The Indonesian Capital Market Review

Volume 11
Number 1 *January*

Article 3

1-30-2019

The Profitability of Momentum Strategies : A Study of Indonesian Stock Exchange

Rakhmat Luthfiansyah Mosii
Faculty of Economics and Business, Universitas Indonesia, rakhmat.luthfi@yahoo.co.id

Sigit Sulistiyo Wibowo
Faculty of Economics and Business, Universitas Indonesia

Recommended Citation

Mosii, Rakhmat Luthfiansyah and Wibowo, Sigit Sulistiyo (2019) "The Profitability of Momentum Strategies : A Study of Indonesian Stock Exchange," *The Indonesian Capital Market Review*: Vol. 11 : No. 1 , Article 3.
DOI: 10.21002/icmr.v11i1.11174
Available at: https://scholarhub.ui.ac.id/icmr/vol11/iss1/3

Indonesian Capital Market Review 11 (2019) 15-29

INDONESIAN
CAPITAL MARKET REVIEW

The Profitability of Momentum Strategies: A Study Of Indonesian Stock Exchange

Rakhmat Luthfiansyah Mosii* and Sigit S. Wibowo
Faculty of Economics and Business, Universitas Indonesia, Indonesia

(Received : November 2018/ Revised : July 2019/ Acceptance : August 2019/ Available Online : September 2019)

We investigate the profitability of style and price momentum strategy in the Indonesian stock market from the year 2000 to 2015. We find the style momentum strategy yields significant positive returns while the price momentum strategy tends to produce negative returns. This result confirms the findings of Lewellen (2002) that style momentum returns are generally stronger than the conventional momentum. The average monthly returns of the double-sorted size-B/M style momentum are ranging from 1.98% to 2.64% and persistent after controlling for market factor using JSX index. Our findings suggest investors should utilize publicly available information such as size and book-to-market ratio on their investment decision in the Indonesian stock market.

Keyword: *stock returns, momentum strategy, Indonesian stock exchange, efficient market hypothesis, CAPM*

JEL Classification: G11, G12, G14

Introduction

The efficient market concept has a strong implication on the investment approach of investors and traders in the stock market. Regarding this matter, efficient market hypothesis argues that under weak-form market efficiency, future returns of stocks or portfolios should not be dependent upon its past returns. In other words, it is not possible securing profit consistently using historical trend. This conjecture is well-accepted in the field of financial research until Jegadeesh and Titman (1993) (afterward will be abbreviated with JT) introduced the concept of financial anomaly named "momentum strategy." JT conjectured that the US stock markets are not at the weak-form efficient state after they discovered a trading strategy that able to generate excess returns on average 12% per year between 1965 and 1989. Furthermore, they argue this profitability was not due to the systematic risk described by stock betas, in which contradicts Fama's efficient market hypothesis.

This anomaly has been massively examined by financial researchers for the last 20 years as a prevalent anomaly in the asset pricing field that can not be explained by Fama-French three factors model of asset pricing (Chordia and Shivakumar, 2006). For instance, Rouwenhorst (1998) extends the work of JT by testing the significance and profitability of momentum strategies in international markets and found that the return continuation anomaly is present in twelve European countries in 1978 to 1995 period. Also, this momentum returns are correlated with the momentum returns found in the

* Corresponding author's email: rakhmat.luthfi@yahoo.co.id

US stock market; he suggests the possibility of exposure from common risk factors drives the profitability of momentum strategies.

Findings on the significance and the profitability of momentum strategies; however, to some extent, have been inconclusive. In some market, researchers have discovered that momentum strategies yield inconsistent profit. Bekaert et al. (1997) explore cross-sectional determinants of investment strategies in emerging markets (27 countries including Indonesia) given that emerging market has unique characteristics that separate them from the developed market such as high average returns, high volatility, and low correlation both across the emerging markets and developed markets. They find that on emerging markets, the evidence for the momentum variable is somewhat inconsistent.

Chui et al. (2000) examine the profitability of momentum strategies in eight Asian Countries that consist of Hong Kong, Indonesia, Japan, Korea, Malaysia, Singapore, Taiwan, and Thailand. Their methods are similar to JT, Jegadeesh, and Titman (2001), Rouwenhorst (1998) and Rouwenhorst (1999). Different approaches have been utilized to address the issue of illiquidity of the smaller Asian stock. Hence they value-weight instead of equally-weight the long and short positions of momentum portfolios. They also use different cut-offs, 30% rather than the 10% cut-offs used by JT in light of smaller sample sizes in most Asian countries. The evidence indicates that momentum profits present in all sample countries except for Indonesia and Korea, and other countries, the presence of momentum profit is generally weak. Consistent with the previous finding in the US stock market, they also found that momentum profits are relatively stronger for small-sized firms, low B/M firms, and high turnover firms.

Kim and Shamsuddin (2008) test the stock markets efficiency in nine Asian countries by applying multiple variance ratio tests based on wild bootstrap and signs. They find that Hongkong, Japan, Korea, and Taiwan stock market are efficient in the weak-form, while Indonesia, Malaysia, and the Philippines stock market have no sign of market efficiency. Furthermore, Singapore and Thailand have developed into an efficient market after the Asian crisis period. They mentioned that Asian stock market was expanding in size and considered as high growth and volatile region, while the previous results of studies in Asian stock market efficiency are varied and distributed over different methods, research periods and type of data frequencies. Amanda and Husodo (2015) also stated that Indonesia is an emerging country with growing stock market and positive trend of market returns and increasing trading volume from the year 2003 to 2013, while numbers of illiquid stocks are present. Similar results of the form of the Indonesian capital market is found by Arshad *et al.* (2016). Using multifractal detrendend analysis, they studied eleven OIC countries and find that the Indonesian capital market also show weak form market efficiency.

The inconsistent findings of momentum in Indonesian stock market, along with the interesting characteristics of emerging market are essential aspects to further study the momentum effect to provide additional empirical evidence of the presence of momentum profits in an emerging market. JT, Rouwenhorst (1998), and Wu (2016) sorted momentum portfolios by its past returns, while Lewellen (2002) and Chan and Docherty (2015) formed the momentum portfolios based on the past size and B/M ratio (style momentum strategy). We investigate the style momentum strategy since previous literature has conjectured that style momentum able to generates stronger profits than the price momentum. Moreover, To best of our knowledge, there are only a few kinds of literature that study the profitability of style momentum strategy, particularly in the Indonesian stock market.

