International Review of Business Research Papers
Vol. 9. No.1. January 2013 Issue. Pp. 1 – 21

Do Investors Under-React to ROE?

Hongsong Neuhauser*

A delayed market response to public information such as P/B or P/E ratios is still of great interest to money manager in seeking deeper understanding of equity valuations. In this study, we uncovered the investors' under-reaction to ROE (Return on Equity), which provides further evidence interoperating the P/B and P/E anomalies. We found that, over time, a quarterly rebalanced portfolio holding the top decile highest ROE stocks will earn a risk controlled annual abnormal excess return of approximately 15.2 percent due to investors' under-reaction. We also discovered that investors' under-reaction to ROE diminishes with decreasing ROE level and almost vanishes at the lowest two deciles of ROE ranked portfolios. More importantly, investors have been persistently under-reacting to ROE information since 1973, especially the recent period from 1980 to 2004 during which the annual abnormal excess returns stayed at over 16 percent.

JEL Codes: G11, G32, and G35

1. Introduction

It is commonly understood that firms doing a better job in milking profit from their operations typically have a competitive advantage which normally translates into superior returns for investors. This research on how does market in general react to firms' ROE (Return on Equity) information in terms of valuation of their stocks is motivated by the following interesting questions: Are quality firms which are known as superior in generating earnings for shareholders being appreciated such that it is promptly reflected through market price of their stocks?

ROE is particularly important in that it allows cross-sectional comparison between firms so as to prevent investors from being misled by most firms' annual reports with regard to "achieving record earnings". As a sign of success, the ROE takes into account the retained earnings from previous periods, and tells investors how effectively their capital is being reinvested. So ROE serves as a far better gauge of management's fiscal adeptness than does earnings per share. What is more important is that ROE essentially is a speed limit on a firm's growth rate for it can be shown that a company cannot grow earnings faster than its current ROE without raising additional cash, which is why money managers rely on it to gauge growth potential. In fact, combining a caped debt/equity ratio, many practitioners are using ROE rather earnings per share as one of their first tier screening criteria when picking winning stocks for their portfolios (Domash 2002, Buffett 1978). The high ROE, low debt investment strategy has been known for years (Hagstrom 1994).

Given such widely publicized lucrative investment strategies, directly focusing on ROE as oppose to other market valuation ratios studied in the finance and accounting literature, this study is to provide evidences to answer the question of how far

*Dr. Hongsong Neuhauser; Department of Business, Elizabethtown College, USA, Email: neuhausere@etonwn.edu

investors, in general, have gone in timely recognizing firms' superior ROE when valuing publicly traded US companies' stocks such that risk adjusted abnormal excess return is too small to make such simple ROE screening strategy a superior profit opportunity in later periods. This research mainly seeks to investigate how investors trading in US capital market, namely NASDAQ/NYSE/AMEX, react to firms' relative higher ROE information available upon release of their quarterly earnings. Based on previous research findings and discussions, using returns on portfolio investing to control for stocks' idiosyncratic risks and changes in the volatility of market returns over time, we hypothesize and demonstrate that investors in general underreact to firms' ROE information which is further corroborated and strengthened by a specially designed highest ROE firm portfolio investment strategy that earns considerable risk controlled abnormal excess returns due to market under-reaction but not systematic risks or other risk factors.

The organization of this paper is as follows. In the next section, we provide the literature review, followed by a section describing the research design including the definition of variables, the sources of sample datasets, and the constructions of ROE sorted decile portfolios, plus the methodology of quarterly portfolio rebalance investment strategy. Section 4 presents and discusses descriptive statistics on portfolio characteristics and factor estimates, findings of the abnormal excess returns (AER) benchmarked with CRSP equally weighted or value weighted market portfolio and S&P500 Index, as well as results of AER using risk adjustment factor models followed by summarizing the empirical findings in the conclusion section.

2. Literature Review

Foundations of finance theory tell us that firm value is established through profitability, growth, dividends, and other factors among which ROE, as a profitability measure, has a direct impact on growth and dividends pay out. Block (1964) studied the relationships of P/B (Price to Book Value of Equity ratio), P/E (Price to Earning ratio), and ROE using 14 years of Dow-Jones Industrial Average stocks (30 stocks per year) and concluded that:"…Earnings to Book-Value-Equity shines forth as a clear beam of light, leading the way to the price paid for equity assets. Return on equity appears as direct influence on the price/earnings ratio, re-emerges as a major cause of growth, and is seen in a consistent pattern with earnings stability. Even payout is controlled by expectations of profitability;…the basic earning power of a company can be expressed in terms of return on equity." Furthermore, Preinreich (1932) and (Gordon1962) showed that the P/B of a constant growth firm is determined by the differential between the ROE and the required rate of return on its projects. In view of the fundamental role in which return on equity plays in determining P/B and P/E ratios, we infer that ROE may be essentially very closely tied to the well documented equity mispricing, classification of value versus growth stocks and their abnormal stock returns as well as the earning announcement effect that are related to P/B and P/E ratios, which are often considered as 'market anomalies' or 'market inefficiencies' in the academic literature.

Although there are many fruitful studies on setting up an asset valuation system based on P/B ratio and/or P/E ratio. no study of these market anomalies directly focuses on ROE as a key determinant in the finance and accounting literature, For instance, P/B ratio was (a) interpreted as indicating expected ROE and determined by leverage (Graham, Dodd & Cottle 1962); (b) modeled as growth indicator (Preinreich 1932, Kay

1976, and Brief & Lawson 1992), and (c) suggested as an indicator of mispriced stocks (Rosenberg, Reid & Lanstein 1985) or as an indicator of 'value stock' versus 'glamour stock' (Lakonishok, Shleifer, & Vishny 1994). Recently, Chan, Hamao, & Lakonishok (1991) and Fama & French (1992) documented that P/B ratio as a proxy for systematic risks explains mean stock returns. Regarding P/E, the finance and accounting literature documented the investors' underreaction to earning information (Bernard & Thomas 1989, 1990; Foster, Olsen & Shevlin 1984). Since ROE = EPS/BV, and if investors under-react to earnings they may under-react to ROE as well. Moreover, Stephen(1996) found that P/B and P/E are reconciled not by current ROE alone but by the relation between current and expected future ROE. Evidences in previous literature on P/B and P/E conclude that extrapolating growth from current earnings after all provides only a noisy indication of inherent profit generating ability. Given the important role of ROE in distinguishing P/E from P/B, P/B mispricing or P/E anomalies would just be explained by the market mispricing of the ROE that fundamentally determines the ratios related to these anomalies.

Since ROE shines dazzlingly in the spotlight of our investigation for market efficiencies, we cannot help asking two important questions: Do higher ROE stocks inherently carry more risks so that they are intentionally valued less for a higher expected return? Or do investors, in a tardy manner, 'naively' react to firms' ROE information, which causes the P/E or P/B anomalies? Value investing strategies that call for, ceteris paribus, purchasing lower P/E or lower P/B to produce superior returns over a long period of time have been well known(Basu 1983, Bhandari 1988, Fama & French 1992, Lakonishok, Shleifer, &Vishny 1994). However, interpreting these superior returns has been more controversial and mixed (Fama&French 1992, Rafael LP 1996, De chow and Sloan 1996). Although finance literature showed influencing power of ROE on future growth and expected earnings, to our knowledge, there is no prior study focusing directly on ROE for equity valuation nor has there been anyone investigating directly the connection between firms' high ROE and their stock returns in exploring the potential market under-reaction to high ROE information, which we call in this study the investors' underreaction to ROE information.

Following previous studies using financial statement information to predict abnormal stock returns and explore mispricing of stocks (Piotroski 2000, Guay 2000), this study eliminate their limitations by choosing from the entire bandwidth of publicly traded companies for more than 31 years of time period covering several economic cycles in United States and using three risk adjustment factor models including Fama-French 3-factor Model, Fama-French 4-factor Model and a proprietary Jensen Measure 4-factor Model. We show that there is indeed a superior profit opportunity due to investors' larger underreaction to the highest ROE portfolio of stocks. A long equity investment in a quarterly rebalanced portfolio of the 10 percent highest ROE firms is able to earn an annual return of 15.2%. Moreover, we demonstrate that contrary to what is found in PEAD strategy (Johnson & Schwartz 2000), the superior performance earned by the highest ROE firm portfolio investment has not gone away or been eliminated but instead is larger after 1980s.

