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Using Pairs of Criteria to Obtain Superior Stock Portfolio performance

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Cover Page Footnote

First of all I would like to express my deepest gratitude to my supervisor Dr. Nicolas Gresis who has been of very much help during the process of doing this research project. Secondly, I would like to acknowledge Dr. Marlena Akhbari for the help I have received with conducting and analyzing my research data. Finally I would like to thank Dominique Belanger for all the support through this Undergraduate Summer Research Scholarship Program and to all the participants in the program for the all the comments and feedback they have provided during my work in progress.

1. Introduction

Some financial variables have been proposed as explanatory factors for future stock (and portfolio of stocks) returns. In this study we consider some financial ratios and strategies to empirically investigate the financial ratios which, along with the price momentum variable, provide good explanatory factors for future stock and portfolio of stocks returns. The factors chosen for this study are Price Earning (P/E) ratio, Cash Flow-to-price ratio (Cash flow/Price), Dividend-to-price (Dividend/Price) ratio and Price-to-sale (P/S) ratio, along with the Price Momentum.

Price momentum, along with the above financial variables are used to form the portfolios which are kept for 12 week and 24 week holding period over the sample period from December 17, 1999 till February 2, 2012. Total compounded percentage return for each of the portfolios is obtained by back-testing the data over the above sample period. The best empirical returns are obtained from the combination of P/E and Price momentum. This study shows that smaller the number of securities in portfolio obtained on 24 week holding period outperform the portfolios with higher number of securities.

In this paper, we consider the average investor's view point and reform portfolios every 12 week and 24 week holding period over the time period December 17, 1999 till February 24, 2012. We estimated total compounded percentage return for each analyzed portfolio and find that, over the above sample period; the pair of P/E and Price Momentum criteria produces the relatively best results. Corresponding performance level (Jensen's Alpha) and Risk level (Beta) are also measured for each analyzed portfolio through regression analysis. The Jensen's Alpha was also the highest at the pair of P/E and Price Momentum criteria with relatively lower risk level. We keep in mind, however, that the reliability of explanatory factors may change over time.

In Section 2 we review the literature; in section 3, we provide the data and explain the methodology for selecting and managing stock portfolios; section 4, provides the empirical results from the regression analysis. Finally section 5 provides a summary of our study and suggests recommendations for future research.

2. Selective Literature Review

In the Finance literature we see that hypothesis tend to be based on past research or on academic theory, which is usually based on economics rather than direct implication which actual investment behavior. This paucity of actual investment behavior makes quantitative modeling somewhat unrealistic. Many Academic

researchers generate great mathematic models. However, as F.A. Hayek has called it, they suffer from “fatal conceit” that mathematical model does not integrate well with the economic/behavioral activity of real people.

We consider selecting portfolios with extreme magnitude of Price Earning (P/E) ratio, Cash Flow-to-price ratio (Cash flow/Price), Dividend-to-price (Dividend/Price) ratio and Price-to-sale (P/S) ratio, along with the Price Momentum. The CF/P ratio is also important but less popular factor in predicting superior investment performance. Davies (1994) finds that Book Equity to Market value ratio (B/MV), E/P, CF/P and Sales growth (SG) are significantly related to stock returns in January only. Whereas, Chan et al (1991) found that in Japan, both B/MV and the CF/P are positively related to stock returns and are not influenced by seasonality.

Finally, S.T. Lau et al (2002) found that firms’ size, the E/P, the CF/P, the book-to-market ratio and SG exhibit relationships similar to those found in US data. (Lakonishok et al 1994)

Basu (1977) was the first researcher to document the details that investment strategy based on low P/E (or high E/P) ratio can earn significant excess return. (P/E factor is explained more details in next paragraphs)

The regression rendition of the traditional CAPM is given below

$$R_{pt}-R_{ft}=\alpha_p + \beta_p (R_{mt}-R_{pt}) + \text{Error}$$

Where the intercept α_p is called the Jensen’s alpha and if $\alpha \geq 0$, it reflects superior/inferior performance on a risk adjusted basis regardless of portfolio size and investment horizon.

