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AUSTRALIAN STOCK EXCHANGE AND SUB-VARIANTS OF PRICE MOMENTUM STRATEGIES

Abstract

The aim of this study is to examine the sub-variants of price momentum strategies. The paper recommends which sub-variants post above average returns for Australian Stock Exchange. It also analyzes the return behavior of short-term momentum effect among sub-variants of price momentum strategies. It has been found that monthly price momentum strategies result in above average abnormal returns, whereas weekly price momentum strategies should be used in combination with monthly price momentum strategies. Trading volume-based momentum investment strategies should not be used at all.

Keywords

short-term momentum effect, sub-variants of price momentum strategies, weekly price momentum strategies, trading volume-based momentum strategies, zero-cost momentum portfolios

JEL Classification

G1, G11, G15

INTRODUCTION

The existence of short-term momentum effect has been affirmed and reaffirmed by several authors. Its presence has been confirmed in almost all the prominent stock markets in the financial fraternity. However, its existence and the scale and size of its returns have become a debatable topic among authors. There is no unanimity on the scale and size of momentum's returns among authors in this regard. Several authors have claimed that momentum effect has been found but, in emerging and frontier stock markets, it is not as strong as it is in the developed stock markets. Swinkles, De Groot, and Pang (2010) wrote a paper on frontier markets and found that short-term momentum effect was weak in these stock markets. Similarly, Griffin, Ji, and Martin (2005) investigated several stock markets for momentum and found that short-term momentum effect phenomenon was weak as far as Asian stock markets are concerned. It is pretty evident from the above arguments that there are variations in the returns of short-term momentum effect. It is essential to inspect the variations in the returns of momentum effect in this regard. It is also important to mention that short-term momentum investment strategy has many variants and sub-variants and each of them post different returns. The most frequently used version of momentum investment strategy is price momentum strategy, whereas several authors have also used style momentum investment strategy, industry momentum strategy, absolute price momentum strategy, etc. Many of the variants of momentum strategies mentioned above have their own sub-variants or sub-versions. For instance, the sub-variants for price momentum strategies are monthly price momentum strategy,

weekly price momentum strategy, trading volume price momentum strategy, intra-day price momentum strategy, etc. Each sub-variant posts different returns. It would be interesting to investigate, understand, analyze and interpret the returns of momentum strategies generated by sub-variants of price momentum strategies. Therefore, focus of this study will be on analyzing the behavior of sub-variants of price momentum strategies. Three sub-variants of price momentum strategies have been discussed in this study. These are monthly price momentum strategies, weekly price momentum strategies and trading volume price momentum strategies. Short-term momentum effect lasts from 3 to 12 months (Jegadeesh & Titman, 1993) and winner portfolios outperform loser portfolios. Winner portfolios consist of stocks that have performed very well in the recent past, whereas loser portfolios consist of stocks that have performed worst in the recent past. It has been noted that several authors have used different variants and sub-variants of price momentum strategies and analyzed their studies based on respective returns. Each variant or sub-variant can have the same time period, but time interval can be different. Based on different time intervals, each strategy could post different returns. These returns can be abnormal, normal, average or below average. Therefore, it is of prime importance to investigate three different sub-variants of price momentum strategy to examine the magnitude of returns, which sub-variant is the most profitable and which is the least profitable. The stock market that has been chosen in this regard is Australian Stock Exchange (hereafter ASX).

One of the sub-variants of price momentum strategy is monthly price momentum strategy. It is the most important, popular and commonly used sub-variant in the field of momentum. Griffin, Ji, and Martin (2005) examined 38 stock markets. They implemented monthly price momentum strategies, a sub-variant of price momentum strategy, and found that this sub-variant was profitable in all the stock markets examined by the authors. Weekly momentum strategy is also an important sub-variant of price momentum strategy. It gives insight into short-term momentum effect for the shortest time period. Very few investors have done research on momentum using weekly price momentum strategies when it is as implementable as monthly price momentum strategies. Pang, Tang, and Xu (2013) examined momentum phenomenon using weekly price momentum strategies. They examined Chinese and Asian stock markets. They found that weekly price momentum investment strategies were profitable in the initial weeks. Historical data of stocks regarding trading volume also contain information and several authors think that such data can be used to predict future returns. Momentum strategies based on trading volume have been used by some authors to examine the short-term momentum effect. There is a close relationship between stock prices and trading volume, yet, very few authors have used trading volume-based momentum strategies to examine short-term momentum effect. Lee and Swaminathan (2000) examined stock market of USA using trading volume-based momentum strategies. Similarly, Nagel (2000) claimed that trading volume does not play significant role in determining future returns in the long run. Chui, Titman, and Wei (2000) opined that higher turnover ratios lead to higher momentum profit, whereas Hameed and Yuanto (2000) claimed that lower turnover ratios result in low momentum returns. Chan, Hameed, and Tong (2000) also found that higher trading volume leads to higher momentum profits. Glaser and Weber (2001) also used trading volume to examine short-term momentum effect for German stock market.

