Comparison in Measuring Effectiveness of Momentum and Contrarian Trading Strategy in Indonesian Stock Exchange

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This paper wants to explore the effectiveness of momentum or contrarian strategy in Indonesian Stock Exchange using different methods in measuring the performance. The point of momentum or contrarian strategy is selecting winner (stocks with highest gain) or loser stocks (stocks with highest loss) and then buy or sell it based on the research result. This research employed three methods in measuring performance to select winner and loser stocks. The first method used cross section relative return, while the second method used cross section relative return plus risk component (return divided by standard deviation), and the third method employed historical relative return instead of cross section. The result is that, all of those three methods prove that momentum strategy is effectively applicable for winner stock, so in the next period winner stock will continue to make profit, while for loser stock, it is more effective to use contrarian strategy because in the next period, loser stock will rebound and make profit after suffering from high loss.

Keywords: *Momentum strategy, contrarian strategy, behavioral finance, stocks market*

Introduction

In perfectly efficient stock market, investor will get what they have expected. But the researchers have found that stock market is not perfectly efficient, that is why investor could get more than expected profit or suffer from unexpected loss. Investor will try to get more than expected profit by studying the market in order to predict the future, so they can grab the positive return and avoid loss.

These are the graphs to figure out the power of prediction on leveraging investor return. The first graph compares between holding equally weighted market portfolio

all time (no prediction, just buy in the first period and hold it to the end) and using prediction with 100% accuracy (avoid all loss in that period). The result is that, from beginning of 2000 to the end of 2009, no prediction index grew from 100 to 479 or 16.96% per year growth, while 100% prediction index grew from 100 to 4,571 or 46.55% per year growth. So, in ten years, the 100% prediction index will be almost ten times the no prediction index.

But in the real market, no one will be able to make 100% prediction. The second graph contains the comparison of no prediction index with another index which has 10% accuracy in avoiding loss. The result is that, from beginning of 2000 to the end of 2009,
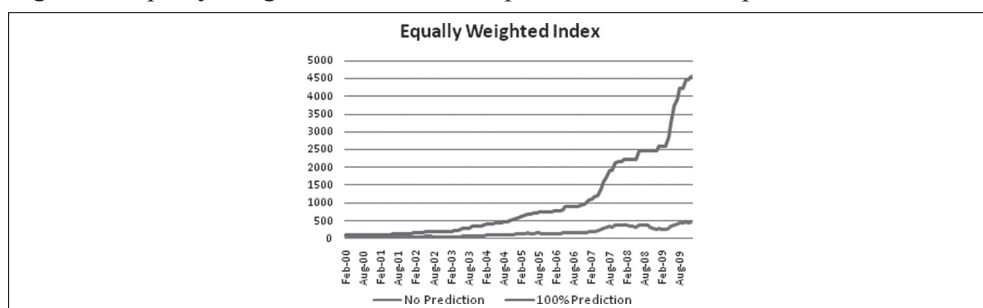
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Figure 1. Equally weighted index without prediction and 100% prediction
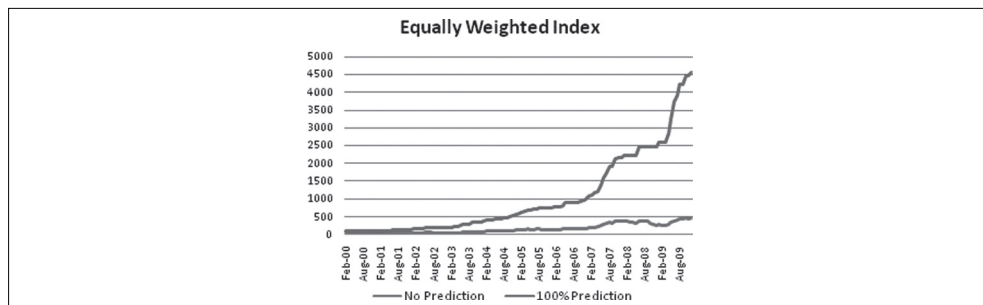
Source: Data processing

Figure 2. Equally weighted index without prediction and 10% prediction

Source: Data processing

10% prediction index grew from 100 to 725 or 21.92% per year growth. So, in ten years, using a prediction with only 10% accuracy will make investor almost twice wealthier than using no prediction at all.

One of the strategies trying to predict the future is momentum strategy or contrarian strategy. Momentum strategy says that winner stock (stock which has high positive return) and loser stock (stock which suffer from high loss) will continue its trend. In other words, in the next period winner stock will continue to make profit, while loser stock will continue to suffer from loses (Jegadeesh and Titman, 1993). On the other hand, contrarian strategy says that the trend will be reversed in the next period. So the winner stock will suffer from loses because it has made high gain, while the loser stock will go up in the next period.

The research in the momentum strategy and contrarian strategy will be the same, because they try to see what happen to the winner and loser stock in the next period. If it is proved that the trend is continuing, the conclusion will say that momentum strategy can be used. But, if it is proved that the trend is reversed in the next period, the contrarian strategy will be visible to execute.

Jegadeesh and Titman (1993) concluded that strategies that buy past winner and sell past loser realize significant abnormal return. It means stock which is top winner (gain high profit) in one period (three, six, nine, and 12 month) would continue to make profit, so investors should buy it. While the top loser stock (suffer from high loss) would continue to get loss, so investors should sell it. This kind of strategy—buying top winner and selling top loser—is called momentum strategy.

Lakonishok et al. (1996) and Grundy and Martin (2001) continued the research on the US stock market and confirmed that the momentum strategy still could

be applied. Other researchers try to apply it out of US stock market. Rouwenhorst (1997) concluded that in European stock market, momentum can largely be found. Hart et al. (2003) did the research in the 32 emerging countries and confirmed that momentum effect still could be found. Chui et al. (2000) confirmed it in Asia. There are at least five stock markets is Asia where this phenomenon appeared. Chan et al. (2000) did an interesting different approach. Instead of comparing individual stock, they tried to compare market index between national stock market to do country selection. The result was consistent that the momentum effect still could be found. The recent study done by Rastogi et al. (2009) and Herberger et al. (2009) in Indian and Swiss equity market respectively, and they still found momentum profitability.

Contrarian strategy was researched first by De Bondt and Thaler (1985) in US stock market. They concluded that sell winner stock and buy loser stock were profitable. The tendencies of people to overreact to unexpected and dramatics news events was the background of this research De Bondt and Thaler (1985). Lakonishok et al. (1994) confirmed this finding in US stock market. Bauman et al. (1999) found that overreaction appeared in international market as well. He did the study on Europe, Australasia, Far East, plus Canadian market (Bauman et al., 1999). Balvers et al. (2000) extended the research on contrarian strategy to 18 countries and found the strong evidence of price reversion. Rastogi et al. (2009) confirmed this phenomenon in Indian equity markets. He found the strong overreaction on mid cap stocks, but low overreaction in low and high cap stocks.