Price/ Earnings ratio:

Among the financial variables that have been proposed for explaining future stock returns, we consider the commonly used price-earnings ratio (P/E).

However, Baruch Lev (1989) after having surveyed 20 years of earnings studies, concludes that earnings provide a very modest prediction of stock returns. Reinganum (1981) shows that after controlling for firm size; the earning price ratio does not have significant explanatory power for stock returns. In addition, Fama and French (1992) report no significant relationship between the E/P ratio and stock returns after controlling for a firm’s size and its Book-to-market value. In this paper however, we show that combining E/P with price momentum produces very strong portfolio performance results.

Basu [June 1977] also studied the empirical relationship between the investment performance of portfolio of securities and their ratio of P/E. According to the semi strong form of efficient market hypothesis the possibility of earning excess return using the P/E ratio is not possible. To the contrary Basu [June 1977] found that the portfolios with low P/E, earned higher return on average than the portfolios with higher P/E on a risk adjusted basis.

Price Momentum

According to the studies done by the Jagdeesh and Titman (1993, 2001), Price Momentum indicates that the stocks performing best (worst) over the previous period of 3 to 12 months tend to continue to perform well (poorly) over the next 3 to 12 months. The strategy is based on the assumptions that winners will continue to generate higher returns whereas the loser will continue to have the negative returns. But the portfolio of the securities should be reformed or reorganized with the latest winners. Jagdeesh and Titman (1993,2001) state that this strategy has been consistently proven in the United States stock market as well as the other developed countries. Studies by Jagdeesh and Titman (1993,2001), Hong, Lim and Stein (2000) and others have documented that the strategies performed better in the broad stock market implementing over a large number of diverse portfolio. Moskowitz and Grinblatt (1999) found that this price momentum strategy did not perform well when it is performed on a restricted industry.

Sales to Price Ratio (S/P)

Another financial ratio that has significant explanatory power is the sales to price ratio (S/P). Fisher (1984) has shown that S/P has significant explanatory power for stock returns. Further, empirical investigation by Barbee (1989), shows that one can expect a positive relationship between the S/P and subsequent stock returns.

Finally, Barbee,Jr., Mukherji and Raines (1996) tested the relations of Book-Market ratio, Debt-Equity ratio, market value of Equity and Sales-Price ratio and the S/P. Consistently S/P has the greater explanatory power for stock returns among the four variables they analyzed during the 1979-91 period.

Jensen's Alpha and Beta

Alpha is commonly known as the traditional measure of performance level of the different investment strategies. The empirical approach to measure performance is to do the regression of the excess return of a portfolio on the excess return of the market factor.

Assuming that the market beta is constant, the slope coefficient β , is the market beta and the intercept, α , is the unconditional alpha coefficient, which measures average performance, that is;

$$RP_t = \alpha_p + \beta_p RM_t + \text{error}$$

Where RM is the return of the market benchmark in excess of a short term treasury bills return and RP is the return of the portfolio in excess of a short term treasury bills return.

Alpha, α , typically reflects stock picking ability or security selection ability and to a lesser extent the ability to predict market returns; whereas, β reflects the unconditional market timing ability.

3. Methodology:

The share price data has been obtained from Zacks Investment Research. The database used includes the securities from NYSE, NASDAQ and DJIA. Several Preliminary screens (described in the next paragraph) were made in the Zack's Research Wizard to create a series of non-overlapping portfolios and to back-test the portfolios. The data used in this study starts from December 17, 1999 and continues through February 24, 2012. During this time period the financial market experienced several crises like Dot-Com bubble during 2001-2002, September 11 attacks and severe recent sub-prime financial crisis during 2007-2009.