3. The Research Design and Methodology

Sample firms' financial statement data and monthly stock returns used in this study are drawn from WRDS (Wharton Research Database Service)'s COMPUSTAT North America Industrial Quarterly and CRSP Monthly Stock. The sample covers a 31 year

period beginning in 1973 and ending in 2004 for a total of 126 quarters. Quarterly financial statement items are obtained as following: starting from the first fiscal quarter (February, March and April) of 1973 to the end of the second fiscal quarter (May, June and July) of 2004, we extract all publicly traded or subsidiary of publicly traded non-ADR firms on three major US stock markets, i.e. NASDAQ, NYSE and AMEX, from COMPUSTAT North America Industrial Quarterly to be included in the sample. We exclude the ADRs to avoid noise introduced by foreign business, financial or legal factors that may be quite different from their industry counterparts operating in America. The initial sample has 460,048 observations across firm, year and quarter (firm-year-quarter observations). In addition, firms traded on Bulletin Board or listed as Pink sheets are also filtered out from our sample. We then eliminate utility firms and firms operating in financial industry due to their different GAAP treatments on liabilities. Firms with missing information on S&P COMPUSTAT calendar year or calendar quarter and on debt or common equity as well as firms that have non-positive debt are deleted in suspecting that either these firms business are uncommon or there are some errors in the database. Firms that have missing value on end of fiscal quarter closing stock price or common share outstanding are also excluded from the sample. To be included in the final sample firms must have positive common equity and net income because they are the interests of this study. Hence, the base sample consists of 125,580 observations from the above filtering process and forms as our primary sample of stocks for calculating and ranking quarterly ROE based on their latest quarter's financial reports (10-Qs). Using the base sample of 125,580 firm-year-quarters, we calculate, for each year and quarter, each stock's ROE and D/E ratio base on the variable definitions described earlier. Stocks that have ROEs larger than 100% or D/E ratios equal or larger than 5 are eliminated so to obtain the firms operating under their normal business conditions. Thus, we have a sample of 123,797 firm-year-quarters left. Further eliminating duplicated records to control for the recording errors from COMPUSTAT we obtain the final sample of 123,743 firm-year-quarters with complete financial information which will be used to form deciles of ROE ranked portfolio and to be merged with matching CRSP monthly stock return data.

In this study, ROE is defined as a company's net-income divided by the total common shareholders' book equity. Net-income is calculated as quarterly income reported by a firm after subtracting extraordinary items, discontinued operations, and preferred stock dividends. Total common shareholder's book equity represents the common shareholders' interests in the company. Leverage is measured by long-term debt as a percentage of total common shareholder's book equity. Following the studies on firms' size effect, firm size is defined as market capitalization which is computed by multiplying the number of common shares outstanding and the close price at the end of each fiscal quarter. Closing share price represents the absolute closed transactions at each fiscal-quarter end for companies on national stock exchanges and bid prices for over-the-counter issues and is adjusted for all stock splits and stock dividends that occurred during the fiscal quarter of the company. The number of common shares outstanding represents the net number of all common shares outstanding at fiscal-quarter-end as of the reported balance sheet date, excluding treasury shares. Each decile ROE portfolio's holding period return is defined either as 3-month buy and hold monthly cumulated returns of equally weighted portfolio holdings or as 3-month buy and hold monthly cumulated return value weighted by portfolio holdings' firm size.

Because the COMPUSTAT calendar quarter indicates the actual month a firm's fiscal quarter ends, we form quarterly portfolios based on COMPUSTAT calendar year and

calendar quarter combinations. In each calendar year *t*, there are four quarterly portfolios constructed as following: sample firms with their COMPUSTAT calendar quarter equal to one having their fiscal quarters end in a 3-month period ranging from February to April are defined as the first quarter portfolio firms; correspondingly by such design, firms having their fiscal quarters end in November, December or January of calendar year *t+1* are the fourth fiscal quarter portfolio firms. In this study, CRSP equally-weighted market portfolio return and the S&P composite index are used as the basic benchmark to evaluate the cumulative excess stock return of each ROE sorted decile portfolio when it is compared with the overall market performance. Therefore, we draw monthly stock return, CRSP equally-weighted market index return and return on S&P composite index from CRSP monthly stock database. In order to make sure the accounting information are known to the market way ahead of the ROE sorted decile portfolios' returns that they are used to explain, each year *t*, we match the accounting data for the first quarter portfolio firms with fiscal quarter ending in February, March and April with returns for the period of June, July and August in year *t*. Accordingly, accounting data for the third quarter portfolios firms with fiscal quarter ending in August, September and October are matched to the returns of December of year *t* and January and February of year *t+1*, and accounting data for the fourth quarter portfolios firms with fiscal quarter ending in November, December and January of year *t+1* are matched to the returns of March, April and May of year *t+1*. By doing so, all firms' accounting data are matched with their corresponding stock returns skipping at least 4 weeks and on average 8 weeks after their fiscal quarter ends so to allow the accounting and financial information to be released and hopefully reflected in the market prices of their stocks. Furthermore, for a stock to be included in our final sample, it must have all such lagged three months return data available from CRSP in order for us to calculate its 3-month buy and hold return. Thus, the final COMPUSTAT/CRSP merged sample is left with 331,410 firm-year-month observations, i.e. a total of 110,470 firm-year-quarters.

We obtain monthly Fama-French market excess return, excess returns on common risk factors and one month treasury T-bill rate (R_f) from Fama-French series at WRDS, plus the Fama-French momentum return factor (UMD) obtained from Kenneth French's Data Library at Dartmouth. Returns used to compute our proprietary return momentum factor are obtained from CRSP monthly stock. From 1971 to 2004, each month we take all NYSE, AMEX, and NASDAQ stocks to re-create zero-investment and factor-mimicking portfolios. The excess return on our momentum factor is computed as equally-weighted average return of portfolio firms having the highest 30 percentile eleven-month returns lagged one month minus the equal-weighted average return of firms having the lowest 30 percentile eleven-month returns lagged one month. We then combine our momentum factor with Fama-French 3-factor model to design our proprietary Jensen Measure 4-factor Model.

Forming portfolios of ROE ranked firms/stocks provides the benefits of effectively expunging much of the firms' specific variations and thereby stronger evidence. The ROE sorted decile portfolios are constructed based on the following procedure: for each fiscal year and quarter, each stock in the COMPUSTAT/CRSP merged sample is assigned with a decile number based on its ROE ranking with decile 0 stocks have the highest ROE and decile 9 stocks have the lowest ROE. We then take all stocks having the same ROE sorted decile number and form them into a quarterly investment portfolio which we call a 'ROE sorted decile portfolio'. Finally, following the same steps described above, these ROE sorted decile portfolios' holdings will be rebalanced

every 3-month period based on each firm's ROE ranking calculated upon its most recent quarter's financial reporting information (10-Qs and 10-Ks) available.

CRSP monthly stock returns on the above quarterly rebalanced ROE sorted decile portfolios' stock holdings are matched to their accounting by skipping one month for each fiscal quarter before they are matched to their monthly returns from CRSP to allow financial information to be publicized. The process is repeated for next quarter as described above. Practically from an investor's perspective, such rebalancing is essentially an investment strategy with quarterly readjustment of portfolio holdings based on firms' previous quarter's profitability and the strategy allows assets to be reallocated equally among all NYSE, AMEX, and NASDAQ traded common stocks having the same ROE rank. Consequently based upon the quarterly rebalance schedule and the matching stocks' monthly return information we calculate each ROE sorted decile portfolio's monthly cumulated 3-month holding period return. Hypothetically, we are to find that investors' underreaction to firm's ROE information through significantly large AERs of these ROE sorted portfolios' lagged holding period return which implies that with a moderate leverage, some higher ROE decile portfolios still frequently beat the market with positive AERs after controlling for risks.