In this paper, momentum or contrarian strategy are tried to be applied in Indonesian stock exchange, using three different approaches and then compare the results. The difference in each approach is in determining whether a stock is categorized

as top winner or top loser. In the original approach, Jegadeesh and Titman (1993), Rouwenhorst (1997) and Chui et al. (2000) used return only as criteria to determine the winner and loser stock. So they rank the stock based on the past return then select the 10% highest rank as winner stock and 10% lowest rank as loser stock. Therefore, it is actually based on relative return compared to others.

That approach has at least two weaknesses that can be identified. First weakness is that it does not include risk embedded in each stock. For example, stock A has average return 10% and deviation 2.5%. While in one period it makes 15% return, it is top performance because statistically probability of happening is only 5%. Stock B has average return 15% and standard deviation 5%. While in one period it makes 20% return statistically it should be not in the winner condition compared to stock A, because probability of happening is 15%. But if original approach is used, stock B will be winner compared to stock A, because the way they were ranked is based on return only, without considering risk (standard deviation). This research proposes approach which includes standard deviation.

The second weakness comes from the relativity model. In determining whether it is top performance or top loser it uses relative return. Imagine that the market is down and the highest return is only 5%, it will become top winner because it is the highest. So this research suggests another approach which compares whether it is top performance or top loser with historical performance not with other stocks.

This paper will measure momentum strategy effectiveness in Indonesian stock exchange using three approaches: original approach comparing the return only among all of stocks; original approach plus risk that is embedded in each stock; and comparison of stock current performance with historical

performance, not with other stock current performance.

Literature Review

This section will explain three previous researches that have been conducted in momentum strategy topic. There will be research of Jegadeesh and Titman (1993) that become the pioneer in this kind of research. They studied momentum strategy in US stock market. The next research provided was conducted by Rouwenhorst (1997), who did the same research in 12 European countries. The last research in this section was conducted by Chui et al. (2000) in the context of Asian countries.

Jegadeesh and Titman (1993)

Jegadeesh and Titman (1993) want to see whether momentum strategy can be applied effectively in US stock market. They called this strategy as "buying winner and selling loser" strategy. To accomplish their research objective, they evaluated the performance of each stock in US market monthly. There were four period that they used in evaluating stock return, three month performance, six, nine, and 12 month. And then they ranked all stock based on their three, six, nine, and 12 month stock return.

From all stock that they had been ranked, they picked up 10% with highest rank as winner stock and formed winner portfolio. They also picked up 10% with lowest rank as loser stock and formed loser portfolio. There were eight portfolios that ready to hold, four winner portfolios based on three, six, nine, and 12 month performance and four loser portfolios based on the same period performance. Then they hold those eight portfolios for three, six, nine, and 12 month as well. In total there were 32 combinations of portfolio based on evaluation period, holding period, and winner or loser categories. They did this

mechanism monthly, from the period of 1965 to 1989.

After forming those portfolios, they calculated the return of each portfolio monthly. They used individual sample mean *t*-test to test whether the strategy realize significant return. They also used CAPM to test whether the strategy made abnormal return after systematic risk adjustment.

The result was that, using "buying winner and selling loser" strategy, they can realize significant profit. Those significant profits were not due to systematic risk of the portfolio. The conclusion was that in US stock market, momentum strategy can be applied effectively. So winner stock will continue to make profit and loser stock will continue to suffer from loses.

Rouwenhorst (1997)

Using the same methodology, Rouwenhorst (1997) tried to apply Jegadeesh and Titman (1993) research out of US stock market. He applied the strategy on 12 European countries. He pooled all of stocks in those 12 countries into one big international stock market. Those countries were Austria (60 firms), Belgium (127 firms), Denmark (60 firms), France (427 firms), Germany (228 firms), Italy (223 firms), the Netherlands (101 firms), Norway (71 firms), Spain (111 firms), Sweden (134 firms), Switzerland (154 firms) and the United Kingdom (494 firms). He converted the currency to Deutschmarks (DM) to make them comparable to be processed.

The result was that, the momentum strategy can be applied in the European stock market as well. When he applied it locally on each country's stock market, the momentum strategy still existed. It means that the local condition did not affect the existence of momentum strategy.

The finding related to systematic risk role was similar to Jegadeesh and Titman (1993) finding. The systematic risk gave

no effect on the existence of momentum strategy. So this was contradictive to the market efficiency theory and asset pricing model that require return to be correlated with its systematic risk.

Rouwenhorst (1997) also tried to find out the relation of momentum strategy and the size of the firms. He found that they were negatively related. Hence, momentum effect is higher in the small firms compared to the large firms.

Chui et al. (2000)

In 2000, Chui et al. (2000) did momentum strategy research in Asian stock market. Using the same methodology, they studied this momentum phenomenon in eight different Asian countries: Hong Kong, Indonesia, Japan, Korea, Malaysia, Singapore, Taiwan and Thailand. As Rouwenhorst (1997) had done, they also used pooled data that combined all countries into one international stock market and local data that compare the stock to other stocks in the same country.

The result is that in pooled data, momentum effect was not significant. They found that this was because the momentum effect was dominated by Japan. In Japan itself, the momentum effect did not appear. Therefore, they excluded Japan from pooled data. The result was that momentum effect was significant in Asian stock market, but the magnitude was lower than the effect in US and European stock market.

When conducting study on local market, they found that momentum effect appeared to be significant in most of the countries, except Korea and Indonesia. Instead of making profit, momentum strategy made loses in those two countries. While in Japan, the effect is positive but it is not significant.

Related to the size of the firm, they also found the same relation. Small stocks exhibited more momentum than large stocks. They also found that growth stocks exhibited more momentum than value stocks, and high turnover stocks exhibited more momentum than low turnover stocks.

Methodology

In this research, the data used is monthly adjusted closing price data of listed company in Indonesian stock exchange. The selection of adjusted closing price is in order to avoid bias due to stock split or reverse stock and dividend sharing. The duration is ten years, from January 2000 to December 2009. In January 2000 there are 293 companies in the list, while in December 2000 there are 379 companies. This research does not require that companies must be listed from the beginning to the ending period. So all the company data available is used without excluding any companies who were listed after January 2000.

For evaluation period, one month and three month are used. The calculation of monthly and quarterly return is needed. To calculate them the following formula is used (Ross, 2001; p. 356):

$$R_{it} = \frac{P_{it}}{P_{it-1}} - 1 \qquad (1)$$

where
R_{it} = Return of stock i at time t.
P_{it} = Price of stock i at time t.
P_{it-1} = Price of stock i at time $t - 1$.

