adjusted R^2s are presented in panel B of Table 3. A comparison of the adjusted R^2s in panel A in comparison with those in panel B indicates that controlling for industry effects is a useful procedure. Mean adjusted R^2s in panel A range between 0.0001 and 0.0895 while mean adjusted R^2s in panel B are between 0.0179 and 0.0967. Except ΔNISL, the other ratios' mean adjusted R^2s are increasing 38 times by controlling for industry. This is a significant improvement in explanatory power considering that only the first-digit SIC classification of industry is used. Panel A of Table 3 shows that ΔEBTA has the highest adjusted R^2, followed by ΔNITA, ΔNISL, ΔOCSL and the others. An inspection of the adjusted R^2s categorized by industries (panel B of Table 3) confirms the order.

Panel A of Table 4 strongly reinforces this belief. The Wilcoxon Z-statistic for $\mathbf{R}^2_{\Delta NISL}$ -$\mathbf{R}^2_{\Delta EBTA}$ is -2.864, which is significant at the level of 0.05 and that for $\mathbf{R}^2_{\Delta EBTA}$ -$\mathbf{R}^2_{\Delta NICP}$ is 3.195, which implies that the adjusted R^2 of ΔEBTA is significantly larger than that of ΔNICP. It shows that the adjusted R^2s of ΔEBTA are significantly larger than the adjusted R^2s of the other ratios unanimously and the null hypothesis regarding the equality of

Table 3

A Comparison of the Goodness-of-fit of Model (1)

Panel A Year by Year Comparisons

Adjusted R^2 for Profitability Ratios

	ΔNISL	ΔOCTA	ΔOCOE	ΔNITA	ΔNIOE	ΔEBTA	ΔOCSL	ΔOCCP	ΔNICP
1975	0.0595	0.0099	-0.001	0.1254	0.0174	0.1301	0.0930	-0.001	0.0917
1976	0.0326	-0.001	0.007	0.0931	0.0388	0.1029	0.0436	-0.001	0.0551
1977	0.1981	0.0268	0.0176	0.1868	0.1214	0.1768	0.1758	0.0092	0.1773
1978	0.0220	0.0006	0.0005	0.0014	0.0023	0.0052	0.0331	0.0022	0.0124
1979	0.1612	0.0324	0.0030	0.1489	-0.001	0.1929	0.1986	0.0010	-0.001
1980	0.0021	0.0050	-0.002	0.0898	-0.002	0.0970	0.0108	-0.001	-0.001
1981	0.3872	0.0023	0.0016	0.0761	-0.002	0.0860	0.0467	-0.001	-0.002
1982	0.0248	-0.002	-0.002	0.0502	0.0004	0.0890	0.0393	-0.001	0.0008
1983	0.0228	-0.000	0.0042	0.0070	0.0031	0.0139	0.0307	-0.001	0.0024
1984	0.0114	0.0173	-0.002	0.0603	0.0022	0.0690	0.0051	0.0014	-0.002
1985	0.0044	-0.002	-0.002	0.0823	-0.003	0.0614	0.0033	-0.003	-0.002
1986	-0.002	0.0077	0.0024	0.0416	-0.003	0.0437	-0.002	0.0257	0.0127
1987	0.0123	-0.001	-0.003	0.1063	0.0197	0.1345	0.0181	0.0049	0.0803
1988	0.0066	0.0204	-0.001	0.0760	0.0051	0.1124	0.0125	0.0004	0.0013
1989	0.0036	-0.004	0.0122	0.1291	0.0126	0.1844	0.0020	-0.001	0.0014
1990	0.0047	-0.004	-0.002	0.0033	-0.004	0.0153	0.0105	-0.002	0.0090
1991	0.0611	-0.003	0.0003	-0.002	0.0027	0.0066	0.0705	-0.003	0.0371
mean	0.0596	0.0062	0.0020	0.0750	0.0115	0.0895	0.0466	0.0001	0.0282