The three sub-variants of price momentum strategies are important, yet, they have never been run together to examine the different returns of short-term momentum effect for ASX. Therefore, it is a first attempt to inspect ASX for three sub-variants of price momentum strategies and understand the magnitude of returns posted by these sub-variants.

The rest of the paper is organized as follows. Section 1 presents a literature review on the sub-variants of price momentum strategies. Section 2 gives detail about the data and data sources and also discusses methodology. Section 3 presents analysis and findings. Last section concludes the paper and provides future direction.

1. LITERATURE REVIEW

This section reviews the literature of momentum for monthly price momentum strategies, trading volume-based momentum strategies and weekly price momentum strategies.

Narayan and Phan (2016) examined monthly momentum strategy on Islamic stocks. They constructed price momentum strategies and inspected their profits for a huge portfolio which consisted of Islamic stocks. They reported that momentum investment strategy generated an average annual profit of 10.56% when it is implemented on Islamic stocks, whereas the same momentum strategy reported an average annual profit of 8.88% when it is examined for non-Islamic stocks. They also reported that winner portfolio which consisted of Islamic stocks was outperforming the returns generated by S&P 500 index over a full sample period and particularly in the time period before the crisis. They documented that momentum profits of Islamic stocks are very closely related to characteristics of stocks. They found a positive relationship between size effect and stocks. They documented that stocks with smallest size were highly profitable and they were posting maximum profits in a time period before the crisis. They were of the view that stocks with smallest size will post higher momentum profits and stocks with bigger size will post lower momentum profits. They further wrote about the profitability of growth stocks and found that growth of Islamic stocks generates strong momentum profits. They documented that momentum profit of Islamic stocks decline as trading volume increases and found evidence about volatility. They found that returns of stocks increase with the increase in its volatility. They also wrote that “up phase” in the stock market is the driving force in momentum returns of Islamic stocks.

Glaser and Weber (2003) wrote a paper titled “Momentum and turnover: evidence from the German stock market”. The authors examined a relationship between momentum investment strategies and stock turnover in a stock market of Germany. They determined turnover of stocks by dividing number of shares traded with number of shares outstanding. They claimed that the relationship between momentum profits and turnover, as a proxy of trading volume, has been catching a lot

of attention for several reasons. They termed momentum as an anomaly and wrote that momentum effect in which winner portfolios outperform loser portfolios is one of the most researched topics in financial literature. Lee and Swaminathan (2000) inspected the relationship between momentum and trading volume for the stock market of USA and reported that momentum is high in the high turnover stocks. Nagel (2002) gave an opposing view and claimed that long-term momentum returns cannot be explained or understood by the turnover. Chui, Titman, and Wei (2000) claimed after implementing country neutral strategy that momentum profits were five times higher for the stocks with higher turnover ratios as compared to the stocks with lower turnover ratios and found that momentum profits were for the stocks which have high turnover ratios in five Asian stock markets. They took 8 Asian stock markets in their sample. Hameed and Yuanto (2001) examined six Asian stock markets and found that stocks with low stock turnover ratios did not generate momentum profits, but they also found that two stock markets reported momentum, as their stocks had high turnover ratios. Rouwenhorst (1999) also found in his paper that the winners in 16 stock markets have high turnover ratios. Chan, Hameed, and Tong (2000) gathered the data on the stock market indices and found that momentum effect gets stronger with the boost in trading volume. Zuchel (2001) also suggested a model that worked as a bridge between momentum and stock turnover. Grinblatt and Han (2001) also implemented the similar model and found that stocks which exhibit high trading volume result in higher momentum. Grinblatt and Han (2001) also accounted for unrealized capital gains/losses and found that stocks with unrealized capital gains beat the stocks with unrealized capital losses. Glaser and Weber (2003) collected the stock prices of 446 companies listed on Frankfurt stock exchange and their time period started from June 1988 and ended on July 2001. They defined trading volume turnover as number of shares traded on a specific day divided by total number of outstanding shares at the end of the day and data's frequency was daily. They followed the methodology of Jegadeesh and Titman (1993) to construct the winners and losers portfolios, but constructed only five portfolios. Glaser and Weber (2003) found that momentum effect was stronger in the stocks which have high turnover and