To calculate monthly and quarterly standard deviation the following formula is used (Berenson et al., 2006; p. 84):

$$S_{it} = \sqrt{\frac{\sum_{n=0}^{23}\left(R_{it-n} - \overline{R_{it}}\right)^2}{24 - 1}} \qquad (2)$$

where
S_{it} = Standard deviation of stock i return at time t (for two years period).
$\underline{R_{it-n}}$ = Return of stock i at time $t - n$.
$\overline{R_{it}}$ = Mean return of stock i at time t (for two years period).

To calculate monthly and quarterly return / risk ratio, the following formula is used:

$$RR_{it} = \frac{R_{it}}{S_{it}} \qquad (3)$$

To calculate monthly and quarterly *t*-statistic of return the following formula is used (Berenson et al., 2006; p. 266):

$$t_{it} = \frac{R_{it} - \overline{R}_{it}}{S_{it} / \sqrt{24}} \qquad (4)$$

where

t_{it} = *t*-statistic of stock *i* at time *t*.
R_{it} = Return of stock *i* at time *t*.
$\overline{R}_{it}$ = Mean return of stock *i* at time *t* (for two years period).
S_{it} = Standard deviation of stock *i* return at time *t* (for two years period).

Forming portfolio using method I

In the first method, cross section relative return as performance measurement is used. The rank of monthly and quarterly return of the stock are needed monthly. Every month, each stock has its own rank according to its own monthly and quarterly return.

From these rank of return, winner and loser portfolio are formed. Every month, the top 10% rank and 10% lowest rank are taken as winner portfolio and as loser portfolio respectively. Then they are hold for a month or three month. So there will be eight combinations of portfolio, four portfolios of winner stocks and four portfolios of loser stocks.

Four combinations of each winner and loser stock come from the combination of evaluation period and holding period. As noted earlier, one month and three month evaluation period are used and the same period for holding the portfolio is used as well. So, there will be *1_1* portfolio (portfolio that come from one month evaluation and will be hold for one month), *1_3* portfolio (portfolio that come from one month evaluation and will be hold for three month), *3_1* portfolio (portfolio that come from three month evaluation period and will be hold for one month), and *3_3* portfolio (portfolio that come from three month evaluation and will be hold for three month as well).

Forming portfolio using method II

In the second method, cross section relative return plus risk component as performance measurement is used (risk component used is standard deviation). Instead of sorting the return of monthly and quarterly stock return, the return / risk ratio of stock is shorted monthly. Every month there will be rank of each stock based on its return / risk ratio.

Top 10% rank of monthly return / risk ratio is taken, then it is hold for a month to form *1_1* winner portfolio, and hold for three month to get *1_3* winner portfolio. Top 10% rank of quarterly return / risk ratio is also taken, then is hold for a month to get *3_1* winner portfolio, and hold for three month to get *3_3* winner portfolio.

The same steps are used for loser portfolio. The 10% lowest rank of monthly or quarterly stock return / risk ratio is taken, and then is hold for a month and three month. Therefore, for loser stocks, there will be four portfolios as well, *1_1*, *1_3*, *3_1*, and *3_3* portfolio.

Forming portfolio using method III

In the last method, a quite different way is used to determine winner and loser stock. In the two previous methods, performance of each stock is compared with other stock in the market, but in the last method it is compared with its own historical performance.

The method of comparison is different as well. In the previous method, rank of each stock is used, but for historical comparison it is difficult to use the same way (ranking).

Ranking method needs a lot of data that easily available in two previous method. In cross section comparison there are hundreds stock data to be compared but in historical comparison there are only 24 data (two years or 24 months) to be compared. So, instead of ranking method, t-statistic of return is used in historical comparison.

From t-statistic value that has been calculated before, its p-value, the tail probability of its t-student distribution, can be found. Every month stocks that have positive return with p-value less then 10% are taken as winner stocks and hold for one and three month. Stocks that have negative return with p-value less then 10% will be the loser stocks. So, similar to the two previous methods, there will be eight portfolios, 1_1, 1_3, 3_1, and 3_3 winner portfolio, and 1_1, 1_3, 3_1, and 3_3 loser portfolio.

Calculating return of portfolio

Return of portfolio is calculated in monthly basis. Equally weighted return is used to find return of portfolio. The following formula is used to calculate return of portfolio:

$$Rp_t = \frac{\sum_{i=1}^{n} R_{it}}{n} \qquad (5)$$

where
Rp_t = Return of portfolio at time t.
R_{it} = Return of stock i at time t.
n = Number of stock in portfolio.

Testing portfolio return using individual sample mean t-test

After calculating return of all portfolios, the hypothesis that strategies used to form those portfolios are effective needs to be tested. In other words, the test of whether the returns of those portfolios are significant (either positive or negative) is needed.

Individual sample mean t-test is used to prove the hypothesis.

In total there are 24 portfolios that need to be tested using this individual sample mean t-test. There are three methods in this research, and in each method there are two categories of portfolio (winner and loser), and in each category there are four combination of portfolio (1_1, 1_3, 3_1, and 3_3). Therefore, there are 3 x 2 x 4 equal to 24 portfolios.

Compare portfolio return and market return using paired sample t-test

After testing hypothesis that the strategy can be effectively implemented, other hypothesis is needed to be proven: whether the strategy can outperform market. The first thing needs to be calculated is market return. Equally weighted market return is used instead of value weighted market return (as used to calculate Jakarta Composite Index), in order to make it comparable to portfolios in this research which calculated using equally weighted. The following formula is used to calculate market return:

$$Rm_t = \frac{\sum_{i=1}^{n} R_{it}}{n} \qquad (6)$$

where
Rm_t = Market return at time t.
R_{it} = Return of stock i at time t.
n = Number of stocks in the market.

After calculating market return, paired sample t-test can be conducted, to prove whether the strategy results better output than the market.

Comparing the three methods

To compare the three methods simultaneously, one-way ANOVA and pair-wise comparison are used. One way

ANOVA will give conclusion whether those three methods resulting different output, while pair-wise can answer which one will make better result or which one is the same as other.

Result and Discussion

The result of the test concludes that in Indonesia both strategies can be applied. Momentum strategy can be applied to the winner portfolio, but for loser portfolio, contrarian strategy should be used. Because based on the result, winner portfolio will continue its trend to make profit, while loser portfolio will rebound and make profit in the next period.

Different methods applied on this research result only slightly different output. Because the profit of the winner portfolio and the loss of the loser portfolio is too high, that make risk component added only give a little effect.