Panel B

Industry-wise Comparison

SIC	ΔNISL	ΔOCTA	ΔOCOE	ΔNITA	ΔNIOE	ΔEBTA	ΔOCSL	ΔOCCP	ΔNICP
1	0.1237	0.0438	0.0505	0.0754	0.0816	0.0825	0.1224	0.0486	0.0438
2	0.0687	0.0066	0.0146	0.0747	0.0337	0.0755	0.0582	0.0152	0.0707
3	0.0547	0.0136	0.0097	0.1284	0.0497	0.1501	0.0761	0.0074	0.0865
4	0.0497	0.0280	0.0153	0.1057	0.0527	0.0989	0.0301	0.0396	0.0954
5	0.0901	0.0279	0.0458	0.1634	0.1114	0.1936	0.1109	0.0449	0.1695
6	0.0985	0.0040	0.0066	0.0359	0.0327	0.0336	0.0409	0.0455	0.0737
7	0.0291	0.0011	0.0001	0.0863	0.0863	0.1170	0.0857	0.0041	0.0581
mean	0.0576	0.0179	0.0204	0.0861	0.0640	0.0967	0.0749	0.0293	0.0854

SIC 1 is extractive industry; 2, food, textile,and paper; 3, rubber,metal, and machinery; 4, transportation; 5, wholesale and retail; 6, banks and insurance; and 7, hotels, services, and pictures.

R^2 is rejected overall. ΔNITA's adjusted R^2s are higher than those of the other ratios except for that of ΔEBTA. ΔNISL and ΔOCSL show the same levels of significance, but not as strong as ΔEBTA and ΔNITA. When the mean adjusted R^2s are examined (Panel B of Table 4), the levels of significance are increasing and their results are consistent. ΔEBTA may be the most useful profitability ratio among the nine ratios to explanation the security price changes. The ratios using owners' equity as a denominator or operating cash flows as a numerator usually show the lowest explanatory power.

Table 4

Wilcoxon Sign Test of Adjusted R^2 Differences

Panel A

Pooled Sample (Panel A of Table 3)
Hypothesis: $R^2_i - R^2_j = 0$

while *i* is the ratio listed in the first column and *j* in the first row.

i \ *j*	ΔOCTA	ΔOCOE	ΔNITA	ΔNIOE	ΔEBTA	ΔOCSL	ΔOCCP	ΔNICP
ΔNISL	2.817**	3.247***	-2.391**	2.769***	-2.864**	-2.343**	3.100***	1.159
ΔOCTA		1.491	-3.62***	-0.592	-3.62***	-2.911**	1.018	-1.538
ΔOCOE			-3.53***	-1.491	-3.62***	-3.38***	0.355	-2.107**
ΔNITA				3.430***	-2.580**	2.012**	3.574***	2.911**
ΔNIOE					-3.62***	-3.20***	1.775*	-2.201**
ΔEBTA						2.485**	3.621***	3.195***
ΔOCSL							3.243***	1.870*
ΔOCCP								-2.201**

Panel B

Mean of adjusted R^2 categorized by seven industries (Panel B of Table 3)

i \ *j*	ΔOCTA	ΔOCOE	ΔNITA	ΔNIOE	ΔEBTA	ΔOCSL	ΔOCCP	ΔNICP
ΔNISL	5.336***	2.711**	-1.351	1.762*	-2.192**	-0.564	5.251***	-0.528
ΔOCTA		-0.063	-5.27***	-3.033**	-5.23***	-3.68***	-0.438	-4.91***
ΔOCOE			-5.14***	-2.854**	-5.25***	-4.04***	0.725	-5.32***
ΔNITA				2.246**	-1.852*	1.405	5.522***	0.796
ΔNIOE					-2.407**	-1.172	3.069**	-2.067**
ΔEBTA						2.854**	5.32***	2.120**
ΔOCSL							3.677***	-0.743
ΔOCCP								-5.34***

*,**,*** indicate statistical significance at the level of 0.10, 0.05, and 0.01 levels, respectively.