they termed it as their primary finding. They associated this relationship with winner portfolios. They found that their momentum profits generating from high turnover trading volume strategies were greater than that of traditional momentum strategies. Nevertheless, these bottom results vanished when the authors concentrated on one third of the stocks with higher market capitalization. They were of the view that, at institutional level, turnover cannot be a good proxy which can be utilized as optimizing momentum portfolios. They claimed that their biggest contribution in the literature was the relationship between momentum and turnover. They were among the first ones to study the relationship between momentum and trading volume in the German stock market.

Pan, Tang, and Xu (2013) worked on another sub-variant of price momentum investment strategy. This sub-variant was “weekly price momentum strategy”. The authors wrote that existing literature on short-term momentum effect in financial literature does not report significant momentum returns in the promising stock markets. The authors claimed that momentum has received huge attention by finance research scholars since its inception by Jegadeesh and Titman (1993). Many subsequent studies have confirmed its existence and profitability in the established stock markets of the world (Jegadeesh & Titman, 2001; Grinblatt & Moskowitz, 1999; Lewellen, 2002). However, momentum is weak or almost non-existent in rising stock markets in general and in Asian stock markets in particular (Rouwenhorst, 1997; Griffin et al., 2003; Chui et al., 2010). The authors were of the view that fluctuations in the returns of momentum across markets provide a good opportunity to inspect several momentum theories. The authors construct portfolios or momentum investment strategies on a weekly basis. They ranked and analyzed stocks on a monthly and weekly basis. They wrote that weekly ranking of stocks was particularly related to Chinese stock market, as quality of information is not so high and prices are less efficient. Mei et al. (2009), Xiong and Yu (2011) mentioned in their respective papers that investors in Chinese stock markets are speculative, not far sighted and carry out trading frequently.

The authors brought two variations to the traditional momentum strategy and applied the modified momentum investment strategy to the stock

market of China. Wang (2004), Wang and Chin (2004), Wang and Zhao (2001), Liu and Pi (2007) could not find strong momentum effect in the stock market of China. The authors collected the daily price for all the A-share companies for the period starting from January 1995 and ending on December 2009. They obtained the data from China Stock Market and Accounting Research (CSMAR) Database. They used Jegadeesh and Titman (1993) strategy to construct portfolios. The authors found a strong evidence of weekly price momentum strategy in the Chinese stock markets and termed this evidence as robust. Their weekly price momentum investment strategies were reporting a return of 4.6% and profits lasted 1 year and more than 50% of the returns have been realized in the first three weeks. They also claimed that though momentum effect was strong and survived for more than a year, it was shortly followed by long-term reversals. They also claimed that traditional momentum strategy did not result in weekly returns with only one exception where stocks were formed and held for 2 to 3 weeks and profits became irrelevant after taking into account transaction cost. The weekly momentum returns vanished during the period of 2002–2009. They could not find monthly momentum returns irrespective of the monthly momentum strategy they implemented. Previous studies have always posted mixed results about short-term momentum effect when it comes to Chinese stock market. For instance, Wang and Zhao (2001), Wang (2004), Wang and Chin (2004), Liu and Pi (2007), Lu and Zou (2007), and Naughton et al. (2008) have reported conflicting results about momentum effect as far as Chinese stock market is concerned, but the abovementioned authors restricted their sample mainly to the year 2000 and these authors claimed that they have extended the sample to 2009. They applied weekly price momentum strategy and found significant momentum profits, but monthly price momentum strategy does not generate momentum profits. The authors also applied variation of momentum strategies in the stock market of Hong Kong, Taiwan, Korea, Thailand and Indonesia. They claimed that momentum exists in different markets in different conditions. They claimed that momentum is pervasive in the short run, as it has been found in the financially closely held stock market like Chinese stock market.