Analysis of effectiveness of momentum or contrarian trading strategy using cross section relative return as performance measurement

This section is aimed to prove the hypothesis that momentum or contrarian trading strategy using cross section relative return as performance measurement can be applied effectively. Test of the return of portfolio using individual sample mean t-test is conducted. If the return is significantly positive (or negative), then the momentum or contrarian strategy is proven as effective trading strategy.

For winner stock, if the result is positive, then the effective strategy will be momentum strategy, but if the result is negative, then the effective strategy will be contrarian strategy. On the other hand, for loser stock, if the result is positive then the effective strategy will be contrarian strategy, but if the result is negative, then

the effective strategy will be momentum strategy.

Test in the winner stock portfolio (Table 1) shows, that momentum trading strategy can be applied effectively. The output shows that in the next period, winner portfolio will make profit. The t-statistic shows that those positive returns are significant at 1% and 5% level.

Table 1 said that when one-month winner portfolio is held for one month, it will realize 2.34% return per month significantly, but if it is held for three-month it will realize higher return, which is 3.10% per month significantly as well. On the other hand, if three-month winner portfolio is hold for three month, it will result lower then if it is held only one month, which are 3.27% and 2.75%, respectively. It means that the winner stock in shorter period (one month) will make higher profit if it is held in longer period (three month). But winner stock in longer period must be held shorter. It means that the cycle of high gain is about three month. If the evaluation and holding period shorter (one month evaluation and one month holding period), the gain will still increase but it can increase more if the holding period is longer. But if it is held and evaluated longer (three month evaluation and three month holding period), the gain has decreased.

For loser portfolio, strategy that can be applied effectively is contrarian trading strategy. The output (Table 2) said that in the next period, loser portfolio will make profit. The t-statistic shows that all of those positive returns are significant at 1%.

Table 2 shows the result of loser portfolio. Returns of one-month loser portfolio hold for one month and three month are 5.70% and 4.17% per month, respectively. They are significant at α=1%. The result of the longer evaluation period shows the same condition. When three-month winner portfolio is hold for three month, it will also realize lower than

Table 1. Return of winner portfolio using cross section relative return as performance measurement

Return of Winner Portfolio			Holding Period	
			1 Month	3 Month
Evaluation period	1 month	return	0.0234**	0.0310***
		t-stat	2.5394	3.711
		p-value	0.0127	0.0003
	3 month	return	0.0327***	0.0275***
		t-stat	3.3794	3.2003
		p-value	0.0011	0.0019

*** Significant at α = 1%
**Significant at α = 5%
*Significant at α = 10%
Source: Data processing

Table 2. Return of loser portfolio using cross section relative return as performance measurement

Return of Loser Portfolio			Holding Period	
			1 Month	3 Month
Evaluation period	1 month	return	0.0570***	0.0417***
		t-stat	6.2153	5.2225
		p-valuea	0	0
	3 month	return	0.0476***	0.0401***
		t-stat	5.1059	4.4276
		p-value	0	0

*** Significant at α = 1%
**Significant at α = 5%
*Significant at α = 10%
Source: Data processing

when it is hold only one month, which are 4.01% and 4.76%, respectively. It means that the loser stock, whether in shorter or longer period, will rebound quickly (in one month). If it is hold longer, the rebound effect will decrease and the average return will be lower as well.

Analysis of comparison between momentum or contrarian trading strategy using cross section relative return as performance measurement and market index

In this section, the result from the previous section will be compared to market return. The test is intended to see whether the hypothesis that momentum or contrarian trading strategy using cross section relative return as performance measurement can outperform market return is proven. Paired sample *t*-test is used to do the comparison. If the result of difference in return is positive and significant, then it is

concluded that the momentum or contrarian strategy can outperform market return.

After comparing the return of winner portfolio with market return, it is concluded that overall, winner portfolio cannot outperform market significantly. Only *1_3* (one month evaluation and three month holding period) portfolio can outperform market significantly at 10% level. On the contrary, *1_1* portfolio gives less return than market (see Table 3).

Return of *1_1* portfolio is 0.07% below market return, while *1_3*, *3_1*, and *3_3* portfolio are 0.69%, 0.86% and 0.34% higher then market. Statistically, it can be said that winner portfolio returns are the same with market return. But in practice, when a portfolio is formed using those strategies, the result is quite interesting. Investment simulation is started with 100 point in beginning of 2002 for all portfolio and market portfolio as well. At the end of 2009 value of market portfolio become 693.13 while *1_3* portfolio 1,201.96 and

Table 3. Return of winner portfolio compared to market using cross section relative return as performance measurement

Return of Winner Portfolio minus Market Return			Holding Period	
			1 Month	3 Month
Evaluation period	1 month	return	-0.0007	0.0069*
		t-stat	-0.1366	1.9675
		p-value	0.8916	0.0521
	3 month	return	0.0086	0.0034
		t-stat	1.4849	0.7631
		p-value	0.1409	0.4473

*** Significant at α = 1%
**Significant at α = 5%
*Significant at α = 10%
Source: Data processing

Table 4. Beginning and ending value of investment simulation of winner portfolio using cross section relative return as performance measurement

Portfolio	Market	1_1	1_3	3_1	3_3
Beginning 2002	100.00	100.00	100.00	100.00	100.00
Ending 2009	693.13	584.14	1,201.96	1,213.75	833.35

Source: Data processing

3_1 portfolio 1,213.75. So, 0.69% and 0.86% differences can make almost twice result at the end.

Even though 1_1 portfolio results lower than market return, in practice it also gives benefit to investor. The reason is that to form the real market portfolio, investor need to set aside huge funds because he has to buy 379 stocks. If he used momentum strategy and buy 1_1 portfolio, he will need about one tenth of the funds, because he only need to buy 37 stocks instead of 379 stocks. It will be preferable for investor because given quite the same return and risk, he needs significantly less money.

For loser portfolio, it is found that the difference in return with market portfolio is positive. From the output (Table 5), it is concluded that all loser portfolios can always outperform market significantly. It is shown from p-value that all of them are significant at 1% level.

Return of 1_1 portfolio is 3.3% below market return, while 3_1, 1_3, and 3_3 portfolio are 2.35%, 1.77% and 1.60% higher then market. Statistically, it is said that winner portfolio returns are higher than market return. When portfolio is formed using the strategy, the result is amazing. The investment simulation is started with 100

point in beginning of 2002 for all portfolio and market portfolio as well. At the end of 2009, value of market portfolio become 693.13 while 1_1 portfolio 11,049.00, 3_1 portfolio 4,384.28, 1_3 portfolio 3,150.98, and 3_3 portfolio 2,419.87. Therefore, in eight years, investment value will grow 110 times the beginning value.