B. Incremental Information Content

Figure 1 shows the adjusted R^2 improvements of increasing the number of independent variables. Among the simple regressions, the highest adjusted R^2 is 0.0967, of which is from the regression of ΔEBTA. The average value of the simple regressions is 0.0591. The adjusted R^2s of the bivariate regressions are higher than those of the simple regressions. The values of the multivariate regressions including more than two accounting ratios are lower than those of the bivariate regressions. The step-wise regressions also stop including more than two ratios. We, accordingly, evaluate the incremental information contents of adding a second variable only.

Figure 1

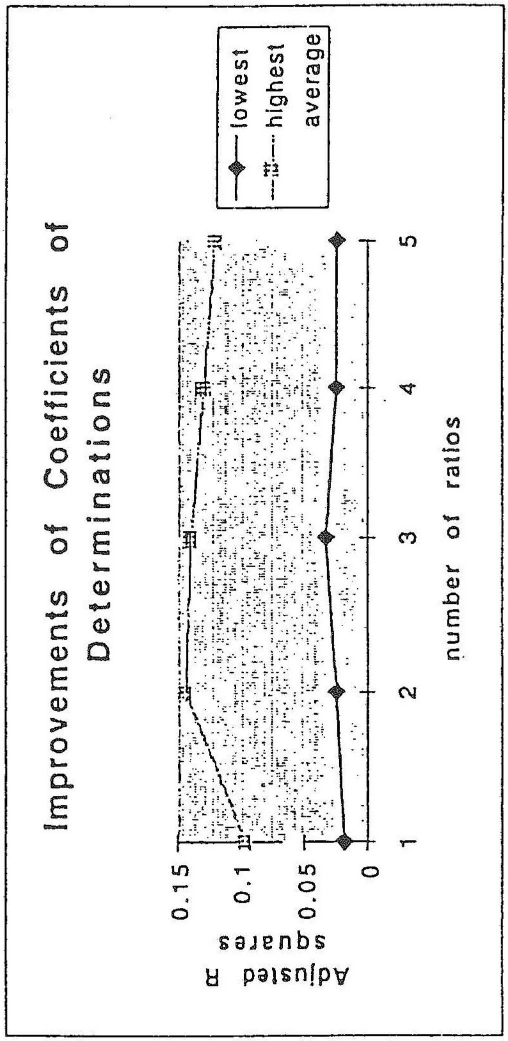
Improvements of Coefficients of Determinations
lowest
highest
average
0.15
0.1
0.05
0
Adjusted R squares
1
2
3
4
5
number of ratios

Table 5 is constructed to show the adjusted R^2s of regressions using two independent variables listed in the first column and the first row.

Table 5

Averages of Industry-Wise Adjusted R^2

of Regressions Using Two Independent Variables (model 3)

ratios	ΔOCTA	ΔOCOE	ΔNITA	ΔNIOE	ΔEBTA	ΔOCSL	ΔOCCP	ΔNICP
ΔNISL	0.0757	0.0880	0.1246	0.1144	0.1440	0.1016	0.0892	0.1216
ΔOCTA		0.0411	0.0960	0.0601	0.1108	0.0777	0.0244	0.0858
ΔOCOE			0.1081	0.0746	0.1187	0.0907	0.0346	0.0931
ΔNITA				0.1155	0.1254	0.1263	0.1112	0.1076
ΔNIOE					0.1344	0.1158	0.0677	0.1163
ΔEBTA						0.1314	0.1231	0.1383
ΔOCSL							0.0909	0.1311
ΔOCCP								0.0922

In each industry category, a regression of two accounting ratios was run for each year. There are 17 adjusted R^2s in industry category. The number in each cell is an average of the 17 adjusted R^2s. The regressions using ΔEBTA, ΔNISL, or ΔNITA show higher adjusted R^2s, which are consistent with table 3 and 4. The range of these adjusted R^2s are between 3.46%(ΔOCCP and ΔOCOE) and 14.40%(ΔEBTA and ΔNISL). By using two accounting ratios instead of one accounting ratio, the adjusted R^2s seem to improve.