This research investigates the profitability of momentum strategies in the Indonesian stock market using price and style momentum. To study this problem, our main research question is to what extent does the profitability of price and style momentum exist in the Indonesian stock market. The rest of this paper is organized as follows. Section 2 provides related literature to this study. Section 3 presents the research methods. Section 4 discusses the empirical results. The last section concludes.

https://scholarhub.ui.ac.id/icmr/vol11/iss1/3
DOI: 10.21002/icmr.v11i1.11174

Literature Review

The momentum phenomenon in stock returns is growing evidence that stock market deviates from the efficient market hypothesis (EMH). EMH was developed by Fama in early 1965 and has a root in the random walk and capital asset pricing model. EMH starts from the random walk hypothesis, that is the successive price changes are independent one from the other. Fama then expands it into market efficient states: weak form, semi-strong form, and strong form efficient market. The test of these market conditions is under the presumption that market equilibrium can be described in expected returns similar to the model of Sharpe and Lintner. Fama also explained the joint-hypothesis problem in proving the EMH. Hence, it is impossible to reject the hypothesis. The two most prevalent evidence on market inefficiency is the return reversal (contrarian strategy) and the return continuation (momentum strategy), which will be discussed in this section. We are aware of the presence of other anomalies aside from the two mentioned earlier such as the seasonality effect (month of the year, week of the month or day of the week effect) could be the possible sources for market inefficiency. We will not discuss those matters and only focus on the contrarian and momentum strategy.

De Bondt and Thaler (1985) discover a substantial weak form market inefficiencies by empirically testing the overreaction hypothesis. Overreaction hypothesis predicts stocks that went through extreme returns realizations; the future price reversals will be more (less) recognizable. The findings are consistent with the hypothesis, that the loser portfolios outperform winner portfolios regardless the winner portfolio appears to be riskier. Using monthly return for NYSE common stocks from January 1926 until December 1982, De Bondt and Thaler (1985) test the two suggested hypotheses: (1) extreme returns realizations in stock prices will be followed by subsequent returns in the opposite direction, and (2) the bigger the past return, the greater subsequent adjustment will occur, the results suggests weak-form market inefficiency.

In 1993, JT introduced the momentum strategy. They mentioned that the return reversals anomaly is still being debated since some of the researchers argued that their results could be explained using the systematic risk of their portfolios and the size effect. In contrast, they found another anomaly that seems to deviate from the weak-form market efficient condition. A series of robustness tests conducted to test the persistence of the anomaly, with the result of it is indeed persistent and could not be explained using systematic risk measure. Utilizing the stocks listed in NYSE and AMEX from 1965 to 1989, they find that a relative strength strategy that buys winners and selling losers portfolio can generate consistent profits. They argue if stock prices are either overreact or underreact to information, then it will be possible to gain profits using strategies that select stocks based on their past returns. The relative strength strategies is a set of portfolios that buys stocks with the highest past returns (from 3 to 12 month lagged period) and then hold it for 3 to 12 month after the formation period. The most successful relative strength strategy yields 1.31% in profits per month.

JT reveals that the momentum profits are due to the positive estimates of the autocovariance of market model residuals for individual stocks. This suggests that stocks prices indeed underreact to firm-specific information and violates the efficient market hypothesis. Rouwenhorst (1998) tests the momentum anomaly in the international context covering 2,190 stocks from 12 European countries to provides out of sample evidence on this particular anomaly. He finds that an internationally diversified relative strength strategy that is going long on medium-term winners and going short on medium-term losers earns around 1% profit per month. The profits cannot be attributed to conventional proxies for risks.

Rouwenhorst (1999) further expands the international tests of momentum anomaly by reaching the emerging markets. The sample consists of more than 1700 firms from 20 emerging countries. He found that on average, emerging markets stocks exhibit momentum anomaly, small stocks outperform large stocks, and value

stocks outperform growth stocks. Jegadeesh and Titman (2001) expand the sample period of JT from 1990 to 1998 to tests whether the momentum anomaly is persistent with a different period. They found that momentum strategy is persistent over time since the strategy generates a statistically different from zero profits on about 1.39% per month. In this study, they also examine the cross-sectional dispersion of expected stock returns using the Fama-French three-factor model (the previous research only utilizing CAPM) and find that the Fama-French three-factor model can not explain the momentum profits since the three factor-beta indicating that the winner's portfolio tends to be less risky than the losers portfolio.

Lewellen (2002) study the momentum anomaly in stock returns. He extends the portfolio ranking method by employing firm-specific indicators such as the market value of equity (firm size), book equity-to-market equity ratio (B/M), and double sorted size-B/M ratio. Lewellen, motivated by Fama and French (1992), argues that this method served as a better proxy for risk in stocks portfolios. The results suggest that the size, B/M, and double sorted size-B/M momentum portfolio generates profits as substantial and in some cases stronger than momentum profits found in individual or industries stocks.

Chan and Docherty (2015) provide the out of sample evidence on Lewellen (2002) style momentum by examining the style momentum in the Australian context. They study the style momentum by creating 25 portfolios double-sorted on size and book equity-to-market equity ratio. Their result suggests that Australian stocks exhibit style momentum that robust after controlling for frequently identified systematic risk factors and monthly seasonality.

From the above discussions, we argue it is presumably safe to say that the conventional momentum and style momentum are persistent anomalies. However, as best to our knowledge, there are only a few kinds of literature that study the style momentum, and furthermore, there has been no attempt taken to study the profitability of style momentum strategy in Indonesian context wherein provides a unique characteristic of Asian emerging markets. This is the main basis of our research, as we will test the profitability of the conventional momentum and the style momentum strategy in Indonesian stock exchange.