2. METHODOLOGY

Australian Stock Exchange has been selected for the construction of price momentum strategies' sub-variants. In order to construct monthly price momentum strategies, past prices of ASX stocks have been downloaded from Datastream for the period starting from June 10, 2011 and ending on February 10, 2017. It is the data for the past 69 months. Only those companies have been selected for the construction of monthly price momentum strategies that have the data for the past 69 months. Therefore, 130 companies have been selected and 16 companies have been dropped in this regard. Stock prices have been converted to returns using the following formula, because they are unit free and bring uniformity to the data.

$$Return = \frac{Price_t}{Price_{t-1}} \cdot 100, \quad (1)$$

where $Price_t$ – closing price, $Price_{t-1}$ – opening price.

Monthly price momentum strategies have been constructed using the methodology of Jegadeesh and Titman (1993). Winner and loser portfolios have been constructed after formation (J) and holding period (K). J equals to 3, 6, 9 and 12 months and K also equals to 3, 6, 9 and 12 months. To construct the winner and loser portfolios, all stocks listed on ASX index are ranked in descending order based on their previous J^{th} month return. Therefore, each month will show four different individual portfolios depending on formation period J. Winner (W) portfolios will consist of 10 stocks which performed exceptionally well and posted the highest returns, whereas loser (L) portfolios will consist of 10 stocks that have performed worst and posted the lowest returns. Hence, for winner and loser portfolios, top ten and bottom ten performing stocks will be selected, respectively, and portfolios are formed for J months. After that, these portfolios will be held for K months. For a J3K3 strategy, for instance, a portfolio on September 10, 2011 will show the performance from July 2011 to August 2011 and it will be held till December 10, 2011. So the portfolio's return will be the average monthly return of liquidation month and K-1 month. In each monthly price momentum strategy, there will be

a winner portfolio, loser portfolio and “W – L” or zero cost momentum portfolio. “W – L” portfolios are formed by going long in winner portfolios and selling short loser portfolios. Many notable authors have constructed W – L portfolios to analyze the momentum phenomenon in stock markets in their respective papers (Jegadeesh & Titman, 1993; Griffin, Ji, & Martin, 2005; Zoghلامي, 2013). Total of 16 monthly price momentum strategies will be calculated ($4J \times 4K$).

Momentum portfolios can also be built on the basis of trading volume i.e. trading volume-based momentum strategies. The same methodology of Jegadeesh and Titman (1993) has been followed to construct trading volume-based momentum strategy. In order to construct winner, loser and momentum portfolios based on trading volume, trading volume for each stock has been determined. Trading volume is average daily turnover of several formation periods. Turnover can be defined as number of shares traded divided by total number of shares outstanding. Therefore, at the beginning of each month, all stocks are sorted based on their trading volume over the preceding J^{th} month formation period. The stocks are categorized into two groups, i.e. high trading volume and low trading volume. There will be 16 momentum strategies for each group and total momentum strategies based on trading volume will be 32. This sub-variant will be helpful in analyzing the momentum returns from trading volume perspective.

Weekly price momentum strategies have been also calculated. These strategies have been constructed using the same methodology of monthly price momentum strategies. The only difference between two strategies is the frequency of the data. In monthly price momentum strategies, frequency of data is monthly, whereas in weekly price momentum strategies, data frequency is weekly. However, the formation and holding periods are different than that of monthly price momentum strategies. The formation and holding periods are 3, 4, 5 and 10 and 3, 4, 5 and 10, respectively. There will be 16 weekly price momentum strategies, i.e. ($4J \times 4K$).

In a nutshell, there are three sub-variants of price momentum strategies and total number of momentum strategies are 64.

3. ANALYSIS

In this section, it will be examined whether or not three sub-variants of price momentum strategies are profitable. It will also be examined which one of the sub-variants of price momentum strategies gives above average return. It will also be inspected whether two sub-variants can be used in combination to generate above average returns. This is first study of its kind on the Australian Stock Exchange (hereafter ASX) that examines the several sub-variants of price momentum strategies together in ASX and determines which one of the sub-variants is profitable and generates above average returns for the investors. Three sub-variants are monthly price momentum strategies, weekly price momentum strategies and trading volume momentum strategies. Each sub-variant has its own winner and loser portfolios, momentum strategies and momentum profits which will be presented in this section in separate tables.

3.1. Monthly price momentum strategies – 1st sub-variant

First sub-variant of price momentum strategy under discussion here is monthly price momentum strategy. Highest and lowest momentum profits will be identified. The momentum strategies associated with the highest and lowest momentum profits will also be identified and analyzed. It will also be examined which momentum strategy would be feasible for the investor. It is also worth inspecting to compare the returns of loser portfolios of different monthly price momentum strategies to analyze which loser portfolio is generating the lowest returns among several monthly price momentum strategies.