From the pattern of the simulation investment value in the graph below, it is shown that high return is resulted from the associated high risk. When the market value increases, the loser portfolio value increases higher. But when market decreases, loser portfolio will result worse decrease as shown in August 2008 to April 2009 period.

Analysis of effectiveness of momentum or contrarian trading strategy using cross section relative return plus risk adjustment as performance measurement

In this section, instead of using cross section relative return as performance measurement, cross section relative return plus risk adjustment is used. The hypothesis said that this method will realize positive significant return as well. So, individual sample mean t-test is applied to check whether the hypothesis is proven.

Figure 3. Graph of investment simulation value of winner portfolio using cross section relative return as performance measurement
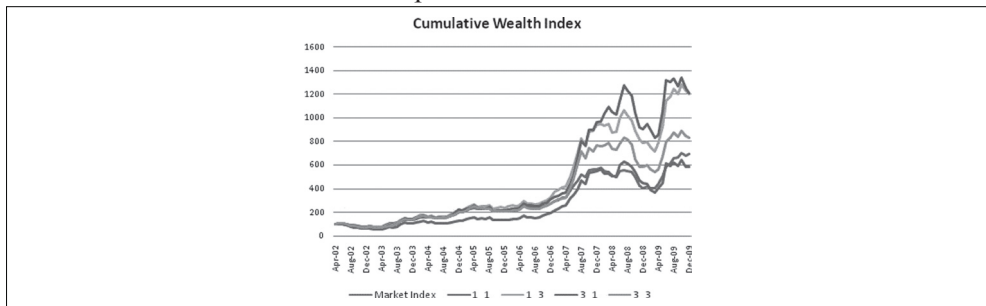
Source: Data processing

Table 5. Return of loser portfolio compared to market using cross section relative return as performance measurement

Return of Loser Portfolio minus Market Return			Holding Period	
			1 Month	3 Month
Evaluation period	1 month	Return	0.0330***	0.0177***
		t-stat	6.1321	5.5245
		p-value	0.0000	0.0000
	3 month	Return	0.0235***	0.0160***
		t-stat	4.5644	3.6447
		p-value	0.0000	0.0004

*** Significant at $\alpha = 1\%$
**Significant at $\alpha = 5\%$
*Significant at $\alpha = 10\%$
Source: Data processing

Table 6. Beginning and ending value of investment simulation of loser portfolio using cross section relative return as performance measurement

| Portfolio	Market	1_1	1_3	3_1	3_3
Beginning 2002	100.00	100.00	100.00	100.00	100.00
Ending 2009	693.13	11,049.00	3,150.98	4,384.28	2,419.87

Source: Data processing

For winner portfolio, it is found that momentum trading strategy can be applied effectively. From the output, it is concluded that in the next period, winner portfolio will make profit. The *t*-statistic shows that all of those combinations of evaluation and holding period result positive significant returns at 1% level.

From the table above it is shown that when one-month winner portfolio is hold for one month, it will realize 2.31% return per month significantly, but if it is hold for three month, it will realize higher return which is 2.96% per month significantly as well. Different with previous method (using return only), when the evaluation period is three month there is no different whether it is hold for a month or three month, the

results are quite the same, 3.02% and 3.01%, respectively. It means that in the longer period, using second method will result more stable return. The explanation is that, when risk component is included in evaluating winner portfolio, it will realize the winner stock which has lower risk compared to the previous method. So, it is possible to get higher profit in the longer period for its stability or low risk.

For loser portfolio, instead of applying momentum strategy, it is found that applying contrarian trading strategy is more effective. It is shown from the table that in the next period, loser portfolio will make profit. The *t*-statistic shows that all of those positive returns are significant at 1%.

Figure 4. Graph of investment simulation value of loser portfolio using cross section relative return as performance measurement
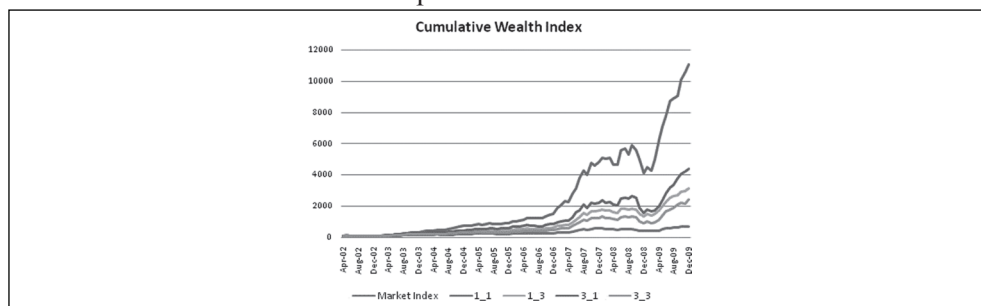
Source: Data processing

From Table 8, it is shown that when one-month loser portfolio is held for one month, it will realize 5.64% return per month significantly, but if it is held for three month, it will realize lower return which is 4.00% per month significantly as well. On the longer evaluation period the result show the same. If three-month winner portfolio is held for three month, it will also realize lower than if it is held only one month, which are 4.04% and 5.22%, respectively. It means that the loser stock, whether in shorter or longer period, will rebound quickly (in one month). If it is held longer, the rebound effect will decrease and the average return will be lower as well.

Analysis of comparison between momentum or contrarian trading strategy using cross section relative return plus risk adjustment as performance measurement and market index

In this section, the hypothesis that this strategy can outperform market will be tested. Paired sample *t*-test is used to proof whether the difference between return of this strategy and market return is positive and significant.

From the output in Table 9, it is shown that overall the return difference is not positively significant. Only *1_3* (one month evaluation and three month holding period)

portfolio can realize higher significant profit than the market at 10% level. Unfortunately, *1_1* portfolio gives less return than market instead.

The difference between *1_1* portfolio return and market return is -0.09%. It means that it is below the market return. Meanwhile, *1_3*, *3_1*, and *3_3* portfolio realize 0.56%, 0.65% and 0.63% more return then market. Therefore, statistically it cannot be concluded that the strategy can outperform market. Similar to previous approach, simulation is conducted by forming portfolio using those strategies. The result shows that at the end of 2009, value of market portfolio become 693.13 while *1_3* portfolio 1,107.51, *3_1* portfolio 1,051.24 and *3_3* portfolio 1,103.71. In other words, the second approach makes the result more stable.

From the graph below, it can be seen that almost all portfolio result better return than market, except *1_1* portfolio. They move in the same direction with market but the value is higher. When market makes return, they make higher return, but when market suffer from loss they also hit by higher loss.