Research Methods

We employ dataset that consists of monthly returns of all firms in the Indonesian stock market (*Bursa Efek Indonesia*) to form price momentum portfolios. In accordance with Lewellen (2002) and Chan and Docherty (2015), we use market and book values of equity data of individual stocks to construct style momentum. All data are obtained from Datastream, and the sample periods start from January 2000 to December 2015. The Stock and market return are calculated with arithmatic returns using the closing price of the first date for each month, and then substracted with risk free rate to get stocks and market excess returns. The stock and market returns is defined as:

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

where P_{it} is today stock price, and $P_{it\text{-}1}$ is the yesterday price. Due to data availability, the 30-day Indonesian Central Bank Certificates (*Sertifikat Bank Indonesia*) is used as a proxy for the risk-free rate of return instead of 10-year government bond yield under the assumption that the difference between treasury bill (SBI) and government bond (SBN/SUN) will have no substantial effect on the findings of momentum returns. Our sample consist of 518 stocks listed in *Bursa Efek Indonesia* (Indonesian Stock Exchange) from 1 January 2000 to 1 December 2015. The stock data include monthly prices, market value, and book value of equity for each stock. We removed 185 stocks that have been delisted from the BEI, and 15 stocks that do not have sufficient number of observations of market value and book value of equity in the end of our sample period from our sample.

Price Momentum

Adopting JT's approach, we sort stocks data in Indonesian Stock Exchange at the end of each

https://scholarhub.ui.ac.id/icmr/vol11/iss1/3
DOI: 10.21002/icmr.v11i1.11174

Table 1. Overview of Momentum Portfolios

	Formation Period			
Holding Period	3	6	9	12
3	(3-3)	(6-3)	(9-3)	(12-3)
6	(3-6)	(6-6)	(9-6)	(12-6)
9	(3-9)	(6-9)	(9-9)	(12-9)
12	(3-12)	(6-12)	(9-12)	(12-12)

Note: Each cell represents a momentum strategy that buys stocks based on k month formation period and then holds it for n month holding period. Source: Vas and Absalonsen (2014).

month *t* into deciles based on their prior three, six, nine, and twelve-month returns. The winner portfolio is the top performers (top decile), and the loser portfolio is the worst performers (bottom decile). To mitigate the possible bid-ask bounce effects (see Moskowitz and Grinblatt, 1999), we skip a month between the end of the formation period and the start of holding period, so the formation-period for three-month returns are calculated from *t*-2 to *t*-1, skipping month *t*. The holding periods for the momentum portfolios are calculated for four holding periods: three month holding period (*t*+1 to *t*+3), six month holding period (*t*+1 to *t*+6), nine-month holding period (*t*+1 to *t*+9), and twelve-month holding period (*t*+1 to *t*+12) so in total there are 16 price momentum portfolios. The portfolios are illustrated in Table 1.

Following Chui et al. (2000), we form the second set of price momentum portfolios with 30% portfolio size rather than deciles (10%) to overcome the small sample size which commonly occurs in Asian emerging markets. The momentum portfolios are the difference in going long the past winners (best performers) and going short the past losers (worst performers).

For example, for October 2000, the (3-3) momentum portfolio returns are the sum of the monthly return from August, September, and October of 2000, where the profit used in each of this month is from holding period months 1, 2, and 3, respectively. The (3-3) momentum portfolio, in this case, is formed at the end of June 2000 (skipping July) which consists of formation period May and June (3 months, skipping the third month). Portfolio explained above has an overlapping period, that is investing in a *k* number of momentum portfolio at a time, as We follow JT for using the overlapping period to enhance the result. Since the returns are overlapping, there is a possibility that the data exhibit serial correlation issue thus could make the result spurious. We will discuss the treatment for this case in the series of the robustness test section.

Style Momentum

In general, style momentum is formed similar to the price momentum, with the exception, rather than utilizing past returns to differentiate the winners and losers portfolio, Lewellen (2002) sorted the stocks based on size, B/M ratio, and double-sorted size-B/M ratio. We define size as the market value of the stocks, and B/M as the ratio between the book value of equity to the market value of equity. Lewellen (2002) constructs 25 portfolios for the double-sorted size-B/M portfolios by dividing the stocks by quintiles (20%) for each size and B/M so in total gives 5×5 portfolios (25) for each formation-holding period. Chan and Docherty (2015) expand the style momentum by using Brailsford et al. (2012) breakpoint that consists of 75% cut-off for the largest portfolios, followed by 15%, 5%, 3%, and 2% for the smallest portfolio, so in total this method also gives 5×5 portfolios (25) for each formation-holding period. In this study, we use 30% breakpoints in light of the small sample size addressed by Chui et al. (2000). Therefore in total we construct 3×3(9) double-sorted size-B/M portfolios, 3 size portfolios, and 3 B/M portfolios for each formation-holding period (3−3), (3−6), (3−9), (3−12), (6−3),...,(12−12) respectively.

Momentum Profitability Significance

The statistical significance of the momentum returns is tested using a 2-sided t-test statistics. We utilize 2-sided *t*-test since the average return of the momentum portfolio could generate

a positive and negative result. The *t*-test is defined as:

$$\frac{\mu_W - \mu_L}{\sqrt{\frac{\sigma_W^2}{N_W} + \frac{\sigma_L^2}{N_L}}} \quad (2)$$

where μ_W is the mean of the monthly return from withe nners portfolio (W), μ_L is the mean of the monthly return from losers portfolio, N_W is the number of monthly observation in the winners portfolio, N_L is the number of observation in losers portfolio (L), σ_W^2 is the variance of the winners portfolio, and σ_L^2 is the variance of the losers portfolio. Since the number of observation in winners and losers portfolio are indifferent, the denumerator in Equation (2) above denotes the Mean Squared Error of the momentum returns (see Hon and Tonks 2003). To determine whether the result are statistically significant, we compare the *t*−statistics against the critical values given by the Student's *t* distribution. We evaluate each *t*−statistics at 1%, 5%, and 10% level of significance.

Comparison of Price and Style Momentum Profitability

Lewellen (2002) conjecture that the profitability of style momentum strategy is stronger than the price momentum strategy. To compare the profitability of momentum strategies, we employ *t*-test in Equation (2) on each portfolio in price momentum strategy against each corresponding portfolio in style momentum strategy, so we will have the (3-3) price momentum portfolio tested against (3-3) style momentum portfolio and so on until the (12-12) price momentum portfolio is tested against (12-12) style momentum portfolio. The result will stand as a benchmark of whether the style momentum strategy is better than the price momentum strategy in term of profitability.