4. The Results and Analysis

4.1 Portfolio Characteristics

Figure 1 demonstrates that during the period of 126 quarters the number of stocks in each quarterly reconstructed decile portfolio rises as the number of total publicly traded firms in US markets increases over time. Consistent with previous research findings on 'earning management' and 'January effect', Figure 1 shows that for over 31 years, the fourth quarter portfolio almost always has the largest number of stocks among other quarter portfolios in the same fiscal year; except for year 2001 in which the second quarter portfolio has just two more stocks than the fourth quarter's. more important, Figure 1 shows that "boosted" accounting numbers do not last in that for 26 out of 32 years, the consistent largest stock holdings in the fourth fiscal quarter portfolio are reversed immediately in the first quarter of next year. in order to provide a better knowledge of how ROE, D/E, price, and size have been changing over time, we divide the sample into 3 sub-periods and report the portfolio characteristics in separate panels in Table 1. The values of mean and median are close suggesting that the distributions of portfolio characteristics are skewed neither over years nor across ROE sorted deciles. Table 1 also shows those relatively more profitable firms appear to have been continuously striving for higher return for their shareholders. It is important to note that for all three decades Table 1 shows a 'U-shape' on D/E ratio across ROE sorted deciles of portfolios, because D/E is defined as a company's leverage on a long term basis. So the 'U-shape' in D/E across ROE sorted portfolios provides evidence corroborates the traditional trade off theory when it is applied to both profitable firms and unprofitable firm, and is consistent with Myers (1984) pecking order in that both highly profitable firms and highly unprofitable firms could obtain a higher D/E ratio. Surprisingly, firm price for the highest ROE portfolio is lower than that of some of its lower ROE buddies, which the initial hypothesis is that the group of highest ROE stocks is somewhat under-valued due to investors' underreaction to ROE. In particular, if investors underreact to firms ROE information, such underreaction will show up most evidently in the portfolio of firms that have the highest ROE among deciles of ROE sorted portfolios.

Figure 1: Number of Stocks in Quarterly Portfolios

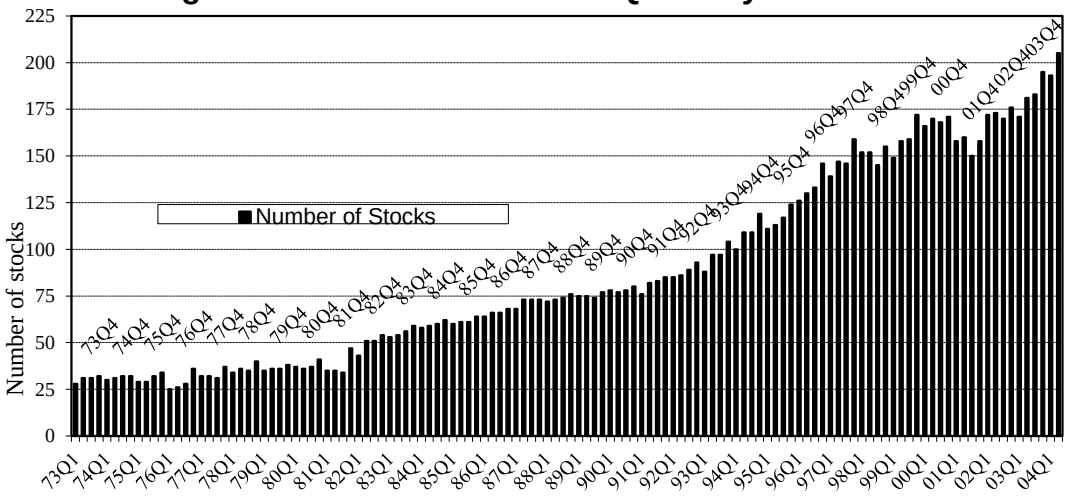

Figure 2: ROE&D/E Ratio of Quarterly Rebalanced Highest ROE Decile Portfolio

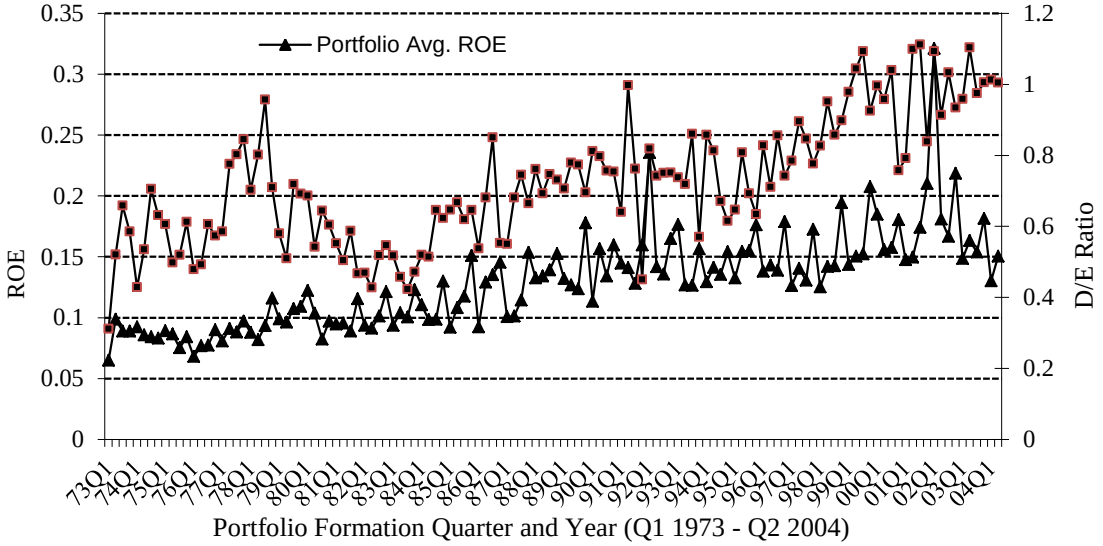

Table 1: Summary Descriptive Statistics on Mean (Median) Values of Selected Characteristics for 10 Portfolios of Firms

Formed Quarterly by Assigning to Deciles Based on ROE Reported for Last Fiscal Quarter, Sample Contains 110,470 Firm-Year-Quarters Between First Quarter of 1973 and Second Quarter of 2004; Portfolio Characteristics are Presented by Dividing Sample into 3 Sub-Periods

	Portfolio ROE Ranking									
	Decile 9 (Lowest)	8	7	6	5	4	3	2	1	Decile 0 (Highest)
Panel A : 1st Quarter of 1973 to 4th Quarter of 1982										
ROE	0.009	0.019	0.026	0.031	0.036	0.04	0.045	0.05	0.059	0.092
	(0.01)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)	(0.09)
D/E	0.589	0.545	0.49	0.482	0.479	0.446	0.423	0.436	0.454	0.599
	(0.57)	(0.53)	(0.50)	(0.46)	(0.46)	(0.45)	(0.41)	(0.42)	(0.44)	(0.59)
Price	15.316	20.479	23.658	24.684	26.821	28.718	30.335	34.437	33.722	26.921
	(14.94)	(20.30)	(23.75)	(25.10)	(26.90)	(28.61)	(30.45)	(34.52)	(32.33)	(25.20)
Size	387.02	416.178	1,035.90	1,025.13	876.791	958.452	1,253.73	1,722.87	1,412.97	924.177
	(275.00)	(372.46)	(825.31)	(780.98)	(783.41)	(793.88)	(1012.92)	(1645.28)	(1324.72)	(740.94)
Panel B : 1st Quarter of 1983 to 4th Quarter of 1992										
ROE	0.005	0.014	0.021	0.027	0.033	0.038	0.044	0.051	0.064	0.131
	(0.01)	(0.01)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.06)	(0.13)
D/E	0.551	0.539	0.502	0.509	0.478	0.466	0.425	0.422	0.476	0.673
	(0.55)	(0.55)	(0.50)	(0.51)	(0.47)	(0.47)	(0.42)	(0.41)	(0.47)	(0.69)
Price	15.671	20.18	23.526	26.505	28.349	28.41	30.795	30.434	30.109	27.539
	(15.47)	(19.32)	(23.77)	(25.27)	(27.34)	(27.97)	(30.08)	(30.19)	(30.65)	(26.93)
Size	559.615	977.759	1,310.30	1,520.47	1958.7	1705.323	2,088.80	2,406.83	2,347.76	2691.509
	(471.21)	(859.59)	(1132.36)	(1424.68)	(1764.63)	(1624.36)	(2040.24)	(2217.69)	(2329.63)	(2497.55)
Panel C : 1st Quarter of 1993 to 2nd Quarter of 2004										
ROE	0.005	0.013	0.02	0.026	0.032	0.038	0.045	0.055	0.072	0.16
	(0.01)	(0.01)	(0.02)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.07)	(0.15)
D/E	0.549	0.547	0.54	0.544	0.531	0.529	0.518	0.562	0.627	0.875
	(0.55)	(0.54)	(0.53)	(0.52)	(0.52)	(0.51)	(0.52)	(0.57)	(0.62)	(0.86)
Price	17.066	19.323	20.581	22.591	24.993	27.089	28.334	29.186	30.174	28.454
	(17.08)	(18.98)	(20.62)	(22.81)	(25.00)	(26.82)	(28.14)	(29.47)	(30.10)	(29.27)
Size	1647.055	2143.957	2015.215	2129.326	2603.509	3338.761	4213.963	5940.665	7538.129	8447.141
	(1471.18)	(1688.40)	(1896.52)	(1912.92)	(2161.15)	(3193.86)	(3583.19)	(5810.15)	(6583.95)	(8652.52)

ROE = net-income divided by the total common shareholders' book equity. Net-income is calculated as Income before Extraordinary Items (DATA8) minus Preferred Dividend (DATA24) minus Extraordinary Item & Discontinued Operations (DATA26) from COMPUSTAT North America Industrial Quarterly; Common Equity (DATA 59) includes Common stock, Capital surplus, Retained earnings and Treasury stocks adjusted for both common and nonredeemable preferred stock.