A single and traditional price momentum strategy consists of one winner portfolio, one loser portfolio and winner minus loser portfolio, which is also known as zero cost momen-

Table 1. Returns of monthly price momentum strategies

		Holding period (K)				
Formation period (J)		3	6	9	12	
Winner	3	11.35411	11.40558	11.44295	11.46689	
Loser		-4.95627	-7.80178	-7.79846	-7.78694	
Winner – Loser		16.31038	19.20735	19.24141	19.25383	18.50324
(t-stat)		52.8326	63.5645	76.0825	89.768	
Winner	6	8.964218	9.047896	9.102462	9.139826	
Loser		-5.46847	-5.51826	-5.54228	-5.54092	
Winner – Loser		14.43269	14.56616	14.64474	14.68075	14.58108
(t-stat)		46.9208	53.54351	59.4828	64.7727	
Winner	9	8.177366	8.270813	8.333757	8.366059	
Loser		-4.55643	-4.62027	-4.65033	-4.66613	
Winner – Loser		12.7338	12.89109	12.98409	13.03219	12.91029
(t-stat)		45.5501	47.1617	49.4796	51.3906	
Winner	12	7.749379	7.842481	7.895258	7.925519	
Loser		-4.00721	-4.07205	-4.11905	-4.1583	
Winner – Loser		11.75659	11.91453	12.01431	12.08382	11.94231
(t-stat)		42.952	42.0378	42.3658	43.0301	

Notes: Table 1 exhibits the returns of first sub-variants of price momentum strategies, i.e. monthly price momentum strategies. Horizontally, Table 1 shows the holding period K, i.e. 3, 6, 9 and 12. Vertically, similarly, Table 1 shows the formation period J, i.e. 3, 6, 9 and 12. In the first column, Winner, Loser and Winner minus Loser portfolios and their respective *t*-stat can be found. Last column of the table shows the average return for each J and K family. In the rest of the columns, the individual returns of all momentum strategies are written.

tum portfolio. For instance, a J3K3 monthly price momentum strategy would consist of one winner, one loser and one winner minus loser portfolio.

Table 1 shows the results of 16 monthly price momentum strategies. All the returns are statistically significant. The highest return is generated by J3K12, i.e. 19.25%, whereas J12K3 strategy records the lowest return among all 16 monthly price momentum strategies, which is 11.75%. One thing is also worth noticing that, diagonally, there is a downward trend in the table in terms of returns. It means that momentum effect is stronger when the time period is shorter, but as time period increases, momentum effect gets weaker and eventually disappears. This finding is in line with the finding of existing literature in the field of short-term momentum effect. For instance, Jegadeesh and Titman (1993) documented that momentum effect could last from 3 to 12 months. The same notion is claimed by Griffin, Ji, and Martin (2005) and Rouwernhorst (1997, 1999). A J3K3 monthly price momentum strategy is giving a return of 16.31%. This 16.31% is a return of zero-cost momentum portfolio. Similarly, in J3K3 monthly price momentum strategy, winner portfolio is generating a return of 11.35% and loser portfolio is resulting in -4.95%. The return of J3K3 monthly price momentum strategy is enhanced by 4.95%, which is generated from going short in the loser portfolio. Minus sign shows that a portfolio is a loser portfolio and it has been sold short. It is clear from the table that a J3 family of returns is giving the highest returns in the table, whereas J12 family of returns is registering the lowest returns in the table. This finding goes in line with the finding of existing literature on finance. The average returns of J3, J6, J9 and J12 families of returns are 18.50%, 14.58%, 12.91% and 11.91%, respectively. It is evident from the results that momentum profits decreases as time period increases. This finding goes exactly in line with the definition of momentum which states that in the short run, winner portfolios will outperform loser portfolios or winners will remain winners and losers will remain losers in the short run. The abovementioned evidence is also in line with the evidence documented by Jegadeesh and Titman (1993), Joseph D. Vu (2012), Griffin, Ji and Martin (2003, 2005), Rouwenhorst (1997, 1999) Hong, Lee, and Swaminathna (2003),

Chui, Titman, and Wei (2000).