Several screens were created for portfolio formation and data simulation. Screening was adopted in a way to assure that these trading strategies can be examined and executed in the real world by any investment firms or individuals. Firstly, the stocks with prices less than \$5 were eliminated, because many institutional investors prefer not to buy stocks that cost less than \$5. Secondly, any stock with volume of less than 50,000 shares traded during the 20 trading days prior to portfolio formation was eliminated from consideration. This screening followed the suggestion made through the study by Tziogkidis and Zachouris [2009] and Ainina, James and Mohan [2010]. Thirdly all sectors were included except the Financial sector. Fourthly, the companies with negative quarterly net income were eliminated because rational investor will not be interested to invest on the securities of the companies with negative net income on quarterly period. Fifthly, the top 100 ratios were selected from four different criteria. Sixthly, the last screen consists of the largest percentage change in price over the 12 weeks period during the sample period from December 17, 1999 till February 24, 2012.

According to the screening the back-testing was performed, repeated by combining into equal dollar weighted portfolios of 5, 10, 15 and 20 securities and the largest percentage change in price over the 24 weeks period. The same back-testing was repeated only by the Price Momentum Strategy; that is, only the securities with highest percentage price changes were selected into different portfolio formation over the holding period 12 and 24 weeks respectively. Later to draw the comparison between the results obtained from back testing, the process was repeated without the price momentum, and only with the selected criteria.

To investigate the reward relationship associated with each portfolio from different combinations, the cumulative Wealth formula was used to obtain the dollar return of the portfolios. Even the annual compounded percentage returns were obtained from the excel files. In order to assess the risk associated with portfolio returns, the beta (standard deviation) was calculated for each portfolio through the regression analysis. The performance measure was done through measuring the Jensen's alpha for each portfolio from different combinations. S&P 500 was used as the benchmark to compare the percentage return of the portfolios over the 12 and 24 weeks holding period during the investment horizon from December 17, 1999 till February 24, 2012.

4. Empirical Results:

Empirical results obtained from this study during the above stated time period, are summarized in Exhibit 1 and 2. Exhibit 1 shows the total percentage compound return of various investment strategies with their respective market return during the time period. Exhibit 2 summarizes the Jensen's Alpha and beta for the different investment strategies. The total percentage compounded return for the S&P 500 for quarterly and semiannually are 40.2% and 39.7% respectively. During 12 weeks period, out 32 different combinations of criteria on 4 different portfolio sizes, 26 portfolios have outperformed the market and 27 portfolios in the case of 24 weeks period.

In Exhibit 1, the cumulative percentage return for the strategies with the highest return for each combination of holding period and portfolio size is shown in bold italics. In 12 weeks period, the "Cash Flow Price ratio+ Price Momentum" combination with 10 and 15 securities portfolio sizes give the highest cumulative return of 596.2% and 527.4% respectively. "Price Earnings ratio+Price momentum" combination provides 515.3% return with smaller number of securities (5 securities) in portfolio. Dividend/Price ratio alone performed highest with 513.7% return on the portfolio consisting only 5 securities in 12 weeks period.

Portfolios reformed every 24 weeks period gave some spectacular result on Price momentum strategy. “Price Earnings ratio and Price momentum” combination generates 4083.2% and 787.4% return on portfolio sizes of 5 and 10 respectively. “Cash Flow Price ratio+ Price Momentum” did well with return of 525.3% and 582.4% with portfolio sizes of 10 and 15 respectively. Dividend Price criteria went down a bit lower than 12 weeks period on portfolios with sizes of 10 and 15 securities. Other ratios standing alone like Price/sales and cash Flow/Price, Price momentum underperformed though they were successful number of times to beat the market return.

In case of the portfolio rebalancing or reforming frequency the Price Momentum strategy with the combination of highest valued ratios, performed well on the 24weeks period. In case of portfolio size, smaller number of securities have perform better than the portfolios with higher number of securities.

In order to justify the total compounded percentage return of the portfolios, the performance level and risk associated with investment strategy is also measured. Exhibit 2 summarizes the alpha and beta value of different investment strategies. In Exhibit 2, the alpha and beta for different strategies with the highest value for each combination of holding period and portfolio size are shown in bold italics. P/E+price momentum combination provides the highest alpha (21.3%) and beta (1.29), alpha (10.6) and beta (1.35) of portfolio sizes of 5 and 10 securities respectively.

5. Conclusion and Recommendations for Further Research

Our results give support for the use of pairs of criteria in selecting and managing equity portfolio. The synergy effect of combining a financial ratio with the price momentum obtains both statistical and economical superior performance results.