"Empirical evidence . . . can help analysts and corporate owners make more informed decisions as to what profitability ratios they have to look at in order to maximize the firm's value."

In order to test marginal information content, the adjusted R^2s of each year are subtracted by the higher average adjusted R^2s of the two simple regressions of the two variables in panel B of table 3. For example, the 17 adjusted R^2s of the regressions of ΔOCTA and ΔNISL, one for each year, were subtracted by 0.0576, which is the higher between the two average adjusted R^2 of simple regressions, ΔNISL and ΔOCTA, (0.0576 and 0.0179). The marginal improvement of the bivariate regression of ΔOCTA and ΔNISL is averaged over seven industry categories, which is 0.0087 in panel A of table 6. Panel A of table 6 shows that on average the average adjusted R^2 improves by increasing number of independent variables.[8] Panel B of table 6 shows significance of these marginal improvements. The regressions of ΔNICP and ΔOCSL, ΔEBTA and ΔNIOE, and ΔNICP and ΔNISL show significant improvements. The bivariate regressions show improvements (most of the t-values are positive) but their t-values are not significant.

V. CONCLUSION

No prior research has examined as to which profitability ratios are useful in assimilating capital market returns, although many financial analysts assume a group of profitability ratios is useful to predict a firm's market values. To test the analysts' belief, this study seeks to address the usefulness of nine profitability ratios in explaining residual returns. Empirical evidence from such an analysis can help analysts and corporate owners make more informed decisions as to what profitability ratios they have to look at in order to maximize the firm's value. The methodology of the analysis is primarily cross-sectional regression of residual returns on profitability ratios. Usefulness is defined as goodness-of-fit of the regressions. The analysis is conducted from two perspectives: relative usefulness and incremental usefulness. The former compares the explanatory power of the various profitability ratios; the latter, the incremental explanatory power of the profitability ratios that are not included in the original simple regression.

Based on the large sample selected over 17 years, the analysis leads to three generalizations. First, the earnings before interests and income taxes divided by total assets, net income by total assets, and net income by sales dominate the other ratios. Especially, the ratios using owners' equity are noisier than the other ratios. This is due to the negative values of owners' equity. Another possible reason is that net income affects the numerator and denominator of NIOE significantly and dividing NI by OE generates extreme values. Because of this technical limitation, NIOE has the lowest R^2, although current literature suggests this ratio is the most appropriate for common stock valuations.

The second generalization is that, with controlling for industry, the levels of usefulness of the most profitability ratios improve. The controlling for industry may decrease the noisiness of each accounting ratio and the knowledge of industry may be useful in using and choosing appropriate profitability ratios,

The third generalization is that using more than one profitability ratios in addition to ΔEBTA, ΔNITA, or ΔNISL does not improve the explanatory powers. Using ΔEBTA may sufficiently explain what various profitability ratios can predict.

"Using ΔEBTA may sufficiently explain what various profitability ratios can predict."

A practical implication of these findings is that, in situations where one has to use a parsimonious model, it would be appropriate to use ΔEBTA ratio alone. When analysts want to use any profitability ratios using owners' equity or operating cash flows, it is important to control for industry differences. This paper shares some common limitations as Lev (1989) argued. The typical R^2s from price-earnings relationship studies are disappointingly low and this study seems to support the analysts' common belief weakly. These R^2s do not seem to improve even when the number of independent variables is increased due to a high correlation between profitability ratios. When more than two profitabilities are used, the average R^2 decreases. This may possibly imply that we have to investigate the usefulness of other variables from non-financial statements and we should carefully interpret analysts' opinions when they use this price-profitability relationship predicting stock prices.

