The Cause of Short-Term Momentum Strategies in Stock Market: Evidence from Taiwan

Hung-Chih Wang[1], Y. Angela Liu[2], and Chun-Hua Susan Lin[3+]

[1]B. A. Dept.,C C U, and B. A. Dept., Taiwan Shoufu University, Taiwan (R.O.C.)

[2]Dept. of B. A., C C U, Taiwan (R.O.C.).

[3]Dept of H&B B.A., Taiwan Shoufu University, Taiwan (R.O.C.)

Abstract. This study used the daily return data of the stock market in Taiwan to verify short-term investment performance. Referencing the momentum strategies proposed by Jegadeesh and Titman (1993). We found that Taiwan stocks had significant short-term momentum. The cause of this was the investors' sentiments, especially toward the stock market turnover rate and the ratio of margin purchase to short-sale are significant cause of short-term momentum by interpreting and cross-validating CAPM, three-factors (Fama and French, 1992), macroeconomic factors model (Chen et al., 1986), and investors' sentiments (Baker and Wurgler, 2006).

Keywords: Investors' sentiments, Momentum strategies, Zero-investment portfolios

1. Introduction

Studies concerning price momentum have contended that short-term (four weeks to one month) contrarian strategies facilitate excess returns (Lehmann, 1990; Lo and Mackinlay, 1990; Jegadeesh, 1990; Jegadeesh and Titman, 1995) and medium-term (three to 12 months) momentum strategies result in abnormal returns (Jegadeesh and Titman, 1993; Conrad and Kaul, 1998; Roberto and Eric, 2008). However, Hameed and Yuanto (2002), and Chui et al. (2010) believed that Taiwanese stocks lacked momentum. The weekly data reported by Roberto and Eric (2008) shows various forms of medium-term momentum in the U.S. Thus, the objectives of this study were to determine whether Taiwanese stocks have short-term momentum or not, to verify the price momentum of Taiwanese stocks using data of daily returns, and to identify the causes of them. Taiwan's stock market has significant short-term momentum during most periods by using daily return samples, the highest daily results reported was obtained by adopting (J_{day}=10; K_{day}=3), and the value was 0.081%.

Subsequently, we investigated the causes of short-term momentum in the stock market in Taiwan using the CAPM, three-factors model (Fama and French, 1992), investors' sentiments (Baker and Wurgler, 2006), and CRR macroeconomic factors (Chen et al., 1986). The results indicate that abnormal returns can only be explained using investors' sentiments. We infer that this phenomenon is the result of investors' irrational behavior. The results show that only the stock market turnover rates and the ratio of margin purchase to short-sale are significant. This finding is consistent with the conclusion explained previously.

2. Literature Review

Studies concerning price momentum have stated: (1) Excess returns can be acquired by adopting four-week (or one-month) contrarian strategies (Lehmann, 1990; Lo and Mackinlay, 1990; Jegadeesh, 1990; Jegadeesh and Titman, 1995; Conrad and Kaul, 1998); (2) monthly return of 3- to 12-month stocks have positive autocorrelation, and excess return can be acquired by adopting medium-term momentum strategies (Jegadeesh and Titman, 1993; Conrad and Kaul, 1998; Roberto and Eric, 2008); (3) long-term stock prices of 3 to 5 years appear to have negative autocorrelation, and excess returns can be acquired by adopting contrarian strategies (De Bondt and Thaler, 1985; 1987; Conrad and Kaul, 1998).

+ Corresponding author: **Chun-Hua Susan Lin**, *Associate Professor, Department of H&B B.A., Taiwan Shoufu University.* Address: No.168, Nanshi Li, Madou Dist., Tainan City,Taiwan (R.O.C.); Tel: (886)6-5718888-718; fax: (886)6-5718595. *E-mail*: shanhaw@*gmail.com*.