In J3 family, a J3K3 monthly price momentum strategy is giving a return of 16.31% in which winner portfolio is generating a return of 11.35% and loser portfolio is resulting in 4.95%. Zero-cost momentum portfolio's return is 16.31%. A J3K3 monthly price momentum strategy's return is boosted by 4.95%, which is earned by selling short loser portfolio. A J3K6 monthly price momentum strategy is giving a return of 19.20%, which is higher than its previous monthly price momentum strategy. The winner portfolio's return is 11.40% and return of loser portfolio is 7.80%. This winner portfolio's return is slightly higher than the return of winner portfolio (11.35%) of J3K3 monthly price momentum strategy. The return of loser portfolio of J3K6 is 7.80%, whereas the return of J3K3's loser portfolio is 4.95%. There is an increase in the return of J3K6 monthly price momentum strategy, which is caused by selling short loser portfolios. In J6 family, a steady increase can be observed in all four monthly price momentum strategies. It is very evident that J6K3 monthly price momentum strategy is giving a return of 14.43%, whereas a J6K12 monthly price momentum strategy is documenting a return of 14.68%. Investor can earn profit up to almost 15% using J6K12 monthly price momentum strategy. A J9K3 monthly price momentum strategy is generating a return of 12.73%, whereas J9K12 monthly price momentum strategy is documenting a return of 13.03%. An investor has an opportunity to adopt J9K12 momentum strategy to boost the return by 4.66% by selling short loser portfolio. J12 family is posting the lowest returns among all monthly price momentum strategies. The lowest return is 11.75%, which is posted by J12K3 monthly price momentum strategy, but a slight increase can be observed in the rest of the three momentum strategies of J12 family. A J12K12 monthly price momentum strategy is giving a return of 12.08%. It is quite clear from Table 1 that all the returns documented here are statistically significant. An investor has an opportunity to earn above average returns by going long in winner portfolios and selling short loser portfolios. All 16 monthly price momentum strategies are behaving in a traditional manner of price momentum strategies in which winners remain winners and losers remain losers in the short run and winners outperform los-

ers. All these findings are in line with the findings of previous authors, for instance, Nguyen (2012) finds that momentum strategies are profitable in the stock market of Vietnam. Fernandes and Ornelas (2008) also found that momentum strategies are profitable in the emerging stock markets of Asia. Table 1 also sheds the light on the profit potential of Australian Stock Exchange. ASX is a thriving stock market that offers above average returns to the investors as far as monthly price momentum strategy is concerned.

3.2. Weekly price momentum strategies – 2nd sub-variant

Pan, Tang, and Xu (2013) found that weekly momentum profits were significant. All weekly momentum results reported in this study are statistically significant and in line with the findings of existing literature on momentum (Pan, Tang, & Xu, 2013).

Table 2 exhibits the returns of weekly price momentum strategies. It is quite evident from the table below that the highest weekly price momentum strategy is J3K9, which is posting a return of 8.69%. The lowest return is posted by J12K3,

which is 4.52%. It is very evident from Table 2 that weekly momentum returns of weekly price momentum strategies are lower than the monthly momentum returns of monthly price momentum strategies mentioned in Table 1. For instance, the highest return of monthly price momentum strategy is 19.25% by J3K9, whereas the highest return of weekly price momentum is 8.69% by J3K9. Similarly, the lowest return of monthly price momentum strategy is 11.75% by J12K3 whereas lowest return of weekly price momentum is 8.69% by J12K3. The profit percentages of monthly price momentum strategies are way higher than the momentum profits of weekly price momentum strategies. It is also evident from Table 2 that momentum returns have declined as time period increases, which indicates that momentum effect was stronger in the beginning of the table, but it gets weaker as momentum strategies reach the end of the table. This finding is in line with the finding of existing literature on short-term momentum effect. Although the returns of weekly price momentum strategies are lower than that of monthly price momentum strategies, second sub-variant behaves exactly like first sub-variant in which momentum effect is stronger when time period is short, gets weaker when time period is long

Table 2. Returns of weekly price momentum strategies

Formation period (J)		Holding period (K)				
		3	6	9	12	
Winner	3	4.74517	4.753356	4.763041	4.767032	
Loser		-3.93356	-3.93547	-3.92723	-3.91758	
Winner – Loser		8.678728	8.688824	8.69027	8.684607	8.685607
(t-stat)		99.7978	116.156	126.583	134.702	
Winner	6	3.483263	3.501053	3.512445	3.519476	
Loser		-2.73609	-2.73723	-2.73378	-2.72901	
Winner – Loser		6.219357	6.238282	6.246223	6.248489	6.238088
(t-stat)		95.0947	103.9193	112.322	119.113	
Winner	9	2.955771	2.973747	2.98971	2.995496	
Loser		-2.21207	-2.21692	-2.21758	-2.21649	
Winner – Loser		5.167836	5.190664	5.20729	5.211986	5.194444
(t-stat)		86.3066	89.3432	90.6559	96.4408	
Winner	12	2.627759	2.646623	2.659931	2.669132	
Loser		-1.89777	-1.90342	-1.90577	-1.90905	
Winner – Loser		4.525527	4.550043	4.565696	4.578182	4.554862
(t-stat)		77.3394	78.6379	80.7792	83.0457	