Table 6

A Comparison of the Goodness-of-fit of Model (3)

Panel A
Marginal Adjusted R^2 averaged over industry categories of Model (3) over Model (1)

ratios	ΔOCTA	ΔOCOE	ΔNITA	ΔNIOE	ΔEBTA	ΔOCSL	ΔOCCP	ΔNICP
ΔNISL	0.0087	0.0211	0.0196	0.0356	0.0281	0.0205	0.0223	0.0547
ΔOCTA		0.0231	0.0057	-0.0037	0.0066	0.0091	0.0070	0.0750
ΔOCOE			0.0150	0.0109	0.0145	0.0220	0.0083	0.0727
ΔNITA				0.0192	0.0200	0.0295	0.0196	0.0173
ΔNIOE					0.0275	0.0436	0.0021	0.0525
ΔEBTA						0.0237	0.0172	0.0341
ΔOCSL							0.0203	0.0625
ΔOCCP								0.0704

Panel B
T-values of Improvements of Industry-wise Average Adjusted R^2 using Model (3) over Model (1)

ratios	ΔOCTA	ΔOCOE	ΔNITA	ΔNIOE	ΔEBTA	ΔOCSL	ΔOCCP	ΔNICP
ΔNISL	0.2505	0.5842	0.8748	1.5474	1.1175	1.0147	0.6226	2.024**
ΔOCTA		0.7238	0.1917	-0.1444	0.2481	0.2886	0.2048	1.5258
ΔOCOE			0.7972	0.3690	0.5855	0.6231	0.3517	1.5514
ΔNITA				1.0958	1.2838	1.0943	0.5188	0.3871
ΔNIOE					1.6941*	1.5361	0.0726	1.5345
ΔEBTA						1.1245	0.5956	0.8770
ΔOCSL							0.5953	3.328***
ΔOCCP								1.4989

NOTES

1. Deakin (1976) conducted a comprehensive study of stochastics of accounting ratios. After examining the cross-sectional distribution of 11 ratios over the 1953-72 period for large populations of manufacturing firms, he concluded that the typical normality hypothesis had to be rejected. Lee (1985) extended this study evaluating stochastic characteristics of accounting ratios based on factorial control. Other papers in this avenue are Frecha and Hopwood (1983), Lev and Sunder (1979).

2. There are many studies that examine the predictive ability of accounting ratios for bankruptcy. For example, Abel-Kjalik et al. (1980), Altman (1968), Beaver (1966), Deakin (1972), Libby (1975), and Ohlson (1980) studied bankruptcy predictions.

3. Numerous papers after Peter Easton (1985) divide earnings by stock prices or other variables in order to control for the share size effect. A few of them are Baginski et al. (1993), Joh and Lee (1992), Ou and Penman (1989), Freeman and Tse (1989), Wilson (1987), and Rayburn (1986). Wilson (1987) and Rayburn (1986) are two of many papers examining the relative and incremental information contents of cash flows and accrual income. These papers report the adjusted R^2 between five percent and ten percent. (Lev, 1989) These papers use the stock price which is not available from financial statements. This paper, However, evaluate the information contents of ratios from financial statements.

4. This paper uses the changes of each accounting ratio for the tests of association between market value changes and ratio changes. Changes of the ratios in the first year of the test period are not computed since the prior year data are not available. Changes in 1972 are also excluded because 1993 Compustat includes only a part of total available firms.

5. Since there is a large body of research using the level of accounting ratio (in addition to changes), the entire empirical analysis here is repeated by adding the level of accounting ratio. However, the two sets of results are qualitatively the same, so only those results based on (1) are reported for parsimonity.

6. Because of the negative values of owner's equity, the adjusted R^2 s are computed and compared based on the ratios of the sample of positive owner's equities. They improve slightly but not significantly. The results are based on the sample of both positive and negative owner's equities, accordingly.

7. Industry categories 0 (agriculture), 8 (service), and 9 (conglomerate) were dropped because they did not give a sufficiently large sample size.

8. In order to examine any additional improvements by increasing the number of independent variables more than two, step-wise regressions and regression models of three variables were run. Step-wise regressions did not include more than two profitability ratios when a criteria of 10% marginal significance level was used. The regressions of more than two variables provided lower adjusted R^2 than those in table 5.

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