Risk-Adjusted Profits

To investigate whether the result of the momentum strategies are valid and persistent even after factor models are taken into consideration, we examine whether the momentum strategies profits can be explained by the CAPM using the Ordinary Least Squares (OLS) method. Following Cooper et al. (2004), we adjust the significant momentum profits with the market factor based on CAPM, which will be explained below.

To form the CAPM risk-adjusted profits, for each holding period, We regress the time-series of price and style momentum profits on market factor and a constant. The risk-adjusted profits are presented by the alpha coefficient, that is to show how well the momentum profits performed compared to the market portfolio. The model for CAPM adjusted profits is shown below:

$$R_{W-L} - R_f = \alpha_1 + \beta_2 R_m - R_f + e \quad (3)$$

where $R_{W-L} - R_f$ is time series of momentum returns, α_1 is a constant, R_f is the risk free rate, β_2 is the momentum portfolio beta, e is the model's residual, R_m is the return of the market portfolio defined as market index (*IHSG*), and $R_m - R_f$ is the market risk premium. In light of heteroscedasticity and auto correllation issue addressed by Coopper et al. (2004), we employ the robust standard error using Newey-West adjustment (1987).

Seasonality Effect

JT excludes the month of January in their sample period since it tends to exhibit extreme value in terms of stock returns. To investigate the January effect in the momentum profits, consider the following model:

$$\begin{aligned} R_{W-L} - R_f = {} & \alpha_0 + \beta_1 (R_M - R_f) + \alpha_1 DUMMY_1 \\ & + \alpha_2 DUMMY_2 + \alpha_3 DUMMY_3 \\ & + \alpha_4 DUMMY_4 + \alpha_5 DUMMY_5 \\ & + \alpha_6 DUMMY_6 + \alpha_7 DUMMY_7 \\ & + \alpha_8 DUMMY_8 + \alpha_9 DUMMY_9 \\ & + \alpha_{10} DUMMY_{10} + \alpha_{11} DUMMY_{11} \\ & + e_{W\text{-}L} \end{aligned} \quad (4)$$

where $R_{W-L} - R_f$ is the momentum strategy returns, α_0 is a constant, $DUMMY_1$ is a dummy

https://scholarhub.ui.ac.id/icmr/vol11/iss1/3
DOI: 10.21002/icmr.v11i1.11174

Table 2. Descriptive Statistics

Portfolio	Mean	Std. Dev	Skewness	Kurtosis	Observations
Price 10% Winner	0.0085	0.0655	-0.0101	2.9579	180
Price 10% Loser	0.0123	0.0899	1.3060	7.8674	180
Price 30% Winner	0.0101	0.0609	0.1449	3.3126	180
Price 30% Loser	0.0106	0.0730	0.4977	5.4332	180
Size Winner	0.0191	0.0661	-0.1610	5.3806	180
Size Loser	0.0059	0.0638	0.9027	4.5787	180
B/M Winner	0.0169	0.0741	0.6548	4.0166	180
B/M Loser	0.0052	0.0550	-0.4249	5.0164	180
Size-B/M Winner	0.0280	0.0964	1.6135	7.5091	180
Size-B/M Loser	0.0055	0.0621	-0.5006	6.7449	180

Note: This is the descriptive statistics for (6-6) momentum winners and losers portfolio that consists of 10% price momentum, 30% price momentum, size, B/M and double sorted size-B/M portfolios. Source: author's calculations.

that takes a value of 1 when the month is January and 0 otherwise, and so on, until $DUMMY_{11}$ is November dummy, and $e_{W\text{-}L}$ is an error term. We drop the last month (December) dummy to avoid perfect collinearity problem and instead of using the constant as a base measure for December Month. The inclusion (exclusion) of January month in our next models will be decided by the significance of the α_1 coefficient. If it is not significant, we will include it in the next models and *vice versa*.

Another potential seasonality problem in our data is the sub-prime mortgage crisis in the U.S between 2007 and 2009, which can potentially disturb the data in the Indonesian stock market. To investigate this issue, we conduct the same process as for the January effect explained above, but, instead of using month dummy, we use a dummy that will take the value of 1 in the crisis period and 0 otherwise. We define the crisis period from July 2007 to May 2009 based on the Bank for International Settlements (2009). So, consider the following regression model:

$$R_{W-L}-R_f = \alpha_0+\beta_1(R_M-R_f) + \alpha_1 DUMMYCRISIS_1+e_{W\text{-}L} \quad (5)$$

where $R_{W-L}-R_f$ is the time series of momentum returns, α_0 represent the Non Crisis period, α_1 represent the coefficient of the Crisis Period $DUMMYCRISIS_1$, that takes a value of 1 in the crisis period and 0 otherwise. The exclusion (inclusion) of the crisis period will be depend on the statistical significance of the crisis period dummy.

Results and Discussions

The descriptive statistics of all portfolios used in this study are reported in Table 2.

Table 2 shows the descriptive statistics for (6-6) strategy of price momentum, size, B/M, and double-sorted size-B/M portfolios. The average monthly returns differ from 0.005% to 0.028% per month, using 180 monthly observations for each portfolio. The sample period for the (6-6) momentum strategy starts from 1 January 2001 to 1 December 2015. We employ this sample period to provide the latest studies in the momentum profitability in the Indonesian stock market.

There are 518 stocks listed in *Bursa Efek Indonesia* (BEI) which includes all stocks from Datastream after making some adjustments. We employ the equally weighted returns for each momentum portfolios. The skewness and the kurtosis of all portfolio indicating a violation of normal distributions (kurtosis = 3, and skewness = 0). However, We follow the Central Limit Theorem as in Fama (1965) that is the stock returns in aggregate, as the number of observation increase will be normally distributed regardless of the underlying distribution. The price momentum (the 10% and 30% portfolio size) generates negative returns while the style momentum generates positive returns for this period sample. We will discuss the momentum profitability in detail in the next section.