D/E = long-term debt (DATA 51) as a percentage of total common shareholder's book equity (DATA 59).

Price = Closing Price of a Fiscal Quarter Ending Month (Data 14), which represents the absolute closed transactions at each fiscal-quarter end for companies on national stock exchanges and bid prices for over-the-counter issues and is adjusted for all stock splits and stock dividends that occurred during the fiscal quarter of the company

Size (i.e. market capitalization**)** = the number of common shares outstanding (DATA 61) multiplies the close price at the end of each fiscal quarter. The number of common shares outstanding represents the net number of all common shares outstanding at fiscal-quarter-end as of the reported balance sheet date excluding treasury shares

Finally, in order to be sure that there is no 'glitch' in the previous described sample selection and portfolio construction methods, Figure 2 presents the ROE and D/E ratio on the quarterly rebalanced decile 0 (the highest) ROE portfolios. Consistent with Fama and French (1999)'s Figure 2, over our entire sample period, on average both ROE and D/E ratios of stocks in the highest ROE decile portfolio exhibit an upward trend with its D/E ratio ranges from 0.3 to 1.1 and most of the time the portfolio's ROE falls approximately in between 6 percent and 23 percent. Figure 2 also shows that this highest ROE portfolio's ROE and D/E ratios are somewhat correlated which is further verified with a Pearson product moment correlation coefficient of 0.6.

4.2 ROE Sorted Decile Portfolios' AER Benchmarked using Market Indexes

We first compute these ROE sorted portfolios' abnormal excess return (AER) by subtracting from the buy and hold monthly cumulated return for the holding three

months its matching holding period cumulative return on S&P composite index and CRSP equally weighted portfolio return (includes distribution). The evidences in Figure 4 and Table 2 strongly suggest that investors in general under-react to ROE information. We found that controlling for leverage[i], through entire sampling period of 126 quarters; decile portfolios with higher ROE consistently outperform the market portfolios whereas the lower ROE portfolios do not. Figure 4 shows that the highest ROE portfolio outperforms the market regardless the market benchmark used. Table 2 shows the highest ROE (decile 0) portfolios on average gain an absolute cumulative return of 7.55 percent in a three month holding period which is equivalent to 33.8% in annual return terms. The 3rd and 5th columns in Table 2 report whether the ROE sorted decile portfolios outperform or underperform the market. In particular, the average three-month holding-period cumulative return on the decile 0 ROE portfolio beats the CRSP equally weighted market portfolios by 3.18 percent (*ARewmkt*) and outperform the S&P Composite Index by 5.31 percent (*ARs&p*), which translate into an annual abnormal excess return of 13.34% and 22.99% in respectively. In addition, according to t-statistics all abnormal excess returns on the highest ROE portfolio are significantly different from zero. From the highest ROE portfolio to the lowest ROE portfolio, Table 2 also supplies an important insight on the relative performance of all deciles of ROE sorted portfolios: there is a positive correlation between portfolios' *CRptf* and its ROE which suggests a delayed reaction in valuing the higher ROE stocks. The evidence from Table 2 demonstrates the simple portfolio selection strategy based upon firms' quarterly ROE ranking is able to gain annual returns that are significantly higher than the market benchmarks, and investor's under-react most to firms with the highest ROE.

Figure 4: ROE Ranked Decile Portfolios' 3-Month Holding Period Cumulative Return and Market Benchmarked Excess Returns

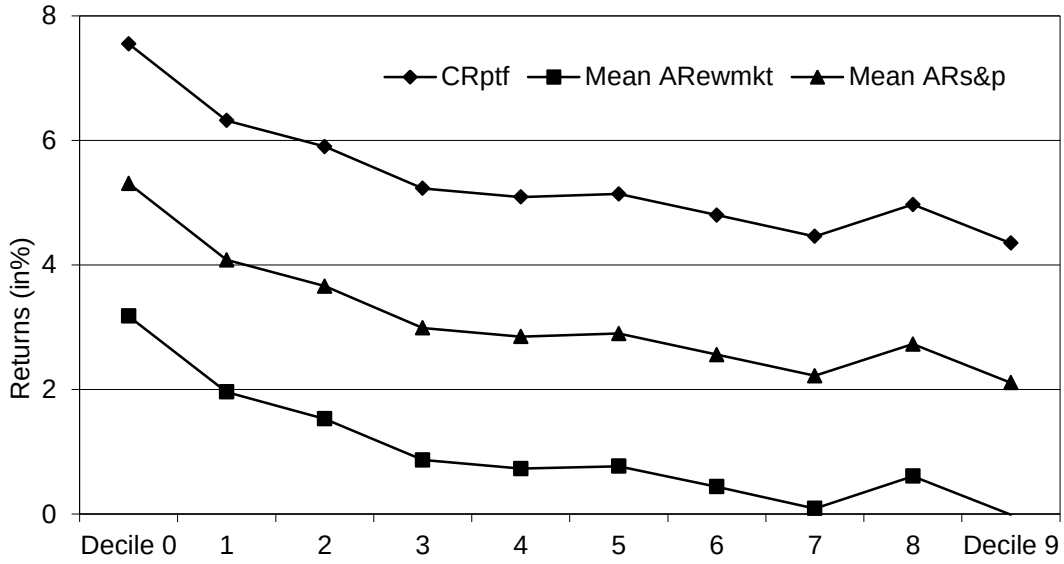

Table 2: Summary Statistics on Quarterly ROE Sorted Decile Portfolios' Absolute Cumulative Return and Abnormal Excess Returns Benchmarked with CRSP Equally-Weighted Market Portfolio and S&P Composite Index

Portfolio Rank	Mean CRptf (% per quarter)	T Value^	Mean ARewmkt (% per quarter)	T Value	Mean ARs&p (% per quarter)	T-Value
Decile 0 (Highest ROE)	7.55	6.62**	3.18	6.93**	5.31	7.39**
Decile 1	6.32	6.32**	1.96	4.45**	4.08	7.64**
Decile 2	5.9	6.04**	1.53	3.43*	3.66	7.12**
Decile 3	5.23	5.62**	0.87	2.03*	2.99	5.74**
Decile 4	5.09	5.38**	0.73	1.87	2.85	5.41**
Decile 5	5.14	5.54**	0.77	1.91	2.9	5.55**
Decile 6	4.8	5.07**	0.44	1.26	2.56	4.37**
Decile 7	4.46	4.77**	0.09	0.27	2.22	4.03**
Decile 8	4.97	4.95**	0.61	1.97	2.73	4.36**
Decile 9 (Lowest ROE)	4.35	4.04**	-0.01	-0.03	2.11	3.00*

[1] Summarized based on returns averaged across total 126-quarter starting from June 1973 to November 2004.

[2] CRptf is the absolute monthly Cumulated Portfolio Return over the 3 month holding period lagged one month.

[3] ARewmkt is the abnormal excess return gained over CRSP Equally Weighted (EW) Market (Mkt) Portfolio return by holding one particular percentile ROE level firms as a portfolio for the same three month holding period.

[4] ARs&p is the excess return gained over S&P Composite Index by holding one particular percentile ROE level firms as a portfolio for the same three month holding period.

^ T-value is the Student's t statistic to test the null hypothesis that the population mean is equal to zero.

** PROBT (Pr >|t|) <.0001, where PROBT is the two-tailed p-value for Student's t statistic, T, with (n-1) degrees of freedom. This is the probability under the null hypothesis of obtaining a more extreme value of T than is observed in this sample.

4.3 Models of Under-Reaction Measurement

We employ three models of performance measurement: the Fama-French Three Factor Model described in Fama-French (1992), the Fama-French Four Factor Model and a proprietary Jensen Measure four-factor Model based on (Carhart 1995a, 1995b, 1997).