The predictive power of the above criteria shows that the concept of semi-strong-efficiency in the equity market is not always correct and the Exhibit 2, that includes Jensen’s Alpha shows that our simple model, that does not use higher mathematics, beats the performance of the S&P 500 stock index on a risk adjusted basis.

We believed that the performance results are outstanding when price momentum is paired with financial ratios and other accounting numbers that may be factored in the prediction of future stocks and equity portfolio returns. Since long term performance, is a series of short term performances, our results show that price disequilibria can be exploited and refute the efficient market hypothesis.

Further research can be performed on this topic by increasing the portfolio ranges or financial variables. Portfolio reformation frequency can be also be increased. This study can also be done on foreign stock markets with sufficient information, altering the strategies and variables.

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Appendix:

Exhibit 1: Total Percentage Compound Return of Various Investment Strategies

Wn	Pn	S&P500	Price Momentum	With Price Momentum				Without Price Momentum			
				E/P	D/P	C/P	P/S	E/P	D/P	C/P	P/S
	5	40.2	-87.1	515.3	257.3	361.5	172.4	-34.6	513.7	-21.2	-32.6
12	10	40.2	53.3	305.9	447.8	596.2	117.3	68.2	433.3	4.2	18.8
	15	40.2	102.4	202	399.6	527.4	254.9	43.3	435.8	46.6	42.8
	20	40.2	157.6	283.8	310.4	466.1	239.9	116.3	366.8	80.9	36.4
	5	39.7	-22.9	4083.2	465.9	142.3	213.8	54.4	427.5	-43.9	-15.3
24	10	39.7	374.2	787.4	445.2	525.3	57	255.9	452.1	20.1	21.8
	15	39.7	300.4	488.9	452.9	582.4	116.6	154	446.3	10.6	49.8
	20	39.7	149.6	541.8	378.2	437	117.4	178	391.2	51.3	46.9

Wn= Number of Weeks

Pn= Number of Securities in Porfolio

Exhibit 2: Jensen's Alpha (α) and Beta (β) for Various Investment Strategies

W n	P n	Price Momentum	With Price Momentum $\alpha(\beta)$				Without Price Momentum $\alpha(\beta)$			
			P/E	D/P	C/P	P/S	P/E	D/P	C/P	P/S
12	5	[3.42](1.34)	5.77(1.46)	3.26(0.90)	4.69(1.32)	4.08(1.71)	0.54(1.51)	4.95(1.18)	0.65(1.78)	[0.91](1.04)
	1		4.12(1.49)	3.63(0.91)	4.82(1.37)	2.83(1.61)	1.81(1.57)	4.28(1.09)	0.82(1.65)	0.58(1.07)
	0	1.71(1.43)								
	1		3.03(1.39)	3.22(0.88)	4.46(1.45)	3.53(1.54)	1.37(1.52)	4.29(1.08)	1.67(1.75)	0.65(0.98)
	5	2.30(1.55)								
	2		3.22(1.38)	3.40(0.57)	4.45(1.41)	3.25(1.55)	2.04(1.42)	3.70(1.09)	1.83(1.63)	0.48(1.07)
24	5	1.67(1.38)	21.3(1.29)	7.08(1.03)	4.97(0.97)	5.46(1.19)	1.30(1.38)	7.32(1.31)	[2.42](1.85)	[1.78](1.11)
	1		10.6(1.35)	6.62(1.15)	8.29(1.31)	1.65(1.07)	4.50(1.58)	6.96(1.13)	[0.05](1.68)	[0.40](1.15)
	0	7.04(1.33)								
	1		7.85(1.20)	6.45(0.98)	7.90(1.38)	2.43(1.12)	2.80(1.61)	6.77(1.30)	[0.62](1.74)	0.41(1.04)
	5	6.52(1.58)								
	2		7.69(1.29)	5.54(0.95)	6.22(1.26)	2.21(1.21)	3.08(1.51)	5.98(1.30)	0.45(1.61)	0.08(1.14)