A number of scholars contended that the causes of short-term stock price reversals were market microstructures, such as nonsynchronous trading, bid-ask spreads, discreteness, and transaction costs caused by investors' cognitive biases (Conrad and Kaul, 1998). Gibbons and Ferson (1985) believed that short-term stock price reversals were caused by time-varying economic risk premiums. Conrad and Kaul (1998) stated that momentum profits were possible primarily because of the cross-sectional variation in expected returns. Regarding medium-term momentum, Fama and French (1996) contended that the three-factor model could not rationally explain stock market anomalies in medium-term momentum strategies. Roberto and Eric (2008) constructed a return ranking of momentum investment portfolios for a 52-week holding period based on weekly data of U.S. stocks and found that significant reversal only occurred in the Weeks 1 and 2; continuous positive returns were observed from Weeks 4 and 52. This new momentum anomaly differed from the deduction proposed by Jegadeesh and Titman (1993).

Behavioral finance explains momentum and reversal anomalies based on psychological biases. Daniel et al. (1998) stated that overconfidence and the self-attribute bias of investors overreacting to stock prices caused continuous overreactions during the initial emerging stage; subsequently, reversals occurred because of information disclosures and adjustments. Chan et al. (1996), Barberis et al. (1998), Hong and Stein (1999), Hong et al. (2000), and Jegadeesh and Titnam (2001) contended that the cause of momentum was insufficient reactions when information reached the stock market; in the long-term, momentum traders' overreactions result in stock price reversals (Hong and Stein,1999; Jegadeesh and Titnam, 2001). Baker and Wurgler (2006) asserted that the higher the market sentiment of noise traders, the greater their influence on expected future returns.

3. Trading Strategies, Research Samples, and Empirical Strategies

We referred to Jegadeesh and Titman (1993) for trading strategies, and ranked stock returns into deciles groups for the construction of zero-investment portfolios. We established the portfolios of momentum investments using the method of overlapping holding periods and also investigated the returns by adopting each of the portfolios. Periods 2, 3, 4, 5, 10, and 20 of the formation period (J_T) and holding period (K_T) were selected for calculating each (J_T, K_T) investment portfolio strategy after the transaction costs were deducted. This study used TWSE-listed companies as samples; the data were obtained from the Taiwan Economic Journal (TEJ) from January 1, 1981, to December 31, 2011. Daily returns data were collected from 8,680 sampling days. Stocks that contained missing daily return data were excluded from the study.

Table 1. Adopting rebalance and buy-and-hold strategies to exclude portfolio ups and downs to stop the average daily return of the portfolio

		Holding period K_{day}					
Rebalance strategy B&H strategy		**K=2**	**K=3**	**K=4**	**K=5**	**K=10**	**K=20**
Formation period J_{day}	**J=2**	**0.037** (2.15)* **0.075** (6.57)*	0.026 (1.68) **0.065** (6.68)*	0.024 (1.76) **0.063** (7.23)*	0.024 (1.87) **0.055** (6.96)*	0.029 (3.19)* **0.055** (9.19)*	0.019 (2.85)* **0.048** (10.74)*
	J=3	**0.055** (3.03)* **0.053** (4.63)*	**0.046** (2.37)* **0.052** (5.21)*	**0.043** (2.89)* **0.049** (5.57)*	**0.045** (3.24)* **0.045** (5.61)*	**0.042** (4.04)* **0.057** (9.60)*	0.018 (2.37)* **0.049** (10.96)*
	J=4	**0.072** (3.78)* **0.046** (3.90)*	**0.061** (3.50)* **0.040** (4.04)*	**0.063** (3.88)* **0.038** (4.27)*	**0.053** (3.59)* **0.035** (4.24)*	**0.047** (4.17)* **0.061** (10.04)*	0.018 (2.13)* **0.052** (11.32)*
	J=5	**0.076** (3.94)* **0.037** (3.11)*	**0.063** (3.49)* **0.034** (3.33)*	**0.063** (3.74)* **0.033** (3.59)*	**0.060** (3.85)* **0.033** (3.88)*	**0.052** (4.33)* **0.065** (10.65)*	0.021 (2.31)* **0.055** (11.79)*
	J=10	**0.074** (3.55)* **0.043** (3.51)*	**0.081** (4.15)* **0.058** (5.50)*	**0.073** 3.94)* **0.068** (7.14)*	**0.075** (4.20)* **0.079** (9.12)*	**0.044** (3.01)* **0.097** (15.46)*	0.016 (1.41) **0.067** (13.91)*
	J=20	0.041 (1.87) **0.067** (5.43)*	**0.045** (2.15)* **0.076** (7.00)*	**0.043** (2.13)* **0.080** (8.27)*	0.034 (1.75) **0.083** (9.41)*	0.008 (0.48) **0.082** (12.69)*	0.003 (0.18) **0.048** (9.64)*

Notes: (1) Numbers in brackets are *t*-values; * indicates 5% statistical significance. (2) the unit for returns is %; (3) items marked in **boldface** represent strategies that are significant and have annual returns that exceed 10%; and (4) sampling period: 8,680 sampling days from Jan 1, 1981, to Dec 31, 2011.