As shown in Fama-French (1992), the mimicking returns for market (RM-RF), size (SMB) and BE/ME (HML) risk factors capture the cross-sectional average stock returns so that the residues from three factor regressions that using not only Sharp-Linter's market factor but also SMB and HML will do a better job in isolating the firm's or portfolio's specific components of returns. In order to gauge more accurately investors' underreaction to stocks of firms having higher ROE, and further separate out and control for common risk factors found in Fama-French (1992), first we follow their methodology by using the equally weighted ROE sorted decile portfolio's excess return as dependent variable in the Fama-French 3-factor model, so the obtained intercept captures the abnormal excess returns due to investors' underreaction to firms' ROEs. In addition, it is known that 3-factor model is incapable of explaining cross-sectional variation in momentum-sorted portfolio returns (Fama and French 1996). Yet Chan, Jegadeesh & Lakonishok (1996) suggested the momentum anomaly as market

inefficiency due to slow reaction to information. Moreover, Jegadeesh & Titman (1993) showed that the momentum is robust to time-periods. Motivated by these previous studies on momentum returns and their close and robust relationship with the market wide slow reaction to information, we construct the 4-factor models by integrating Fama-French 3-factor model with an additional factor capturing Jegadeesh & Titman (1993) one year momentum anomaly. The intercepts (Alphas) estimated using the 4-factor models are the abnormal excess returns on decile portfolios formed based on firms' ROE ranking. Two momentum return factors are employed in creating the 4-factor models. First, to be consistent with the factor construction used in 3-factor model, we design a four-factor Fama-French model by using the UMD created and calculated as such: six value-weight portfolios are formed each month on size and prior two to twelve months' returns using the median NYSE market equity as the monthly size breakpoint and 30^{th} and 70^{th} NYSE percentiles as prior return breakpoints; then the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios is defined as UMD. UMD then is incorporated into the Fama-French 4-factor model. Next, we constructed the second type of four-factor model following Carhart (1997) where the author developed a four-factor regression eliminates almost all of the patterns in pricing errors, indicating that its four-factor model well explains the cross-sectional variation in average stock returns Following the Jegadeesh & Titman (1993) as well as Carhart (1997)'s momentum definition, we compute a proprietary momentum factor, JTUMD, as the equally weighted average portfolio return of all firms having the highest 30 percentile eleven-month returns lagged one month minus the equally weighted average portfolio returns of firms having the lowest 30 percentile eleven-month return lagged one month. The above portfolio is reformed monthly from year 1972 to 2004 using all publicly traded common stocks on NYSE, AMEX, and NASDAQ from CRSP monthly stock return file. To be included in our momentum excess return factor calculation portfolio, a firm must have at least all past 11 month returns available lagged one month prior to the momentum return factor valuation month. Essentially, this Carhart 4-factor model is a four-factor Jensen Measure, so we call it 'a proprietary Jensen Measure Four-factor Model'. According to this proprietary Jensen Measure 4-factor model, in the absence of underreaction or biased valuation the expected return for each ROE sorted decile portfolio is the sum of the risk-free return and the products of the betas with the factor risk-premium, which are simply the expected returns of each of these zero-investment portfolios based on size, book-to-market and past return momentum, i.e. the intercept shall be trivia.

The three risk factor models used to estimate investors' underreaction to ROE information are summarized in the following regression equations. In regression equation (1), (2) and (3), the intercept a_i represents the abnormal excess return used to measure investors' underreaction, i.e. the return component left unexplained by the 3-factor model and the 4-factor models.

$$R_{i,t} - R_{F,t} = a_i + b_i*RMRF_t + s_i*SMB_t + h_i*HML_t + e_{i,t}\ ,\ t = 1, 2, \ldots, T \quad (1)$$

$$R_{i,t} - R_{F,t} = a_i + b_i*RMRF_t + s_i*SMB_t + h_i*HML_t + m_i*UMD_t + e_{i,t}\ ,\ t = 1, 2, \ldots, T \quad (2)$$

$$R_{i,t} - R_{F,t} = a_i + b_i*RMRF_t + s_i*SMB_t + h_i*HML_t + j_i*JTUMD_t + e_{i,t}\ ,\ t = 1, 2, \ldots, T \quad (3)$$

Where $R_{i,t} - R_{F,t}$ is net return of the portfolio i in excess of one-month T-Bill return; *RMRF* is equal to *RM-RF*, i.e. the excess return on a value-weighted aggregated

market proxy calculated as the value weighted return on all NYSE, AMEX and NASDAQ stocks in CRSP minus one month Treasury bill rate; *SMB, HML* and *UMD* and *JTUMD* are defined as described above. The subscript *i* represents either individual stock or a particular decile ROE ranked portfolio of stocks and the subscript *t* represents either one month or a three-month holding period.

Table 3 provides the summary statistics on the factor estimates used in the above abnormal excess return regression models. Similar to Carhart (1997), Table 3 indicates both Fama-French 4-factor model and the proprietary Jensen Measure 4-factor model can explain considerable variation in returns. First, the relatively high variance of SMB, HML, UMD and JTUMD zero-investment portfolio's excess returns plus their low correlations with each other and with the market proxy RMRF together suggest that the two versions of 4-factor model can explain sizeable time-series variations. Second, the high mean returns on SMB, HML, UMD, and JTUMD suggest that the three common factors plus the momentum return factor could account for much cross-sectional variation in the mean return on stock portfolios. In addition, the low cross-correlations between RMRF, SMB, HML, and UMD or between RMRF, SMB, HML, and JTUMD imply that the multicollinearity does not substantially affect the estimated factor loadings in the 4-factor regression models. Also, note the only high correlation is between UMD and JTUMD and both mean and variance of these two factors' returns are close yet far apart from other factor return estimates, which imply that either factor is able to function well individually in the corresponding 4-factor model for controlling return momentum.

Table 3: Summary Statistics on Under-Reaction Estimation Model's Factor Portfolio Based on Monthly Factor Returns (January 1972~ December 2004)

Factor Portfolio[2]	Monthly Excess Return	Std. Dev.	T-stat^	Cross-Correlation&				
				RMRF	SMB	HML	UMD	JTUMD
RMRF	0.53	4.67	2.19*	1				
SMB	0.27	3.33	1.59	0.25	1			
HML	0.47	3.17	2.91*	-0.47	-0.29	1		
UMD	0.85	4.33	3.79*	-0.06	0.03	-0.11	1	
JTUMD	0.76	5.41	2.75*	-0.11	-0.14	0	0.85	1

[1] Summarized based on total 378 monthly returns from January 1972 to December 2004.

[2] RMRF is the excess return on Fama-French (1993)'s market proxy. SMB, HML, and UMD are Fama and French's factor mimicking portfolios for size, book-to-market equity, and past return momentum. JTUMD is a factor mimicking portfolio for one year return momentum, i.e. newly created momentum factor based on Carhart (1997) and Jegadeesh & Titman (1993).

^ T-stat is the Student's t statistic to test the null hypothesis that the population mean is equal to zero.

& Statistics on Pearson correction coefficient test.

4.4 Hypothesis Testing on Performance of ROE Sorted Deciles of Portfolio

Hypothesis I: *Investors' underreaction to ROE decreases with the portfolio's ROE.*

Using the three factor regression models, we regress month by month T-bill adjusted excess returns of quarterly rebalanced ROE ranked decile portfolios on excess returns of systematic risk factors. Thus, the values of alpha obtained from above regression models measure the investors' underreaction to each decile portfolio's ROE and represent the profits obtainable in terms of monthly risk adjusted abnormal excess return. According to Table 4, in all regression models for higher ROE portfolios the factor loading on momentum factor returns are small and insignificant whereas for lower ROE portfolios the momentum factor loading appear to be significant although still small relative to other factor loadings from the same regression. So we conclude that although momentum factors play some role in explaining the excess returns on lower ROE decile portfolios, it has little power in helping to explain the excess returns obtained on the highest ROE decile portfolios. This result is consistent with many other pervious literatures which prove that Fama-French three common risk factors model can explain the variation in stock and portfolio return very well. Also there is strong evidence that alphas in all three regression models are diminishing as we move from the highest ROE portfolio to the lowest ROE portfolio, which indicate that investors' underreaction indeed decreases as portfolios' ROE gets lower. Overall Table 4 provides evidence justifies the hypothesis that investors' underreaction to ROE information diminishes as firms' ROE declines. More important, even after allowing more than 4 weeks for investors to value firms' financial information into their stock price, investing in the top 10 percent highest ROE firms each quarter still is able to generate, on average, a significantly positive monthly abnormal return of approximately 1.1% which translates into an annual return of 14.03%.