Returns of Price Momentum

Table 3 presents the average returns of the 10% Price Momentum Strategy from 3-3 to

Table 3. Returns of Price Momentum with 10% portfolio size

Holding Period	Formation Period			
	3	6	9	12
3	-0.0099	-0.0118	-0.0086	-0.0105
Probability	-0.2483	0.1796	0.3352	0.2236
6	-0.0059	-0.0048	-0.0030	-0.0054
Probability	0.4671	0.5533	0.7216	0.5040
9	-0.0025	0.0005	-0.0063	-0.0111
Probability	0.7490	0.9436	0.4207	0.1716
12	-0.0066	-0.0092	-0.0169	-0.0089
Probability	0.3840	0.2105	0.0268	0.2474

Note: The intersection between 3 to 12 formation and holding period is the reported mean profits and probability value obtained using the t-test for each portfolio. The probability in bold is statistically different from zero. Source: author's calculations.

Table 4. Returns of Price Momentum with 30% portfolio size

Holding Period	Formation Period			
	3	6	9	12
3	0.0000	-0.0036	-0.0040	-0.0016
Probability	0.9953	0.6065	0.5670	0.8165
6	-0.0025	-0.0013	-0.0001	-0.0037
Probability	0.7104	0.8422	0.9828	0.5799
9	0.0018	0.0010	-0.0027	-0.0056
Probability	0.7888	0.8798	0.6868	0.3997
12	-0.0048	-0.0068	-0.0071	-0.0076
Probability	0.4700	0.2916	0.2795	0.2456

Note: The intersection between 3 to 12 formation and holding period is the reported mean profits and probability value obtained using the t-test for each portfolio. The probability in bold is statistically different from zero. Source: author's calculations.

12-12 holding-formation periods. All stocks that have return information available from the formation period after adjustments are included in this particular strategy. All stocks available after adjustment are ranked based on their past returns and then held on a certain holding period; we skip a month between the formation period and the holding period.

The returns for all portfolios are negative and insignificant except for the 9-12 portfolios, which have a negative return and significant probability value. The lowest returns are given by the 9-12 portfolio, with an average return around −1.11% monthly. This finding is consistent with Chui et al. (2000) that documented inconsistent momentum profits in the Indonesian stock market. However, this result could arise from the smaller numbers of listed stocks in Indonesian Stock Exchange compared to the New York Stock Exchange in which employed in JT's paper. Hence, we need to test the profitability of the price momentum strategy using bigger portfolio size, following Chui et al. (2000), we use the 30% portfolio size were the results provided in Table 4.

Table 4 reports the average returns of the 30% price momentum strategy from 3-3 to 12-12 holding-formation periods. The results are rather indifferent from the 10% Price Momentum Strategy explained in Table 3 with some exception, that there are positive returns for this strategy in 3-3, 3-9, and 6-9 portfolios that give average return around 0.004%, 0,18%, and 0,1% per month respectively. Consistent with Chui et al. (2000), this strategy also gives inconsistent profits given by the insignificance of the probability value of all portfolios. Looking at the results of the 10% and 30% Price Momentum Strategy, we can see that it is not profitable to buy the winner portfolio and short the loser portfolio. Our result indicates that the Indonesian stock market is in a weak-form efficient state since it is unable to predict stocks prices using strategies based on past returns (see also Fama, 1970). However, we construct another momentum strategy to find a profitable momentum strategy; the next momentum strategy is discussed in the next section.

https://scholarhub.ui.ac.id/icmr/vol11/iss1/3
DOI: 10.21002/icmr.v11i1.11174

Table 5. Returns of Size Momentum Portfolio

Holding Period	Formation Period			
	3	6	9	12
3	0.0146	0.0139	0.0134	0.0137
Probability	0.0324	0.0421	0.0497	0.0493
6	0.0146	0.0133	0.0129	0.0152
Probability	0.0324	0.0504	0.0617	0.0265
9	0.0134	0.0127	0.0151	0.0150
Probability	0.0497	0.0672	0.0281	0.0301
12	0.0133	0.0152	0.0146	0.0131
Probability	0.0553	0.0283	0.0344	0.0557

Note: The intersection between 3 to 12 formation and holding period is the reported mean profits and probability value obtained using the t-test for each portfolio. The probability in bold is statistically different from zero. Source: author's calculations.

Table 6. Returns of Book-to-Market Momentum Portfolio

Holding Period	Formation Period			
	3	6	9	12
3	0.0146	0.0131	0.0129	0.0123
Probability	0.0381	0.0578	0.0596	0.0740
6	0.0121	0.0114	0.0104	0.098
Probability	0.0777	0.0941	0.1256	0.1425
9	0.0105	0.0103	0.0091	0.0071
Probability	0.1252	0.1309	0.1761	0.2993
12	0.0102	0.0085	0.0075	0.0074
Probability	0.1360	0.2119	0.2724	0.2725

Note: The intersection between 3 to 12 formation and holding period is the reported mean profits and probability value obtained using the t-test for each portfolio. The probability in bold is statistically different from zero. Source: author's calculations.

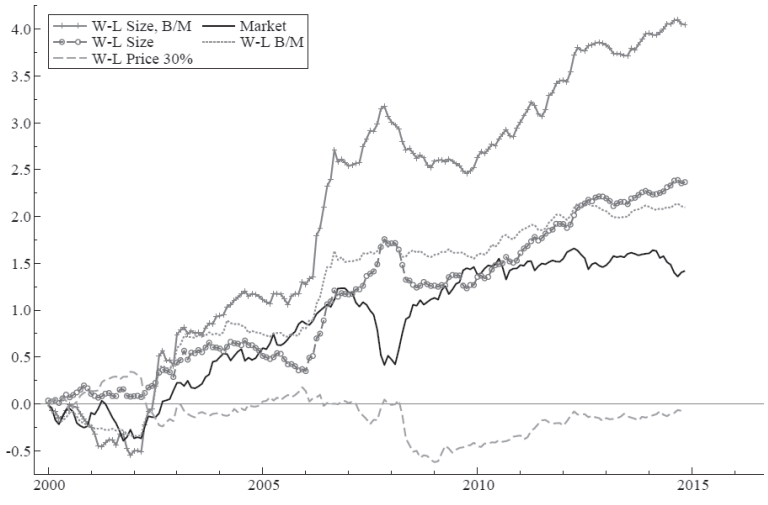
Returns of Style Momentum

This section reports the average returns of the style momentum following Cooper et al. (2004) that is size, B/M, and double-sorted size-B/M portfolios. All strategies employ 30% size portfolios with holding and formation period the same as the price momentum strategy. Table 5 documents the returns of the size momentum portfolio. Each month, We rank all stocks based on their past size (market value) and then hold them on a certain holding period, the winner portfolio is the 30% smallest size stocks and the losers portfolio is the 30% biggest size stocks. In contrast to the price momentum, the size momentum portfolio consistently able to generates positive returns on all 16 portfolios with a statistically significant probability value. The (12-6) portfolio is the most profitable portfolio, with an average return around 1.5% per month and significant on a 5% level of confidence.