Referencing Jegadeesh and Titman (1993), we selected the stocks of listed companies in Taiwan as the sample and selected investment portfolios with annual returns greater than 10% to investigate returns of momentum strategies. Table 1 shows the daily data obtained based on the price momentum of Taiwanese stocks. We found that most investment portfolios that adopt rebalancing and buy-and-hold strategies have significant momentum after excluding stocks that are at their rising or falling limits and deducting transaction costs. We examined significant trading strategies that provided annual returns greater than 10% and found that the annual returns for most short-term momentum strategies exceed the returns reported by Jegadeesh and Titman (1993). The highest daily returns were obtained from investment strategies of the ten-day formation period and three-day holding period (J_{day} = 10; K_{day} = 3); the daily return was 0.081% (t-value = 4.15). Contradicting the results reported in previous studies, we infer that short-term momentum strategies are more appropriate for Taiwan stocks.

4. Causes of Short-Term Momentum for Taiwan Stocks

To investigate the cause of short-term momentum among Taiwanese stocks, we selected five sample investment portfolios (in Table 1) and used rebalance trading strategies to calculate the abnormal returns. The CAPM, Fama-French three-factors, investors' sentiments, CRR, and their cross combinations were adopted to identify the factors that influence the short-term momentum of Taiwanese stocks.

First, we verified the abnormal returns of the investment portfolio using the CAPM model; the regression equation is as follows:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i (R_{m,t} - R_{f,t}) + \varepsilon_{i,t} \quad (1)$$

where $R_{i,t} - R_{f,t}$ represent the return obtained by adopting the ith short-term momentum strategy in the tth month, minus the returns of the non-risk interest rate; the premium of the stock market $R_{m,t} - R_{f,t}$ was obtained from the Taiwan Stock Exchange Index in the tth month, minus the non-risk interest rate for that month; α_i is the constant of the regression equation (1), and indicating that the CAPM cannot explain the cause of short-term momentum among Taiwanese stocks.

Next, we verified the short-term momentum of Taiwan stocks using the Fama-French three-factor model; the regression equation is as follows:

$$R_{i,t} - R_{f,t} = \alpha_{FFi} + \beta_i (R_{m,t} - R_{f,t}) + s_i (SMB_{i,t}) + h_i (HML_{i,t}) + \varepsilon_{i,t} \quad (2)$$

The results of the three-factor model indicate that the constants α_{FFi} have significant positive correlations, demonstrating that the short-term momentum of Taiwanese stocks do not result from the three factors.

Chen et al. (1986) explained the causes of medium-term momentum using the overall business cycle model. Therefore, we adopted the CRR model to verify whether the short-term momentum of Taiwanese stocks was affected by the factors of the overall business cycle (Chen et al., 1986); the regression equation is as follows:

$$R_{i,t} - R_{f,t} = \alpha_{CRR-i} + \lambda'_{1i}(MP_t) + \lambda'_{2i}(UI_t) + \lambda'_{3i}(DEI_t) + \lambda'_{2i}(UPR_t) + \lambda'_{3i}(UTS_t) + \varepsilon_{i,t} \quad (3)$$

The result indicates that the constants α_{CRR-i} also have significant positive correlation; however, they still cannot explain the short-term momentum of Taiwanese stocks.