After comparing the return of loser portfolio with return of market, it is concluded from Table 11 that all loser portfolios can always outperform market significantly. The difference between portfolio return and market return is always positive and significant at 1% level.

Table 7. Return of winner portfolio using cross section relative return as performance measurement

Return of Winner Portfolio			Holding Period	
			1 Month	3 Month
Evaluation period	1 month	Return	0.0231***	0.0296***
		t-stat	2.698	3.8117
		p-value	0.0083	0.0002
	3 month	Return	0.0302***	0.0301***
		t-stat	3.3600	3.7026
		p-value	0.0011	0.0004

*** Significant at α = 1%
**Significant at α = 5%
*Significant at α = 10%
Source: Data processing

Table 8. Return of loser portfolio using cross section relative return plus risk adjustment as performance measurement

Return of Loser Portfolio			Holding Period	
			1 Month	3 Month
Evaluation period	1 month	Return	0.0564***	0.0400***
		t-stat	6.7937	5.8997
		p-value	0.0000	0.0000
	3 month	Return	0.05222***	0.0404***
		t-stat	6.5969	5.5317
		p-value	0.0000	0.0000

*** Significant at α = 1%
**Significant at α = 5%
*Significant at α = 10%
Source: Data processing

Table 9. Return of winner portfolio compared to market using cross section relative return plus risk adjustment as performance measurement

Return of Winner Portfolio minus Market Return			Holding Period	
			1 Month	3 Month
Evaluation period	1 month	Return	-0.0009	0.0056*
		t-stat	-0.1935	1.7358
		p-value	0.8470	0.0859
	3 month	Return	0.0065	0.0063
		t-stat	1.1991	1.4982
		p-value	0.2336	0.1375

*** Significant at α = 1%
**Significant at α = 5%
*Significant at α = 10%
Source: Data processing

Return of *1_1* portfolio is 3.24% below market return, while *3_1*, *1_3*, and *3_3* portfolio are 2.85%, 1.60% and 1.67% higher then market. The differences of return are so high that when portfolio is formed using the strategy, the result is terrific. In the investment simulation, it is found that from 100 point in the beginning of 2002 to the end of 2009, value of market portfolio grew to 693.13, while *1_1* portfolio 11,585.2, *3_1* portfolio 7,936.11, *1_3* portfolio 2,919.82, and *3_3* portfolio 2,878.66. Hence, in eight years, investment value will grow 115 times the beginning value. The interesting result

is *3_1* portfolio with a value of 7,936.11 at the end of the period, compared to the previous approach which result 4,384.28, which is almost doubled. The analysis is that, when risk component is added, it will realize stock with less standard deviation, so when those stock deviate from their average return (suffer from loss), it will rebound more quickly.

From the pattern of the simulation investment value in the graph below, it can be shown that holding period have important effect. The portfolio with three month holding period result almost the

same. While the portfolio with one month holding period make higher ending. It can be concluded from the graph that stocks that suffer from the lost in one month will recover more quickly then the stock that suffer from the lost in three month. But in the longer period (three month) their recovery rates quite the same.

Analysis of effectiveness of momentum or contrarian trading strategy using historical relative return as performance measurement

In this section the hypothesis on the last method is going to be tested. Instead of using cross section relative return, historical relative return as performance measurement is used in determining winner and loser stock. The test will be conducted to see whether using this performance measurement, momentum or contrarian strategy still can be applied effectively. Similar to the previous methods, individual sample mean *t*-test is applied to prove the hypothesis.

For winner portfolio, it is concluded that in the next period, winner portfolio will still make profit. Therefore, momentum trading strategy can be applied effectively. From the output (Table 13) the *t*-statistic shows that all of those combinations of evaluation and

Table 10. Beginning and ending value of investment simulation of winner portfolio using cross section relative return plus risk adjustment as performance measurement

Portfolio	Market	1_1	1_3	3_1	3_3
Beginning 2002	100.00	100.00	100.00	100.00	100.00
Ending 2009	693.13	550.94	1,107.51	1,051.24	1,103.71

Source: Data processing

Figure 5. Graph of investment simulation value of winner portfolio using cross section relative return plus risk adjustment as performance measurement
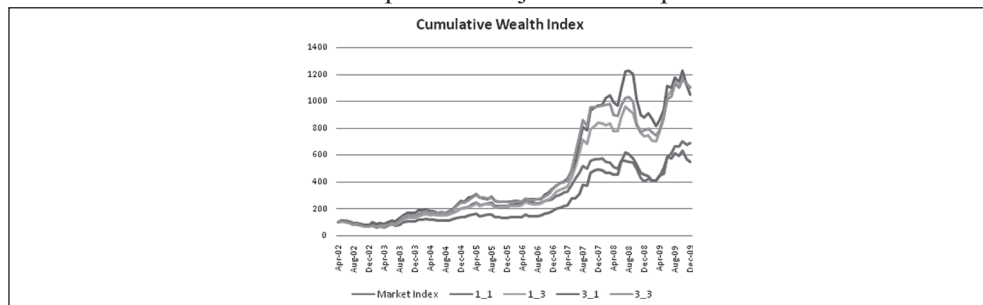
Source: Data processing

Table 11. Return of loser portfolio compared to market using cross section relative return plus risk adjustment as performance measurement

Return of Loser Portfolio minus Market Return			Holding Period	
			1 Month	3 Month
Evaluation period	1 month	return	0.0324***	0.0160***
		t-stat	6.52	6.1908
		p-value	0.0000	0.0000
	3 month	return	0.0285***	0.0167***
		t-stat	5.8598	4.7951
		p-value	0.0000	0.0000

*** Significant at α = 1%
**Significant at α = 5%
*Significant at α = 10%
Source: Data processing

Table 12. Beginning and ending value of investment simulation of loser portfolio using cross section relative return plus risk adjustment as performance measurement

Portfolio	Market	1_1	1_3	3_1	3_3
Beginning 2002	100.00	100.00	100.00	100.00	100.00
Ending 2009	693.13	11,585.24	2,919.82	7,936.11	2,876.66

Source: Data processing

Figure 6. Graph of investment simulation value of loser portfolio using cross section relative return plus risk adjustment as performance measurement

Source: Data processing

holding period result positive significant returns at 1% level.

The return of *1_1* portfolio is 2.39% per month, while *3_1*, *1_3*, and *3_3* portfolio are 2.57%, 2.91%, and 2.55%. Overall, it is lower than the result of the first approach. But the interesting thing is that the risks of those portfolios are lower. It is shown that even the return is lower, the significant level is higher. So, the treatment in the third approach by using historical relative return instead of cross section will decrease the risk but unfortunately the return as well (risk return trade off).