Notes: Table 2 exhibits the returns of 2nd sub-variant of price momentum strategies, i.e. weekly price momentum strategies. Horizontally, Table 1 shows the holding period K, i.e. 3, 6, 9 and 12. Vertically, similarly, Table 2 shows the formation period J, i.e. 3, 6, 9 and 12. In the first column, Winner, Loser and Winner minus Loser portfolios and their respective t-stat can be found. Last column of the table shows the average return for each J and K family. In the rest of the columns, the individual returns of all momentum strategies are written.

and eventually disappears. In other words, weekly price momentum strategies exhibit the behavior according to the definition of short-term momentum effect, which states that in the short run, winner portfolios will outperform loser portfolios.

J3K3 weekly price momentum strategy is documenting a return of 8.67%. In this strategy, winner portfolio is giving a return of 4.74% and loser portfolio is posting a return of 3.93%. In this strategy, an investor's return is boosted by 3.93% by going short in loser portfolio. J3K12 has posted a return of 8.68%, which is the highest return among all J3 family. In this strategy, return is again increased by going short in loser portfolio. It can be seen from the momentum returns of J3 family that there is a very slight increase in the profits of weekly price momentum strategies. It can be observed that in the J6 family, the returns are lower than the returns in J3 family. The lowest and highest returns are 6.21% and 6.28% posted by J6K3 and J6K12, respectively. It can be seen that returns have been significantly decreased from 8% to 6% from J3 group to J6 group. J6K3 has posted a return of 6.21%, whereas 6.23% and 6.24% are posted by J6K6 and J6K9, respectively. A return of 6.24% is posted by J6K12, which is the highest

among the four momentum strategies in the J6 group. It is quite evident from the table that return is decreasing as we travel from left to right in J6 group. Highest return is posted by J6K12 in which investor's profit is boosted by 2.72% by going short in loser portfolios. In J9 group of monthly strategies, the average return is 5.19%. J9K3 weekly price momentum strategy is posting a return of 5.16%. In this strategy, winner portfolio is posting a return of 2.95%, whereas loser portfolio has documented a return of 2.21%. It is quite evident from the returns that loser portfolio's return has become equal to the return of winner portfolio in J9 family. This trend is observed in all the returns of J9 weekly momentum strategies. In J12 group of weekly momentum strategies, the average return is 4.55%. There is an interesting finding being reported here. The average returns of J3, J6, J9 and J12 are 8.68%, 6.23%, 5.19% and 4.55%, respectively. The returns of winner portfolios of J12 group are between 2.62% to 2.66%, whereas the returns of loser portfolios are in between 1.89% to 1.90%.

It is clear from the table that returns of weekly price momentum strategies have fallen from 8% to 4%. Weekly price momentum strategies are profitable, but the returns generated and reported in

Table 3. Returns of trading vol (high trading volume) momentum strategies

Formation period (J)		Holding period (K)				
		3	6	9	12	
Winner	3	0.352638	0.454189	0.517558	0.594426	
Loser		1.208801	1.343261	-1.42581	1.50998	
Winner- Loser		-0.85616	-0.88907	1.943364	-0.91555	-0.17936
(t-stat)		-3.2195	-4.41	3.93898	-6.3988	
Winner	6	0.712452	0.783393	0.852742	0.944198	
Loser		1.216271	1.304632	1.374089	1.449854	
Winner- Loser		-0.50382	-0.52124	-0.52135	-0.50566	-0.51302
(t-stat)		-3.3983	-4.2399	-4.8807	-5.3875	
Winner	9	0.749181	0.828217	0.924993	1.012894	
Loser		1.390075	1.503185	1.584167	1.656179	
Winner- Loser		-0.64089	-0.67497	-0.65917	-0.64329	-0.65458
(t-stat)		-3.468	-4.4591	-5.2549	-6.1368	
Winner	12	0.88517	0.98353	1.062303	1.122731	
Loser		1.246619	1.385324	1.460537	1.482964	
Winner- Loser		-0.36145	-0.40179	-0.39823	-0.36023	-0.38043
(t-stat)		-1.6368	-2.2693	-2.5918	-2.2556	

Notes: Table 3 shows the returns of momentum profits based on high trading volume. There are total 16 price momentum strategies based on trading volume in Table 3. It is evident from the table that returns posted by these strategies are not statistically significant.