Hypothesis II: *A Quarterly Rebalanced Portfolio Holding the Highest ROE Firms Provides Superior Return due to Investors' Underreaction to ROE Information.*

We examine the alphas using the same set of risk factor regression models, but this time the dependent variable and the factor returns are computed on a 3-month cumulative return basis. Quarter by quarter, the highest ROE portfolio's equally weighted excess return over the matching period's cumulative T-bill rate is regressed on the Fama-French three factors, and the UMD or JTUM. Contrary to the results on momentum factors in the test of hypothesis I, Table 5 shows that both momentum factors are in larger magnitude and somewhat significance in the quarter by quarter portfolio excess return regressions, which is expected due to the longer holding periods. Momentum factor appears taking over the role of HML in explaining the longer period cross-sectional returns on ROE sorted decile portfolios. The most noteworthy is when comparing alphas (the AERs) in Table 4 Panel A the month by month regression and alphas in Table 5 the quarter by quarter regression we find that the AERs earned (the alphas obtained from the quarter by quarter regression models) are larger than AERs of their month by month counterparts. This evidence strongly corroborates our hypothesis II: investors tend to consistently under-react to ROE information such that the AERs are not washed out for the a 3-month buy and hold investment period. The t-statistics for all AERs left unexplained by time-series regression of portfolio excess returns on the common risk factors are highly significantly different from zero. Table 5 demonstrates, after controlling for all the well documented common risk factors in stock and portfolio returns, the investment

strategy of long stocks having the highest ROE will not only be able to gain a monthly abnormal excess return of approximately 1.12 percent but also a 3-month buy and hold period abnormal excess return of roughly 3.59 percent on average (3.251, 3.731 and 3.786). Based on the evidence in Table 5, a risk adjusted return of 15.2% may be produced simply because investors under-react to firms' ROE information, especially for the firms that provide the highest ROE.

Table 4: Estimating Investors' Under-reaction to ROE Information on All Decile Portfolios Formed Based on Firms ROE Ranking Regression of Equally Weighted Portfolio Monthly Excess Return on Fama-French 3-Factor Model, Fama-French 4-Factor Model and Proprietary Jensen Measure 4-Factor Model over a Sample Period From 1973 to 2004

Panel A	Fama-French 3-Factor Model Regression							
Portfolio ROE Ranking	Ri - Rf	**Alpha**	RMRF	SMB	HML	UMD	JTUMD	Adj. R-Sq
Decile 0 (Highest ROE)	1.902	**1.077** **(8.63)****	1.16838 (39.62)**	0.5635 (14.75)**	0.11959 (2.71)*			0.8684
1	1.566	**0.823** **(7.63)****	1.12881 (44.27)**	0.41624 (12.6)**	0.0744 -1.95			0.8867
2	1.425	**0.663** **(6.01)****	1.06597 (40.88)**	0.44399 (13.15)**	0.16862 (4.33)**			0.867
3	1.236	**0.445** **(4.34)****	1.08167 (44.63)**	0.47319 (15.08)**	0.19612 (5.42)**			0.8862
4	1.166	**0.359** **(3.65)***	1.06611 (45.84)**	0.50042 (16.61)**	0.23165 (6.67)**			0.8917
5	1.185	**0.338** **(3.34)***	1.07166 (44.76)**	0.5242 (16.91)**	0.29632 (8.28)**			0.8854
6	1.103	**0.22** **(2.26)***	1.06186 (46.14)**	0.65291 (21.9)**	0.30837 (8.97)**			0.8993
7	0.984	**0.0957** **-0.98**	1.04594 (45.27)**	0.65441 (21.87)**	0.33733 (9.77)**			0.8952
8	1.145	**0.172** **-1.52**	1.0942 (40.94)**	0.72602 (20.98)**	0.42131 (10.55)**			0.8751
Decile 9 (Lowest ROE)	0.999	**-0.116** **(-0.9)**	1.15691 (37.93)**	0.93721 (23.72)**	0.53006 (11.63)**			0.8677
Panel B	Fama-French 4-Factor Model Regression							
Portfolio ROE Ranking	Ri - Rf	**Alpha**	RMRF	SMB	HML	UMD	JTUMD	Adj. R-Sq
Decile 0 (Highest ROE)	1.902	**1.097** **(8.56)****	1.16568 (39.17)**	0.564 (14.75)**	0.1149 (2.58)*	-0.01981 (-0.7)		0.8682
1	1.566	**0.83** **(7.49)***	1.12792 (43.81)**	0.4164 (12.59)**	0.07286 -1.89	-0.00649 (-0.27)		0.8864
2	1.425	**0.715** **(6.34)****	1.05899 (40.45)**	0.4453 (13.24)**	0.15648 (3.99)**	-0.05133 (-2.07)*		0.8682
3	1.236	**0.535** **(5.18)****	1.06967 (44.59)**	0.47543 (15.43)**	0.17526 (4.88)**	-0.08824 (-3.88)*		0.8903
4	1.166	**0.424** **(4.24)****	4.05745 (45.53)**	0.50204 (16.83)**	0.21661 (6.22)**	-0.06365 (-2.89)*		0.8938
5	1.185	**0.408** **(3.96)****	1.06237 (44.47)**	0.52593 (17.14)**	0.28018 (7.83)**	-0.06827 (-3.02)*		0.8879
6	1.103	**0.324** **(3.33)***	1.04803 (46.44)**	0.65549 (22.61)**	0.28434 (8.41)**	-0.10166 (-4.75)**		0.9048
7	0.984	**0.242** **(2.55)***	1.02649 (46.7)**	0.65804 (23.3)**	0.30354 (9.22)**	-0.14293 (-6.86)**		0.9067
8	1.145	**0.333** **(3.03)***	1.07273 (41.95)**	0.73003 (22.22)**	0.38402 (10.027)**	-0.15776 (-6.51)**		0.8875
Decile 9 (Lowest ROE)	0.999	**0.0616** **-0.49**	1.13324 (38.68)**	0.94162 (25.02)**	0.48894 (11.14)**	-0.17392 (-6.26)**		0.8799

Hypothesis III: *Investors' underreaction to firms providing the highest ROE is not diminishing in recent years and the abnormal returns gained from investing in the highest ROE firms' stocks has not been eliminated since PEAD anomaly became publicly known.*

Using a sample period from 1991 to 1997, Johnson & Schwartz (2000) found that the profit opportunities previously associated with simple trading strategies designed to exploit the Post-earning Announcement Drift (PEAD) phenomenon have now been substantially eliminated since such arbitrage profit opportunity were documented in academic research. To implement the tests on this hypothesis, we divide the whole sample period of 31 years into four sub-periods of 1973 to 1980, 1981 to 1988, 1989 to 1996 and 1997 to 2004. The sub-periods' alphas in the regression model provide the evidence whether the well-publicized high ROE portfolio investing strategy had been taken advantaged to the extent that it is able to arbitrage away the existing abnormal excess returns as can be obtained in earlier time period.

Table 4 Continued

Panel C	Jensen Measure 4-Factor Model Regression							
Portfolio ROE Ranking	Ri - Rf	**Alpha**	RMRF	SMB	HML	UMD	JTUMD	Adj. R-Sq
Decile 0	1.902	**1.117**	1.16262	0.55401	0.11254		-0.04153	0.8692
(Highest ROE)		**(8.84)****	(39.33)**	(14.42)**	(2.55)*		(-1.84)	
1	1.566	**0.833**	1.12743	0.41398	0.07272		-0.0099	0.8864
		(7.59)**	(43.92)**	(12.41)**	-1.9		(-0.51)	
2	1.425	**0.692**	1.06186	0.43722	0.16358		-0.02966	0.8675
		(6.18)**	(40.56)**	(12.85)**	(4.19)**		(-1.49)	
3	1.236	**0.494**	1.07463	0.4616	0.18751		-0.05077	0.8881
		(4.79)**	(44.48)**	(14.7)**	(5.2)**		(-2.75)*	
4	1.166	**0.39**	1.06171	0.49318	0.22627		-0.03171	0.8923
		(3.91)**	(45.52)**	(16.27)**	-6.51		(-1.78)	
5	1.185	**0.37**	1.06712	0.51673	0.29078		-0.03269	0.8861
		(3.61)**	(44.45)**	(16.56)**	(8.12)**		(-1.78)	
6	1.103	**0.288**	1.05218	0.63697	0.29653		-0.06979	0.9032
		(2.97)*	(46.38)**	(21.6)**	(8.76)**		(-4.03)**	
7	0.984	**0.207**	1.0302	0.6285	0.31808		-0.11347	0.9064
		(2.21)*	(46.93)**	(22.03)**	(9.72)**		(-6.78)**	
8	1.145	**0.33**	1.07179	0.68911	0.39389		-0.1616	0.8955
		(3.15)*	(43.61)**	(21.58)**	-10.75		(-8.62)**	
Decile 9	0.999	**0.0785**	1.12938	0.89186	0.49636		-0.19875	0.8929
(Lowest ROE)		**-0.67**	(40.92)**	(24.86)**	(12.06)**		(-9.43)**	

The table report excess returns over one-month T-bill rate for 10 portfolios formed based on their holding firms' ROE level. Decile 0 portfolio has the highest ROE and Decile 9 portfolio has the lowest ROE. Abnormal Excess return (alpha) and Ri-Rf are in %.