Additionally, Baker and Wurgler (2006) suggested that the sentiment of noise traders can influence the expected future returns. Referring to Baker and Wurgler (2006), we verified the abnormal return rates of Taiwanese stocks using the market turnover rate (*TUN*) (the volume of listed stocks traded during the tth period/the average number of outstanding shares during the tth period), the ratio of new equity issues (*NEI*) (the new equity issues that occurred during the tth period + capital increased with cash)/(new equity issues that occurred during the tth period + capital increased with cash + newly issued bonds), and the ratio of margin purchase to margin short-sale(*SMR*) (the adjusted debit balance during the tth period/the adjusted bearish debit balance during the tth period); the regression equation is as follows:

$$R_{i,t} - R_{f,t} = \alpha_{sent-i} + \lambda_{1i}(TUN_{i,t}) + \lambda_{2i}(NEI_{i,t}) + \lambda_{3i}(SMR_{i,t}) + \varepsilon_{i,t} \quad (4)$$

The results of regression analysis indicate that the constants (α_{sent-i}) all possessed significant positive correlations (not zero). Additionally, the *TUN* for each investment portfolio all possessed significant positive correlations (not zero), where the value of the strategy (J_{day}=3; K_{day}=3) was the greatest. This indicated that the short-term momentum of Taiwanese stocks is influenced by the turnover rate of the stock market, and the smaller the K_{day}, the greater the coefficient of influence. Additionally, the *SRM* possessed significant positive correlation (not zero), and its value was similar. Similar to the findings reported by Baker and Wurgler (2006), one of the factors for abnormal returns in short-term momentum is investors' sentiments. In summary, the cause of short-term momentum among Taiwanese stocks is the result of investors' irrational and sentimental behavior.

5. Conclusions

Referring to the momentum strategy proposed by Jegadeesh and Titman (1993), we used the daily return data of Taiwanese stocks to demonstrate the short-term momentum effects of stocks in Taiwan. Evidence of short-term momentum in Taiwanese stocks was discovered after deducting the transaction costs and adopting investment portfolio rebalancing strategies, excluding stocks at their rising or falling limit, and delaying the construction of momentum investment portfolios for one week.

Consistent with previous studies, we found that the anomalies of short-term momentum in Taiwanese stocks cannot be explained by the CAPM, three-factors, four-factors, or CRR models; only investors' sentiments on market turnover rates and the ratio of margin purchase to margin short-sale can effectively measure abnormal returns in the short-term momentum of Taiwanese stocks. We infer that the short-term momentum of Taiwanese stocks originates from investors' sentiments; that is, the irrational behaviors of investors.

6. References

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Table 2. Verification of investment portfolios with arbitrage returns using CAPM, three-factors, CRR, and investors' sentiments models

Descriptions

1.CAPM model: $R_{i,t} - R_{f,t} = \alpha_i + \beta_i (R_{m,t} - R_{f,t}) + \varepsilon_{i,t}$

2. Three-factor model: $R_{i,t} - R_{f,t} = \alpha_{FFi} + \beta'_i (R_{m,t} - R_{f,t}) + s_i (SMB_{i,t}) + h_i (HML_{i,t}) + \varepsilon_{i,t}$

3.CRR model: $R_{i,t} - R_{f,t} = \alpha_{CRR-i} + \lambda'_{1i} (MP_t) + \lambda'_{2i} (UI_t) + \lambda'_{3i} (DEI_t) + \lambda'_{4i} (UPR_t) + \lambda'_{5i} (UTS_t) + \varepsilon_{i,t}$

4. Investors' sentiment model: $R_{i,t} - R_{f,t} = \alpha_{sent-i} + \lambda_{1i} (TUN_{i,t}) + \lambda_{2i} (NEI_{i,t}) + \lambda_{3i} (SMR_{i,t}) + \varepsilon_{i,t}$