For loser portfolio, same with two previous methods, it is found that contrarian trading strategy can be applied effectively instead of momentum strategy. It is shown from the output that in the next period, loser portfolio will make profit and statistically they are significant at 1%.

The loser portfolio returns from this approach are portfolio 3.96%, 3.97%, 3.31% and 3.33% for *1_1*, *3_1*, *1_3*, and *3_3*, respectively. The interesting thing is that when it is hold for the same period, the result will be the same, whether the

evaluation period is one or three month. Hence, evaluation period does not matter, while holding period does.

Analysis of comparison between momentum or contrarian trading strategy using historical relative return as performance measurement and market index

In this section, the return of portfolio using historical relative return with the market return will be compared as well. The hypothesis is that the portfolio return will be able to outperform market return. To get the conclusion, paired sample *t*-test is run.

The test result (Table 15) said that winner portfolio cannot outperform market significantly. Only *1_3* (one month evaluation and three month holding period) portfolio can outperform market significantly at 1% level. This is interesting because the previous two methods can outperform market only at 10% level.

1_1 portfolio return is 0.001% below market return, while *1_3*, *3_1*, and *3_3* portfolio are 0.51%, 0.19% and 0.18%

higher then market. Statistically it can be said that winner portfolio returns are the same with market return. But differ from the first approach, this approach is quite impractical, because the number of stock that is included in the portfolio is changing over time. Therefore, it possible that in one period the number of stock in one portfolio is five, but in other period is 100, while in the previous approach, the number of stock in each portfolio is always 37.

The ending result of investment simulation using this approach is, they are quite similar to market result, except for *1_3* portfolio. But the main advantage for investor is its low risk compared to others. The graph confirms this low risk by showing almost the same move all over period.

After comparing of the loser portfolio with return of market, it is concluded that all loser portfolios can always outperform market significantly. All of them are significant at 1% level.

Given the lower risk, the result of loser portfolio is not as amazing as the two previous approaches. *1_1* portfolio results 2,521.20 at the end of period while *1_3*, *3_1*, and *3_3* result 1,419.84, 2,710.56

and 1,566.34, respectively. It is interesting to see that *3_1* portfolio ending value is higher than *1_1* portfolio, which is not the case in the two previous approaches. The explanation is that *1_1* portfolio is highly risky portfolio. Using the third approach, the high risk is effectively reduced and also the return.

From Figure 8, it is shown that the risk is neutralized. The movement of portfolio seems the same. The one month holding period portfolios are in one line whether it is evaluated in one or three months. So evaluation period does not matter in this third approach, whether the investor holds it in one month or three months.

Analysis of comparison between the three methods

In this section, the result of those three methods will be compared. The hypothesis is that those three methods will realize different return. To proof this hypothesis, two kind of test one way ANOVA and pair wise comparison are used. One way ANOVA is used to compare those three methods in the same time, while, pair wise

Table 13. Return of winner portfolio using historical relative return as performance measurement

Return of Winner Portfolio			Holding Period	
			1 Month	3 Month
Evaluation period	1 month	return	0.0239***	0.0291***
		t-stat	3.076	4.0568
		p-value	0.0027	0.0001
	3 month	return	0.0257***	0.0255***
		t-stat	3.4843	3.6244
		p-value	0.0008	0.0005

*** Significant at $\alpha = 1\%$
**Significant at $\alpha = 5\%$
*Significant at $\alpha = 10\%$
Source: Data processing

Table 14. Return of loser portfolio using historical relative return as performance measurement

Return of Winner Portfolio			Holding Period	
			1 Month	3 Month
Evaluation period	1 month	return	0.0396***	0.0331***
		t-stat	4.9889	4.4393
		p-value	0.0000	0.0000
	3 month	return	0.0397***	0.0333***
		t-stat	4.9975	4.4794
		p-value	0.0000	0.0000

Source: Data processing

Table 15. Return of winner portfolio compared to market using historical relative return as performance measurement

| Return of Winner Portfolio Market Return			Holding Period	
			1 Month	3 Month
Evaluation period	1 month	return	-0.0001	0.0051***
		t-stat	-0.0481	2.7196
		p-value	0.9617	0.0078
	3 month	return	0.0019	0.0018
		t-stat	0.7684	0.8118
		p-value	0.4442	0.4910

*** Significant at α = 1%
**Significant at α = 5%
*Significant at α = 10%
Source: Data processing

Table 16. Beginning and ending value of investment simulation of winner portfolio using historical relative return as performance measurement

Portfolio	Market	1_1	1_3	3_1	3_3
Beginning 2002	100.00	100.00	100.00	100.00	100.00
Ending 2009	693.13	632.21	1,047.33	782.91	788.38

Source: Data processing

Figure 7. Graph of investment simulation value of winner portfolio using historical relative return as performance measurement
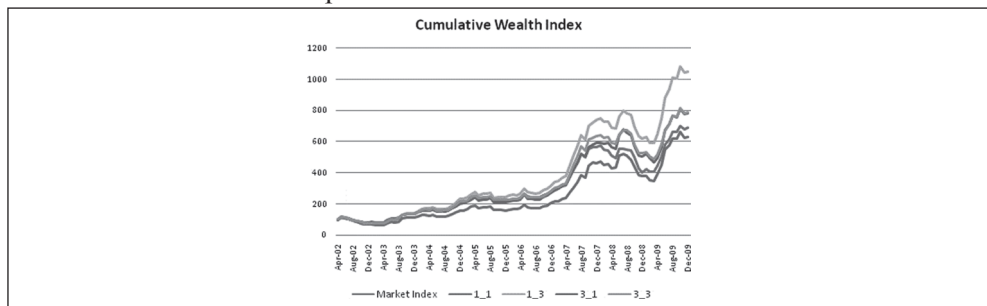
Source: Data processing

comparison is used to see which method result the same return and which method result different return.

Using one way ANOVA to compare return of those three methods, it is found that statistically there is no significant difference of each method. *p*-values of the test are more than 85%. It means that for winner portfolio, those three methods give almost the same result. Comparing *1_1*, *1_3*, *3_1*, and *3_3* portfolio, it is found that *3_1* portfolio is resulting higher difference than others. Therefore, pair wise comparison is conducted for *3_1* portfolio, to know whether there is difference between two methods.

From pair wise comparison, it is found that approach 1 and approach 3 differ more than other. It shows 16.7% level of significance. On average, approach 1 gives 0.7% higher return than approach 3. It could be caused by the lower risk of approach 3 (see the explanation of approach 3 above). In other words, approach 1 generates highest return than others, but it is not significant.