Table 6 provides the book-to-market (B/M) Momentum Portfolio. According to Cooper et al. (2004), the book-to-market ratio is a ratio of the book value of equity divided by the market value of equity. All available stocks after adjustment are ranked based on their past three to twelve month B/M ratio and then being held for three to twelve month holding period. The winner portfolio is the 30% stocks with the highest B/M ratio, and the loser portfolio is the lowest 30% B/M ratio. The B/M momentum portfolio returns are the difference between the winner portfolio and loser portfolio divided by the number of stocks included in the portfolio each month. Overall, the B/M momentum portfolio can generate positive returns with the 3-3 portfolio gives the highest returns, around 1.4% per month. Even though this B/M strategy able to generates positive returns, we have to proceed with a caveat, that is only eight from 16 portfolios gives significant positive returns.

Table 7 shows the returns of 16 style portfolios strategies. The style portfolios are formed with two-way sorts method by ranking all available stocks after adjustment on their past size (market value) and book-to-market (B/M) ratio and then held for a certain month. The winner portfolio consists of stocks that have the following characteristics: (1) 30% smallest market value, and (2) 30% highest B/M ratio and the loser portfolio has the opposite characteris-

Figure 1. Profitability Across Momentum Strategies



Source: author's calculations.

Note: W-L size_B/M represents the cumulative return of the (6-6) double-sorted size-B/M portfolio. Market represents the cumulative market return, W-L size represents the cumulative return of (6-6) size portfolio, and B/M represents the cumulative return of (6-6) B/M portfolio.

Table 7. Returns of Double-Sorted Size-B/M Momentum Portfolios

Holding Period	Formation Period			
	3	6	9	12
3	0.0247	0.0233	0.0250	0.0264
Probability	0.0038	0.0055	0.0038	0.0036
6	0.0223	0.0228	0.0219	0.0247
Probability	0.0078	0.0078	0.0139	0.0062
9	0.0199	0.0218	0.0246	0.0235
Probability	0.0231	0.0149	0.0067	0.0089
12	0.0198	0.0239	0.0212	0.0211
Probability	0.0236	0.0076	0.0166	0.0186

Note: The intersection between 3 to 12 formation and holding period is the reported mean profits and probability value obtained using the t-test for each portfolio. The probability in bold is statistically different from zero. Source: author's calculations.

tics from winner portfolio. This strategy gives consistent positive returns, and all of them are statistically different from zero. Consistent with Lewellen (2002), this result shows that style momentum gives stronger profits than price momentum with the (12-3) portfolio gives the highest return (around 2.6% per month) whereas the lowest return is held by the (3-12) portfolio with around 1.98% return monthly compared to results from price momentum strategies that overall generates negative profits and statistically not different from zero.

Figure 1 describes the cumulative returns of (6-6) momentum strategies and market portfolio, we can see that the double sorted style portfolio (Size-B/M) generates the highest profits compared to price, size, B/M, and market portfolio, whereas, the lowest profits being held by the 30% price momentum strategy. In this period, the market portfolio (with *IHSG/JSX* as a proxy) generated negative cumulative profits from 2001 to 2015. This finding is again consistent with Lewellen (2002) who stated that the style momentum strategy gives a better result compared to conventional momentum strategies since the style momentum represent the common risk factors following Fama and French (1992). This result also serves as additional empirical evidence of stock market inefficiency in the Indonesian stock market that deviates from the EMH.

Risk-Adjusted Profits Regression

The findings in previous sections show that style momentum strategy gives a positive result from the period 2001 to 2015. To provide a measure that considers risk and to make the result more comparable, we adjust the profits of the momentum strategy utilizing market factor.

https://scholarhub.ui.ac.id/icmr/vol11/iss1/3
DOI: 10.21002/icmr.v11i1.11174

Table 8. CAPM-Adjusted Momentum Profits

Holding Period	Formation Period			
	3	6	9	12
3	0.0249	0.0236	0.0254	0.0265
Probability	0.0001	0.0002	0.0001	0.0001
DW Stat	1.6099	1.5182	1.4893	1.4969
6	0.0229	0.0233	0.0224	0.0250
Probability	0.0003	0.0003	0.0011	0.0004
DW Stat	1.5390	1.4874	1.5620	1.5799
9	0.0204	0.0220	0.0250	0.0241
Probability	0.0022	0.0014	0.0005	0.0006
DW Stat	1.6952	1.6139	1.6679	1.6986
12	0.0202	0.0242	0.0217	0.0220
Probability	0.0025	0.0005	0.0016	0.0016
DW Stat	1.6015	1.6064	1.6894	1.7393

Note: The intersection between 3 to 12 formation and holding period is the reported intercepts (serves as a measure for CAPM-adjusted profits) and probability value from the CAPM regression for each portfolio along with the Durbin Watson Statistics in light of Autocorrelation issue. The probability in bold is statistically different from zero. Source: author's calculations.

Table 9. White Heteroscedasticity Test on (6-6) Style Momentum

Test	Coefficient	Probability
F-statistic	6.2225	0.0024
Obs*R-squared	11.8277	0.0027
Scaled explained SS	42.0094	0.0000

Note: This is the result of the White Test on the (6-6) style momentum strategy returns after the returns regressed using CAPM. Source: author's calculations.

Table 8 presents the results. The risk-adjusted profits obtained by regressing the time-series return of the double-sorted size-B/M strategy against a constant and a market factor using CAPM. From Table 8, we can conclude that the profits of style momentum strategy persist after controlling the market factor, with the (12-3) strategy gives the highest result that is around 2.6% per month whereas the (9-12) gives the lowest profits that are around 2.1% monthly. Table 8 also provides the Durbin-Watson Statistics to measure the autocorrelation in the model. The result shows that the model suffers from the autocorrelation problem since none of the DW-stat gives a coefficient of 2 (see also, Brooks, 2008).