In each panel, the monthly regression of portfolio excess return on one specific common risk factor models is reported.

Each ROE sorted decile portfolios is formed at the end of each fiscal quarter based on their last quarters' financial reporting information. Ri-Rf in all panels represents the portfolio monthly excess returns which are equally weighted excess returns of all portfolios holding stocks' monthly excess return lagged one month over the one month T-Bill rate. RMRF is the excess return on Fama-French (1993)'s market proxy. SMB, HML, and UMD are Fama and French's factor mimicking portfolios for size, book-to-market equity, and past return momentum. JTUMD is excess return on a factor mimicking portfolio for one year return momentum, i.e. newly created momentum factor based on Carhart (1997) and Jegadeesh & Titman (1993). Fama-French 4-factor model is the Fama-French 3 factor model extended with a Fama-French momentum factor. Jensen Measure 4-factor Model is our version of Carhart (1997) 4-factor model implemented using the momentum factor described in Jegadeesh & Titman (1993).

The T-Statistics are in parentheses where t-value is the Student's t statistic to test the null hypothesis that the population mean is equal to zero.

* PROBT (Pr >|t|) <.05 and ** PROBT (Pr >|t|) <.0001, where PROBT is the two-tailed p-value for Student's t statistic, T, with (n-1) degrees of freedom. This is the probability under the null hypothesis of obtaining a more extreme value of T than is observed in this sample.

Table 5: Quarter-by-Quarter Estimation of Abnormal Excess Return on Decile 0 Portfolio Constructed with Firms of Highest ROE from Last Fiscal Quarter

Regression Model	Ri – Rf	**Alpha**	RMRF	SMB	HML	UMD	JTUMD	Adj. R-Sq
Fama-French 3-Factor Model	6.016	**3.251**	1.24271	0.63883	0.16043			0.8307
		(6.31)**	(18.47)**	(7.74)**	(-1.92)			
Fama-French 4-Factor Model	6.016	**3.731**	1.2141	0.68578	0.09727	-0.14687		0.8368
		(6.84)**	(18.08)**	(8.22)**	(-1.13)	(-2.36)*		
Jensen Measure 4-Factor Model	6.016	**3.786**	1.19943	0.64166	0.09046		-0.16607	0.841
		(7.14)**	(17.96)**	(8.03)**	-1.08		(-2.99)*	

Abnormal Excess return (alpha) and Ri-Rf are in %.

Decile 0 (the highest ROE) portfolios of firms are formed at the end of each fiscal quarter based on their last quarters' financial reporting information. Ri-Rf in Panel A is the portfolio monthly excess returns which are equally weighted excess returns of all portfolio holding stocks' monthly excess return lagged one month over the one month T-Bill rate. Ri-Rf in Panel B is the portfolio 3-month holding period excess returns which are equally weighted cumulative holding period return of all holding stocks lagged one month from the end of month when the portfolios are formed. RMRF is the excess return on Fama-French (1993)'s market proxy. SMB, HML, and UMD are Fama and French's factor mimicking portfolios for size, book-to-market equity, and past return momentum. JTUMD is excess return on a factor mimicking portfolio for one year return momentum, i.e. newly created momentum factor based on Carhart (1997) and Jegadeesh & Titman (1993). Fama-French 4-factor model is the Fama-French 3 factor model extended with a Fama-French momentum factor. Jensen Measure 4-factor Model is our version of Carhart (1997) 4-factor model implemented using the momentum factor described in Jegadeesh and Titman (1993).

The T-Statistics are in parentheses where t-value is the Student's t statistic to test the null hypothesis that the population mean is equal to zero.

In panel A, N is the number of months and in Panel B N is the number of 3-month holding periods.

* PROBT (Pr >|t|) <.05 and ** PROBT (Pr >|t|) <.0001, where PROBT is the two-tailed p-value for Student's t statistic, T, with (n-1) degrees of freedom. This is the probability under the null hypothesis of obtaining a more extreme value of T than is observed in this sample.

Table 6 reports results showing that the alphas (the measure of AER) by investing in the highest ROE decile portfolio due to investors' underreaction are increasing over time are mostly larger than results shown in Table 5 and are highly significantly different from zero according to the t-statistics. In particular, we find that over time the AERs left unexplained by the risk factor models have been increasing since 1973. During the three recent sub-periods of 1981 to 1988, 1989 to 1996 and 1997 to 2004, the AERs obtained through investing in the highest ROE decile of firms' stocks are very similar. Our result is different from the profitability on using PEAD strategy studied by Johnson and Schwartz (2000), where they found a diminishing profitability on using PEAD strategy in recent years. Therefore, the evidence in Table 6 suggests that the highest ROE firm portfolio investing strategy is essentially different from the strategy in taking advantage of earning announcement drift to make profit.; and most important and further proves Hypothesis III is the fact that the AERs of investment strategy using the highest ROE firm portfolio persists over recent periods.

5. Summary and Conclusions

This research is so far known to be the first study in the underreaction and overreaction literature that directly focuses on testing investors' underreaction to publicly traded US firms' return on equity information. We demonstrate that decile portfolios formed based on firms' most recent ROE ranking are able to gain superior abnormal excess returns for higher ROE portfolios even after controlling for Fama-French common risk factors and the momentum return factors, also such abnormal excess returns tend to diminish for lower ROE portfolio and eventually vanish for the lowest ROE (decile 9) portfolio. In particular, we found that the highest ROE portfolio has outstanding abnormal excess return when compared with other ROE sorted portfolios. We show, even after we allow at least four weeks after the firms fiscal

quarter ending date to make sure that such higher ROE information to be publicly available and wishfully be absorbed into these firms' stock prices, a quarterly rebalanced investment portfolio formed by selecting the 10 percent of highest ROE firms from the most recent fiscal quarter financial reports is able to earn a three month buy and hold abnormal excess return of 3.6 percent which is equivalent to 15.2% annual return due to investors' persistent underreaction to higher ROE.

Table 6: Month by Month Sub-Period Portfolio of Highest 10 Percent ROE Firms Excess Return Estimation

Panel A	Month by Month Portfolio Excess Return Regression (1973 to 1980)							
Regression Model	Ri - Rf							
Fama-French 3-Factor Model	1.854	**0.974**	1.2098	0.6106	-0.067			0.937
		(4.61)**	(25.03)**	(8.17)**	(-0.85)			
Fama-French 4-Factor Model	1.854	**0.863**	1.2032	0.6377	-0.055	0.0819		0.9382
		(3.93)*	(25.06)**	(8.41)**	(-0.7)	-1.66		
Jensen Measure 4-Factor Model	1.854	**0.858**	1.198	0.6658	-0.046		0.0975	0.939
		(3.97)**	(24.99)**	(8.45)**	(-0.58)		-1.96	
Panel B	Month by Month Portfolio Excess Return Regression (1981 to 1988)							
Regression Model	Ri - Rf	**Alpha**	RMRF	SMB	HML	UMD	JTUMD	Adj. R-Sq
Fama-French 3-Factor Model	1.519	**1.198**	1.1178	0.8612	-0.25			0.8984
		(4.68)**	(19.18)**	(8.11)**	(-2.27)*			
Fama-French 4-Factor Model	1.519	**1.198**	1.1179	0.8618	-0.25	-8E-04		0.8973
		(4.6)**	(19.08)**	(8.06)**	(-2.23)*	(-0.01)		
Jensen Measure 4-Factor Model	0.0152	**1.265**	1.1145	0.8494	-0.265		-0.051	0.8979
		(4.61)**	(19.01)**	(7.86)**	(-2.35)*		(-0.69)	
Panel C	Month by Month Portfolio Excess Return Regression (1989 to 1996)							
Regression Model	Ri - Rf	**Alpha**	RMRF	SMB	HML	UMD	JTUMD	Adj. R-Sq
Fama-French 3-Factor Model	2.155	**1.331**	1.107	0.8495	-0.134			0.8797
		(7.4)**	(19.8)**	(11.67)**	(-1.61)			
Fama-French 4-Factor Model	2.155	**1.264**	1.1057	0.8673	-0.125	0.0663		0.8796
		(6.53)**	(19.76)**	(11.54)**	(-1.49)	(-0.95)		
Jensen Measure 4-Factor Model	2.155	**1.365**	1.1087	0.8244	-0.15		-0.042	0.8791
		(7.33)**	(19.77)**	(10.24)**	(-1.74)		(-0.74)	
Panel D	Monthly Portfolio Excess Return Regression (1997 to 2004)							
Regression Model	Ri - Rf	**Alpha**	RMRF	SMB	HML	UMD	JTUMD	Adj. R-Sq
Fama-French 3-Factor Model	2.079	**1.21**	1.0987	0.4739	0.3566			0.8489
		(4.94)**	(19.11)**	(8.09)**	(4.76)**			
Fama-French 4-Factor Model	2.079	**1.33**	1.0509	0.4976	0.3298	-0.101		0.858
		(5.5)**	(17.92)**	(8.66)**	(4.5)**	(-2.62)*		
Jensen Measure 4-Factor Model	2.079	**1.286**	1.0462	0.4817	0.3576		-0.107	0.8712
		(5.67)**	(19.16)**	(8.97)**	(5.17)**		(-4.09)**	