For loser portfolio, the result of one way ANOVA shows that there is no significant difference as well. But from *p*-value data shown in Table 21, it is concluded that in loser portfolio the three approaches are resulting slightly different return, because on overall *p*-value of loser is lower than

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Table 17. Return of loser portfolio using historical relative return as performance measurement compared to market

Return of Loser Portfolio Market Return			Holding Period	
			1 Month	3 Month
Evaluation period	1 month	return	0.0155***	0.0091***
		t-stat	4.6078	4.5574
		p-value	0.0000	0.0000
	3 month	return	0.0160***	0.0096***
		t-stat	4.3507	3.9221
		p-value	0.0000	0.0002

*** Significant at α = 1%
**Significant at α = 5%
*Significant at α = 10%
Source: Data processing

Table 18. Beginning and ending value of investment simulation of loser portfolio using historical relative return as performance measurement

Portfolio	Market	1_1	1_3	3_1	3_3
Beginning 2002	100.00	100.00	100.00	100.00	100.00
Ending 2009	693.13	2,521.20	1,419.84	2,710.56	1,566.34

Source: Data processing

Figure 8. Graph of investment simulation value of loser portfolio using historical relative return as performance measurement
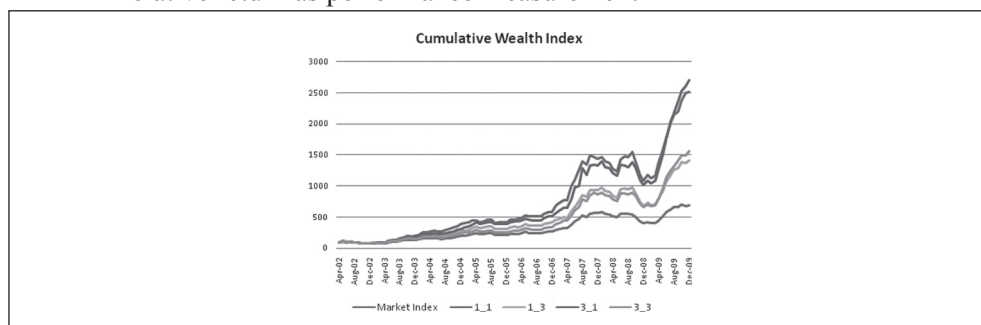
Source: Data processing

winner portfolio. Although there is no different return in comparing those three methods using one way ANOVA, it seems that in pair wise comparison, it will realize two different returns.

From Table 22, it is found that approach 1 and 2 are the same, while approach 3 is significantly different from others. Approach 1 and 2 statistically realize higher return than approach 3. But it cannot be stated which of approach 1 and 2 realize higher return. So, using historical return as relative comparison instead of cross section return gives significant different return, while adding risk component gives only little difference.

Discussion of research finding

It is found that for winner portfolio, momentum strategy can be applied effectively. It is concluded that winner stock will continue to make profit. After comparing this return with market return it is found that the return of winner portfolio can not outperform market return. But still, for investors, this portfolio gives them benefit. Instead of forming market portfolio that consists of 379 stocks, it will be easier to form winner portfolio with 37 stocks while resulting the same return.

Even though all period data show that momentum strategy is effective for winner

portfolio, from the pattern of investment from the beginning to the end of period, it is found that in some period the strategy is not effective. After carefully studying the pattern, it is shown that when market index goes down, the momentum strategy become ineffective. So it is concluded that momentum strategy for winner stock is effective when market is in bullish condition, but when market condition is bearish, contrarian strategy will be more effective.

The loser portfolios show the opposite result. When the market is bullish, it is better to apply contrarian strategy, while in bearish condition, it is better to apply momentum strategy. So for loser portfolio, when market goes up loser will rebound and goes up as well. But when market goes down, the loser portfolio will continue to make a loss.

The addition of risk component to the original methods gives only slightly different return. It will give more stable return and lower risk. But the difference is not significant. Changing the relative benchmark from cross section relative return to historical relative return, give significant difference in return. It makes smaller return but lower risk significantly.

Conclusion

From the analysis above, it is concluded that using any method presented, momentum strategy can be applied effectively for winner stock portfolio. While for loser portfolio, the effective strategy is contrarian strategy. So winner stocks in the past period will continue to make profit in the next period while loser stocks in the past period will rebound and make profit in the next period.

The return of winner stocks using momentum strategy cannot outperform market. Statistically it results the same return with market portfolio, except *1_3* winner portfolio. Using first and second methods (cross section relative return and plus risk component) the significant level is 10% in outperforming market return, but using third method (historical relative return) the significant level increase to 1%.

In addition, the return of loser stock using contrarian strategy can always significantly outperform market return.

Table 19. Result of one way ANOVA test on winner portfolio

Winner Portfolio			Holding Period	
			1 Month	3 Month
Evaluation period	1 month	F-Stat	0.0030	0.0210
		p-value	0.9970	0.9790
	3 month	F-Stat	0.1630	0.0800
		p-value	0.8500	0.9230

*** Significant at $\alpha = 1\%$
**Significant at $\alpha = 5\%$
*Significant at $\alpha = 10\%$
Source: Data processing

Table 20. Result of pair wise comparison test on winner 3_1 portfolio

Return Diff on 3_1		Approach 1	Approach 2
Approach 1	d-return	0.0025	0.007
	t-stat	0.7718	1.3928
	p-value	0.4422	0.167
Approach 2	d-return		0.0045
	t-stat		0.9934
	p-value		0.3231

*** Significant at $\alpha = 1\%$
**Significant at $\alpha = 5\%$
*Significant at $\alpha = 10\%$
Source: Data processing

Table 21. Result of one way ANOVA test on loser portfolio

Loser Portfolio			Holding Period	
			1 Month	3 Month
Evaluation period	1 month	F-Stat	1.4150	0.4370
		p-value	0.2450	0.6460
	3 month	F-Stat	0.5470	0.2250
		p-value	0.5790	0.7980

*** Significant at $\alpha = 1\%$
**Significant at $\alpha = 5\%$
*Significant at $\alpha = 10\%$
Source: Data processing

Table 22. Result of pair wise comparison test on loser 1_1 portfolio

Return Diff on 1_1		Approach 1	Approach 2
Approach 1	d-return	0.0004	0.0179***
	t-stat	0.1300	4.6513
	p-value	0.8969	0
Approach 2	d-return		0.0175***
	t-stat		5.2955
	p-value		0.0000

*** Significant at $\alpha = 1\%$
**Significant at $\alpha = 5\%$
*Significant at $\alpha = 10\%$
Source: Data processing

However, using one way ANOVA test, return of those three methods is relatively the same. But after seeing more detail using pair wise comparison, it is concluded that the first and the second methods result the same return, but both methods are different with the third method that use historical relative return instead of cross section relative return. So changing cross section with historical relative return give more significant impact than adding risk component.

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