where $R_{i,t}$ represents the monthly return of the ith investment portfolio for the tth month; $R_{f,t}$ represents the non-risk interest rate for the tth month; $R_{m,t}$ is the monthly return rate of the weighted stock index of Taiwanese stock for the tth month; $SMB_{i,t}$ is the monthly return rate of the investment portfolio of small-scale companies for the tth month minus the monthly return rate of the investment portfolio of large-scale companies for the tth month; $HML_{i,t}$ is the monthly return rate of investment portfolios with high book-to-market ratios for the tth month minus the monthly return rate of investment portfolios with low book-to-market ratios; $NEI_{i,t}$ is (the new equity issues during the tth period + capital increased by cash)/(new equity issues during the tth period + capital increased by cases + newly issued bonds); $SMR_{i,t}$ is the balance of margin purchases during the tth period/the balance of short sales during the tth period; $TUN_{i,t}$ is the volume of enlisted stock traded in the tth period/the average number of outstanding shares; MPt = ln (the general index of industrial production during the tth period/the general index of industrial production during the t-1th period); UI t = I t-E [It | t-1]; where It = ln CPIt-ln CPI t-1; E [It | t-1] = ln E [CPI t]-ln CPI t-1; CPI t is the consumer price index during the tth period; E [CPI t] is the expected consumer price index during the tth period; DEI t = E [It+1 |]-E [It | t-1]; UPR t is the interest rate of five-year corporate bonds during the tth period - the interest rate of seven-year government bonds during the tth period; UTS t is the long-term interest rate of government bonds – the known interest rate of three-month treasury bonds during the th period. Each of the regression coefficients represents the sensitivity to changes of the regression equation between explained variables and individual explained variables.

	CAPM (1)		Three-factor (2)				CRR (3)						Sentiment factor (4)			
$(J_{day}; K_{day})$	α_i	β_i	α_{FFi}	β_i	SMB	HML	α_{CRR-}	MP	UI	DEI	UPR	UTS	α_{sent-i}	TUN	NEI	SMR
(2,2)	0.02 (2.76)*	24.30 (3.23)*	0.02 (1.99)*	26.56 (3.44)*	0.48 (2.06)*	-0.44 (-2.15)*	-0.26 (-2.01)*	0.01 (0.15)	30.07 (0.99)	9.55 (0.38)	7.89 (0.17)	-103.10 (-1.14)	-2.33 (-1.90)	62.08 (5.31)*	0.53 (0.44)	0.04 (2.55)*
(3,3)	0.19 (2.54)*	21.44 (3.03)*	0.19 (2.34)*	23.98 (3.30)*	0.53 (2.40)*	-0.47 (-2.46)*	-0.05 (-2.15)*	0.01 (0.44)	14.44 (0.50)	21.63 (0.91)	1.02 (0.02)	-97.90 (-1.14)	-1.36 (-1.18)	55.39 (5.03)*	-0.14 (-0.12)	0.04 (2.63)*
(4,4)	0.29 (2.35)*	21.27 (3.18)*	0.29 (2.34)*	24.35 (3.55)*	0.60 (2.89)*	-0.50 (-2.75)*	0.06 (2.18)*	0.02 (0.58)	1.96 (0.07)	27.00 (1.20)	-0.59 (-0.01)	-74.35 (-0.92)	-0.59 (-0.54)	48.63 (4.67)*	-0.64 (-0.60)	0.04 (2.55)*
(5,5)	0.51 (3.68)*	16.30 (1.94)	0.51 (3.68)*	17.81 (2.07)*	0.41 (1.34)	-0.41 (-1.51)	0.38 (4.82)*	0.06 (1.31)	-49.52 (1.27)	32.31 (1.01)	42.21 (0.72)	66.07 (0.57)	-1.02 (-0.80)	45.86 (3.20)*	0.05 (0.44)	0.04 (3.14)*
(10,10)	0.51 (3.81)*	10.19 (1.26)	0.52 (3.83)*	10.23 (1.23)	0.21 (0.57)	-0.30 (-1.23)	0.19 (3.41)*	0.06 (1.46)	-29.61 (0.77)	8.00 (0.25)	16.69 (0.29)	91.71 (0.81)	-1.60 (-0.31)	39.57 (2.88)*	0.77 (0.76)	0.04 (3.29)*
(20,20)	0.38 (2.99)*	7.22 (0.95)	0.44 (3.01)*	6.41 (0.82)	-0.04 (-0.07)	-0.12 (-0.67)	0.31 (3.70)*	0.06 (1.64)	-30.54 (0.84)	-1.23 (0.04)	1.56 (0.02)	119.43 (1.10)	-2.53 (0.00)	44.80 (3.45)*	1.54 (0.86)	0.03 (3.07)*

Note: (1) α is the constant of the regression equations in each model investment portfolio for verifying whether each model has sufficient explanatory power; (2) numbers in brackets are *t*-values; items marked with * have a 5% statistical significance; and (3) the coefficients in this table should be multiplied by 10^3.