In all Panels, the month by month regression of portfolio excess return on the common risk factors is reported.
Abnormal Excess return (alpha) and Ri-Rf are in %. Decile portfolios and risk factors are defined similarly as in
Each panel represents a different sub-period of 8 years divided from the whole sample.
The T-Statistics are in parentheses where t-value is the Student's t statistic to test the null hypothesis that the population mean is equal to zero.
* PROBT (Pr >|t|) <.05 and ** PROBT (Pr >|t|) <.0001, where PROBT is the two-tailed p-value for Student's t statistic, T, with (n-1) degrees of freedom. This is the probability under the null hypothesis of obtaining a more extreme value of T than is observed in this sample.

We unveil, very interestingly, the abnormal excess return earned on decile portfolio of the highest ROE firms due to investors' underreaction not only does not 'fade' but also becomes larger in the three sub-periods post 1980s which is very puzzling.

As an attempt to solve the puzzle of so persistent investors' underreaction to ROE as shown through the risk adjusted abnormal excess returns in this study, we propose the following future research potentials on investigating the determinants of the delayed reaction to ROE information. First, whether the profit of utilizing such a quarterly rebalanced highest ROE stock investment strategy seems too small for investors due to transaction costs. Next, according to the information asymmetry theory, investors' weak belief in the 'goodness' of ROE information reported each quarter by publicly traded firms, especially firms providing extremely high ROEs, could also be the reason why they flounder in reactions to highest ROE firms' stocks

Endnotes

[i] At this point, to some extend we control leverage through using D/E as a screening factor during the portfolio construction process so that only stocks having moderate debt in their capital structure are included in the sample.

References

Abarbanell, JS & Bernard, VL 1992, 'Tests of Analysts' overreaction/Underreaction to Earnings Information as an Explanation for Anomalous Stock Price Behavior', *The Journal of Finance, Vol. 47, No. 3*, pp1181-1207.

Basu, S 1983, 'The relationship between earnings yield, market value and return for NYSE common stocks: Further evidence', *Journal of Financial Economics vol.12,* pp129-156.

Bernard, VL & Thomas, JK 1989, 'Post-Earning-Announcement Drift: Delayed Price Response or Risk Premium?', *Journal of Accounting Research, Vol. 27,* pp1-36.

Bernard, VL & Thomas, JK 1990, 'Evidence that stock price does not fully reflect the implications of current earnings for future earnings', *Journal of Accounting and Economics vol.13,* pp305-340.

Bhandari, LC 1988, 'Debt/Equity ratio and expected common stock returns: Empirical evidence', *Journal of Finance vol.43*, pp507-528.

Brief, RP, & Lawson, RA, 1992, 'The Role of the Accounting Rate of Return in Financial Statement Analysis', *The Accounting Review,* pp411-426; April 1992

Buffett, W 1978, *Chairman Letter To The Shareholder of Berkshire Hathaway Inc.,* 4 March 1978, <http://www.berkshirehathaway.com/letters/1977.html>

Carhart, MM 1995a, 'Survivor bias and persistence in mutual fund performance', Ph.D. dissertation, Graduate School of Business, University of Chicago, Chicago Ill.

Carhart, MM 1995b, 'Survivor bias and persistence in mutual fund performance', Working paper, School of Business Administration, University of Southern California, Los Angeles, California.

Carhart, MM 1997, 'On persistence in mutual fund performance', *Journal of Finance vol. 52,* pp57-82.

Chan, LK., Jegadeesh, N, & Lakonishok, J 1996, 'Momentum strategies', *Journal of Finance Vol. 51,* pp1681-1713.

Chan, LK., Hamao, Y & Lakonishok, J 1991, 'Fundamentals in stock return in Japan', *Journal of Finance vol.46*, pp1739-1789.

Domash, H 2002, *Focus on Return on Equity (ROE),*a stock analysis tutorial: use ROE to pick the best stocks, 1 December 2002, < *http://www.winninginvesting.com/focus_on_roe_not_earnings.htm*>

De Chow, MP & Sloan, GR 1996, 'Returns to contrarian investment strategies: Test of naïve expectation hypothesis', *Journal of Financial Economics 43,* pp3-27.

Fama, EF & French, K 1992, 'The cross-section of expected stock returns', *Journal of Finance, Vol. 47, No.2,* pp427-465.

Fama, EF & French, K 1993, 'Common risk factors in the returns on stocks and bonds', *Journal of Financial Economics, Vol. 33,* pp3-56.

Fama, EF & French, K 1996,' Multifactor explanations of asset pricing anomalies', *Journal of Finance vol. 51,* pp55-84.

Fama, EF & French, K 1999, 'The Corporate Cost of Capital and the Return on Corporate Investment', *Journal of Finance vol. 54,* pp1939-1968.

Foster, FD & Viswanathan, S 1990, 'A theory of the intraday variations in volume, variance, and trading costs in securities markets', *Review of Financial Studies vol. 3,* pp593-624.

Foster, G; Olsen, C & Shevlin, T 1984, 'Earnings release, anomalies and the behavior of security returns', *The Accounting Review vol. 59*, pp574-603.

Block FE 1964, 'A Study of the Price to Book Relationship', *Financial Analysts Journal,* pp108-117, September/October 1964.

Gordon, MJ, 1962, *The Investment, Financing and Valuation of the Corporation,* Homewook, Ill.: Richard D. Irwin.

Graham, B., Dodd, DL, & Cottle, S 1962, *Security Analysis: Principle and Technique,* McGraw-Hill, New York

Jegadeesh, N & Titman, S 1993, 'Returns to buying winners and selling losers: Implications for stock market efficiency', *Journal of Finance 48,* pp 65– 91.

Johnson, WB, & Schwartz, Jr. WC 2000. 'Evidence that capital markets learn from academic research: Earnings surprises and the persistence of post-announcement drift', Working paper, University of Iowa.

Piotroski, JD 2000, 'Value investing: The use of historical financial information to separate winners from losers', Journal of Accounting Research 38, pp1-41.

Kay, JA. 1976, 'Accountants, Too, Could Be Happy in the Golden Age: The Accountants Rates of Profits and the Internal Rate of Return', *Oxford Economic Papers,* pp66-80, November 1976.

Lakonishok, J, Shleifer, A, & Vishny, RW 1994, 'Contrarian Investment, Extrapolation and Risk', *Journal of Finance vol.49*, pp1541-1578.

Myers, SC 1984, 'The Capital Structure Puzzle', *Journal of Finance 39*, pp575-592.

Preinreich, GAD., December 1932, 'Stock Yields, Stock Dividends and Inflation', *The Accounting Review*, pp273-289.

Rafael, LP 1996, 'Expectations and the cross-section of stock returns', *Journal of Finance vol. 51,* pp1715-1742.

Hagstrom, RG Jr. 1994, *The Warren Buffett Way: Investment Strategies of the World's Greatest Investor,* John Wiley & Sons, Inc.

Rosenberg, B, Kenneth R, and Ronald L, 1985, 'Persuasive Evidence of Market Inefficiency', *Journal of Portfolio Management,* pp9-17, Spring.

Stephen, HP, 1996, 'The Articulation of Price-Earnings Ratios and Market-to-Book Ratios and the Evaluation of Growth', *Journal of Accounting Research,* pp235-259, Autumn 1996.

Guay, W 2000, 'Discussion of value investing: The use of historical financial statement information to separate winners and losers', *Journal of Accounting Research 38,* pp43-51.