Table 4. Returns of trading vol (low trading volume) momentum strategies

Formation period (J)		Holding period (K)				
		3	6	9	12	
Winner	3	2.003798	2.001432	1.974426	1.925749	
Loser		0.903321	0.84465	0.776779	0.758231	
Winner – Loser		1.100478	1.156782	1.197647	1.167518	1.155606
(t-stat)		5.27156	7.74613	10.1071	10.6934	
Winner	6	1.935404	1.910685	1.881915	1.858442	
Loser		0.968834	0.900843	0.837816	0.779765	
Winner – Loser		0.96657	1.009842	1.044099	1.078677	1.024797
(t-stat)		6.08949	7.93896	9.68242	11.2644	
Winner	9	1.997261	1.975511	2.086871	1.888756	
Loser		0.862685	0.789629	0.780523	0.66864	
Winner – Loser		1.134577	1.185882	1.306348	1.220116	1.211731
(t-stat)		7.08229	8.5411	10.6248	10.8835	
Winner	12	2.035536	2.01537	1.971905	1.8946	
Loser		0.761636	0.685418	0.617386	0.560231	
Winner – Loser		1.273899	1.329952	1.35452	1.334369	1.323185
(t-stat)		8.18743	10.0265	11.4188	12.3038	

Notes: The table shows the returns of price momentum strategy based on low trading volume. All returns are statistically significant.

the table are average returns. The return of investor's portfolio will be increased by 8% if investor adopts and implements J3 weekly price momentum strategies.

3.3. Price momentum strategies based on trading volume – 3rd sub-variant

This sub-variant of price momentum strategy has two parts. First part consists of returns based on high trading volume and second part consists of momentum returns based on low trading volume. Though, it is evident that in Table 3, magnitude of the momentum profits is also below average return. Investors can earn profit only going short in loser portfolio, but the magnitude of the profits will be extremely low. Momentum strategy based on high trading volume is not at all fruitful for the investors. Hence, it is not recommended at all to any investor. The

results of momentum strategies based on trading volume are in line with the findings of existing literature (Glaser & Weber, 2003). Glaser and Weber (2003) associated momentum profit with the winners. This finding can be seen in Table 4, where momentum winner portfolios are the main driving force of momentum.

Though all momentum returns in Table 4 are statistically significant, they are extremely low and do not increase the investor's portfolio sufficiently. The highest return is posted by J12K9, which is 1.35%. The lowest return is 0.96%, which is documented by J6K3. Unlike other tables, the return pattern is different in Table 4. For instance, high returns are posted by J12 group, whereas J6 group has posted low returns. Similarly, the difference between high returns and low returns is extremely narrow and does not provide sufficient returns to the investor.

RECOMMENDATIONS

It is quite clear from the results of three sub-variants of price momentum strategies that monthly price momentum strategy offers high returns to the investor as compared to weekly price momentum strategies and trading volume-based momentum strategies. It is recommended to the investor to pursue monthly price momentum strategies in order to earn abnormal returns, whereas weekly momentum strategies offer average returns, but trading volume momentum strategies offer extremely low returns.

CONCLUSION

Short-term momentum effect has many variants and sub-variants. One of the important variants of momentum effect is price momentum strategy. It has three important sub-variants. These sub-variants are monthly price momentum strategies, weekly price momentum strategies and trading volume-based momentum strategies. The aim of the study is to analyze the momentum returns of sub-variants in different length of time, examine which sub-variant is the most profitable and recommend the potential investors which sub-variant is profitable. All momentum investment strategies are constructed using the methodology of Jegadeesh and Titman (1993). Australian Stock Exchange has been chosen in this regard. It has been found that monthly price momentum strategies are the most profitable strategies among the sub-variants, whereas trading volume momentum strategies are the least profitable. Weekly momentum strategies offer average returns. It is recommended that a potential investor should use monthly price momentum strategies in combination with weekly price momentum strategies to earn above average abnormal return. Future research should focus on intra-day momentum strategies.

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