Moreover, We also test the possibility of heteroscedasticity issue in the model by conducting the white test on the time series of (6-6) style momentum returns. We assume that by testing only the (6-6) style momentum strategy returns, We will have sufficient evidence for the 15 other style portfolios since all portfolios generate consistent significance. The result of the White test on (6-6) style momentum is shown in table 9.

From Table 9, we can see that the probability value of three types of tests is significant at 1% level. Thus we are confident that our model suffers from the heteroscedasticity problem (see also, Brooks, 2008). Based on the result of autocorrelation and heteroscedasticity tests conducted above, We need to adjust our standard errors of the syle momentum profitability significance using Newey-West Standard Error, with the result explained in Table 11.

As expected, the profitability of the style momentum strategy is persisted after controlling for the market factor and adjusted standard error in light of autocorrelation and heteroscedasticity issue. However, we need to test the seasonality effect of our sample period. The first seasonality test is the January effect, under JT that excludes the January month in their sample period to strengthen their results since January tends to exhibit extreme value, they argue that the momentum profits could come from a specific period (January). To test the January effect, we employ the following model in Equation (4) with the results in Table 11.

From Table 11, the January dummy is not statistically significant. Therefore we include the January month in our sample period. Note that the May and October dummy yield positive

Table 10. CAPM-Adjusted Momentum Profits with HAC Standard Error

Holding Period	Formation Period			
	3	6	9	12
3	0.0249	0.0236	0.0254	0.0265
Probability	0.0010	0.0021	0.0017	0.0020
6	0.0229	0.0233	0.0224	0.0250
Probability	0.0030	0.0030	0.0060	0.0019
9	0.0204	0.0220	0.0250	0.0241
Probability	0.0064	0.0054	0.0016	0.0017
12	0.0202	0.0242	0.0217	0.0220
Probability	0.0078	0.0019	0.0043	0.0028

Note: The intersection between 3 to 12 formation and holding period is the reported intercepts (serves as a measure for CAPM-adjusted profits) and probability value from the CAPM regression with Heteroscedasticity and Autocorrelation Consistent (HAC) Newey-West Standard Error for each portfolio. The probability in bold is statistically different from zero. Source: author's calculations.

Table 11. Seasonality - January Effect

Variable	Coefficient	Standard Error	P-Value
Alpha	0.0011	0.0210	0.9551
RM-RF	-0.0717	0.1001	0.4746
January	0.0009	0.0302	0.9758
February	0.0302	0.0302	0.3190
March	-0.0004	0.0302	0.9888
April	0.0031	0.0302	0.9180
May	0.0595	0.0303	0.0509
June	0.0395	0.0302	0.1933
July	0.0213	0.0302	0.4815
August	0.0374	0.0302	0.2174
September	0.0287	0.0305	0.3484
October	0.0552	0.0302	0.0698
November	-0.0081	0.0303	0.7888
Descriptive Statistics			
R2		0.0714	
Adj-R2		0.0051	
F-stat		1.0775	
DW-stat		1.4617	

Note: This is the regression output of the January Seasonality test using CAPM regression that includes monthly (January to November) dummies that take the value of 1 when the month are January, ..., November, and 0 otherwise. Source: author's calculations.

Table 12. Crisis Period

Variable	Coefficient	Standard Error	Probability Value
Alpha	0.0208	0.0068	0.0026
RM-RF	-0.0535	0.0981	0.5859
Crisis Dummy	0.0188	0.0189	0.3211
Descriptive Statistics			
R2		0.0079	
Adj-R2		-0.0032	
F-stat		0.7116	
DW-stat		1.4945	

Note: This is the regression output of the Crisis Seasonality test using CAPM regression that includes a dummy variable that takes the value of 1 on the given crisis period, and 0 otherwise. Source: author's calculations.

coefficient. However, we argue that as far as We know, there is no specific issue mentioned for May and October in the previous momentum literature. Therefore, we include May and October month in our sample period.

The next seasonality issue is the crisis period in around 2007 and 2009. We employ the model in Equation (5). The exclusion (inclusion) of the crisis period will depend on the statistical significance of the crisis period dummy.

The results in Table 12 suggest that the subprime mortgage crisis occurred in the U.S. does not affect the time series of (6-6) style momentum returns in Indonesian stock market since

https://scholarhub.ui.ac.id/icmr/vol11/iss1/3
DOI: 10.21002/icmr.v11i1.11174

the crisis period dummy does not have a statistically significant probability value. Therefore, we have no problem to include the crisis period into our sample, and we can use the results in Table 10.

The persistence of the style momentum profits and the fact that price momentum profits are not able to give consistent profits in Indonesian context indicates that the Indonesian Stock Market is in the weak-form efficient state of the EMH but does not hold in the semi-strong form efficient state. In the weak-form efficient state, the current stock prices already reflect all information on its historical prices. Hence it is not possible to predict the future price using price momentum strategy which utilizing the historical prices. Our findings in section 4.2 support this statement. The results imply that the semi-strong form efficient state should be ruled out from the Indonesian Stock Market condition since we can obtain a significant profit by employing a style momentum strategy that incorporating publicly available information such as size and book-to-market ratio.

Conclusions

We find the price momentum strategy that ranks stocks based on their past returns is not profitable in the Indonesian stock market. The returns of 10% size price momentum portfolios are negative and insignificant except for the 9-12 portfolio, which has a significant negative return and the 6-9 portfolio that give an insignificant positive average return. The lowest returns are produced by 9-12 price momentum portfolio, which averaged -1.11% per month. We increase the size of the price momentum portfolio from 10% into 30% to overcome the small sample problem addressed by Chui et al. (2000). The results of the 30% price momentum strategy are indifferent from the 10% price momentum strategy with the exception, that there are three portfolios in this strategy that yields insignificant positive average returns which are the 3-3, 3-9, and 6-9 portfolios. These portfolios give average return around 0.004%, 0.18%, and 0.1% per month respectively. Coherent with Chui et al. (2000), this strategy also yields inconsistent profits given by the insignificance of the probability value of all portfolios.

The results of the style momentum strategies, in contrast, can generate an overall positive and statistically significant profits. The style momentum gives higher profits than price momentum with the (12-3) double sorted size-B/M portfolio gives the highest return of 2.6% per month whereas the lowest return on the double sorted size-B/M portfolio is held by the (3-12) portfolio with around 1,98% monthly return. This finding confirms the results of Lewellen (2002) who find the style momentum in some case are stronger than the conventional (price) momentum of JT.

These results indicate that the Indonesian stock market is arguably in the state of weak-form efficient of EMH since we seem unable to predicts positive future returns based on stocks past characteristics, while style momentum strategy that utilizes publicly available information can give consistent positive profits. Our findings support the result of Arshad *et al.* (2016) that Indonesian stock market is in weak-form efficiency. On the other hand, our results deviate from the conclusion of the Indonesian stock market have no sign of market efficiency in Kim and Shamsuddin (2008). However, we emphasize that we did not test the EMH directly as in Malkiel and Fama (1970), Jegadeesh and Titman (1993), Jegadeesh and Titman (2001), or Kim and Shamsuddin (2008), our results only indicate the presence of inefficiency in Indonesian Stock Market.

We want to assert that due to data availability, we utilize 30-day Indonesian Central Bank Certificates (Sertifikat *Bank Indonesia*) as an intermediary for the risk-free rate of return instead of 10-year government bond yield under the assumption that the difference between treasury bill (SBI) and government bond (SBN/SUN) will have no substantial effect on the findings of momentum returns. We also need to accentuate that our results only limited to the 3-3, …, 12-12 forming and holding period of momentum portfolios as in Jegadeesh and Titman (1993), it is possible that momentum returns under different forming and holding period to have a different result.

From the practical perspective, our findings show that implementing a strategy that buys stocks based on its past size and B/M ratio seems able to generate significant profits in Indonesian stock market, while a strategy that selects stocks based on its past returns, in contrast, are unable to give consistent profits. In summary, we recommend investors to apply the style momentum strategy to gain profits in the Indonesian stock market based on an indication of stock market inefficiency that let us do so. For future study, we recommend investigating thoroughly the inability of price momentum strategy to generate profits in the Indonesian stock market, which is inconsistent with the generally accepted findings of JT. We also suggest the source of the profitability of momentum strategies can be further explored.

References

Amanda, C., and Husodo, Z. A. (2015). Empirical test of Fama-French three factor model and illiquidity premium in Indonesia. *Corporate Ownership & Control Journal*, 12(2): 362-373.

Arshad, S., Rizvi, S.A.R, Mat Ghani, G., and Duasa, J. (2016). Investigating stock market efficiency: A look at OIC member countries. *Research in International Business and Finance*, 36: 402-413.

Bank for International Settlements (2009). *The Global Financial Crisis - BIS 79th Annual Report.* Available at http://www.bis.org/publ/arpdf/ar2009e2.pdf.

Bekaert, G., Erb, C. B., Harvey, C. R., and Viskanta, T. E. (1997). What matters for emerging equity market investments. *Emerging Markets Quarterly*, 1(2):17–46.

Bodie, Z., Kane, A., Marcus, A., and Jain, R. (2014). *Investments*, Asia Global Edition. Singapore: McGraw-Hill Global Education Holdings.

Brailsford, T., Gaunt, C., and O'Brien, M. A. (2012). The investment value of the value premium. *Pacific-Basin Finance Journal*, 20(3):416–437.

Brooks, C. (2008). *Introduction Econometrics for Finance*. Cambridge, UK: Cambridge University Press.

Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of Finance,* 52(1):57–82.

Chan, H. and Docherty, P. (2015). Momentum in Australian style portfolios: risk or inefficiency? *Accounting & Finance*, 56(2): 333–361.

Chan, K., Hameed, A., and Tong, W. (2000). Profitability of momentum stragegies in the international equity markets. *Journal of Financial and Quantitative Analysis*, 35(2):153–172.

Chen, J. and Hong, H. (2002). Discussion of momentum and autocorrelation in stock returns. *The Review of Financial Studies*, 15(2):565–573.

Chordia, T. and Shivakumar, L. (2006). Earnings and price momentum. *Journal of Financial Economics*, 80(3):627–656.

Fama, E. F. (1965). The behavior of stock-market prices. *The Journal of Business*, 38(1):34–105.

Fama, E. F. and French, K. R. (1992). The cross-section of expected stock returns. *The Journal of Finance*, 47(2):427–465.

Fama, E. F. and French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, 116:1–22.

Gujarati, D. (2004). Basic Econometrics. Tata McGraw-Hill.

Hon, M. T. and Tonks, I. (2003). Momentum in the UK stock market. *Journal of Multinational Financial Management*, 13(1):43–70.

Jegadeesh, N. and Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *The Journal of Finance*, 48(1):65–91.

Jegadeesh, N. and Titman, S. (2001). Profitability of momentum strategies: An evaluation of alternative explanations. *The Journal of Finance*, 56(2):699–720.

Kim, J.H., and A. Shamsuddin (2008). Are Asian stock markets efficient? Evidence

https://scholarhub.ui.ac.id/icmr/vol11/iss1/3
DOI: 10.21002/icmr.v11i1.11174

from new multiple variance ratio tests. *Journal of Empirical Finance* 15(3): 518-532.

Lewellen, J. (2002). Momentum and autocorrelation in stock returns. *The Review of Financial Studies*, 15(2):533–564.

Malkiel, B. G. (2003). The efficient market hypothesis and its critics. *The Journal of Economic Perspectives*, 17(1):59–82.

Malkiel, B. G. and Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance*, 25(2):383–417.

Moskowitz, T. J. and Grinblatt, M. (1999). Do industries explain momentum? *The Journal of Finance*, 54(4):1249–1290.

Rouwenhorst, K. G. (1998). International momentum strategies. *The Journal of Finance*, 53(1):267–284.

Rouwenhorst, K. G. (1999). Local return factors and turnover in emerging stock markets. *The Journal of Finance*, 54(4):1439–1464.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, 19(3):425–442.

Vas, Alexander and Absalonsen, Kristoffer. (2014). The momentum effect: An empirical study of the Oslo Stock Exchange. Master's thesis, Copenhagen Business School. Retrieved from https://studenttheses.cbs.dk/xmlui/bitstream/handle/10417/4793/kristoffer_absalonsen_og_alexander_vas.pdf