

Full Length Research Paper

Firm-specific attributes and contrarian profits: Evidence from the Taiwan stock exchange

Chu-Chun Cheng¹, Day-Yang Liu¹ and Yen-Sheng Huang^{2*}

¹Graduate Institute of Finance, National Taiwan University of Science and Technology, Taipei, 106, Taiwan.

²Department of Business and Management, Ming Chi University of Technology, Taipei, 24301, Taiwan.

Accepted 29 September, 2010

This paper examines the performance of contrarian strategies and investigates whether such contrarian profits are related to firm-specific attributes. Using data from all listed stocks on the Taiwan stock exchange over the period 1990 - 2008, this paper finds a significant abnormal return of 19.39% earned by the contrarian strategy of buying prior losers and selling prior winners ranked by the cumulative abnormal returns over the three-year performance period. Moreover, firm-specific attributes can be utilized to enhance the performance of the contrarian strategy. The contrarian strategy of buying the losers in the bottom market-to-book quartile and selling the winners in the top market-to-book quartile earns a significant abnormal return of 41.18%.

Key words: Contrarian strategy, overreaction hypothesis.

INTRODUCTION

De Bondt and Thaler (1985, 1987) propose that investors tend to overreact to unexpected and dramatic news events. They suggest that extreme movements in stock prices will be followed by subsequent price movements in the opposite direction. Moreover, the more extreme the initial price movement, the greater will be the subsequent price adjustment. As a result, investors may overvalue firms with unexpected good news and undervalue firms with unexpected bad news. Subsequent to the overreaction, price reversals will occur to correct for the mispricing. Using data from the United States financial markets, De Bondt and Thaler (1985, 1987) conduct empirical investigation by forming winners and losers by the cumulative abnormal returns in the 3-year formation period and testing the performance of the contrarian strategy in the subsequent holding period. They conclude that contrarian strategies of buying prior losers and selling prior winners earn significant abnormal returns.

The overreaction hypothesis suggested in De Bondt and Thaler (1985, 1987) has stimulated much research in the financial literature (Jegadeesh and Titman (2002);

Scheinkman and Xiong (2003); Sadka (2006); Avramov et al. (2006); Sagi and Seasholes (2007)). However, empirical findings regarding the overreaction hypothesis are mixed. Some research suggests that while contrarian strategies perform well for long-run formation periods, momentum strategies of buying prior winners and selling prior losers earn significant abnormal returns in the medium formation periods of less than one year. For example, Jagadeesh and Titman (2002) document that the momentum strategies of buying prior winners and selling prior losers over the past 3 - 12 months perform well over the subsequent 12 months.

Other research attempts to examine the impact of firm-specific attributes on the performance of trading strategies. For example, Daniel and Titman (1997) examine the cross-sectional variation of stock returns by controlling for both the systematic risks and the characteristic risks of stocks. Their results indicate that there is no discernible separate risk factor associated with high or low book-to-market firms and no return premium associated with any of the three factors identified by Fama and French (1993). This suggests that the high returns related to these portfolios cannot be viewed as compensation for the factor risk. Thus, the characteristic risk rather than the covariance structure of returns appears to explain the

*Corresponding author. E-mail: yshuang@mail.mcut.edu.tw.

cross-sectional variation of stock returns. Sagi and Seasholdes (2007) examine the performance of momentum strategies for prior winners and losers ranked by the past quarterly returns. They note that firm-specific attributes such as a firm's revenues, costs, and growth options combine to determine the dynamics of its return autocorrelation. When these firm-specific attributes are used to construct portfolios, firms with high revenue growth volatility, low costs, or valuable growth options outperform traditional momentum strategies by approximately 5% per year.

Previous research provided evidence showing impact of firm-specific attributes on the performance of trading strategies. The purpose of this paper is to examine the performance of contrarian strategies over long-run periods. Moreover, we examine whether firm-specific attributes are associated with the performance of contrarian strategies. We test the hypothesis that firm-specific attributes such as market-to-book ratios and price-to-earnings ratios are related to the contrarian profits. Securities with higher market-to-book ratios and higher price-to-earnings ratios are typically considered as growth stocks. In contrast, securities with lower market-to-book ratios and lower price-to-earnings ratios are considered as value stocks. If investors overvalue securities due to unexpected good news, such overvaluation is likely to be higher for securities with higher growth opportunity. In contrast, if investors undervalue securities due to unexpected bad news, such undervaluation is likely to be deeper for securities with limited growth opportunity. As such, we examine whether these firm-specific attributes are related to the performance of contrarian strategies.

We examine the impact of firm-specific attributes on contrarian profits using data of all listed stocks on the Taiwan stock exchange over the sample period 1990 - 2008. The Taiwan stock exchange is interesting for examining the performance of contrarians strategies since the market is characterized by heavy trading during the sample period. In 2008, for example, the total market trading volume amounts to 26,116 billion New Taiwan Dollars (NT\$) with the volume turnover rate at 138.13%. This high trading turnover suggests that the market may be very volatile and investors could overreact to unexpected news.

Literature review

The traditional wisdom suggests that individuals react to new information in a rational way prescribed by the Bayes' rule. However, De Bondt and Thaler (1985; 1987) note that investors tend to overweight more recent information and underweight prior data. That is, individuals seem to make predictions by a simple rule of thumbs rather than by a rigorous method. This rule-of-thumb is what Kahneman and Tversky (1982) call as representativeness heuristic. Using data from the United States stock

market over the period 1926 - 1982, De Bondt and Thaler (1985) find that losers outperform winners by 25% over the three-year holding period.

Much research has attempted to explain the contrarian profits. On one hand, Lakonishok et al. (1994); Barberis et al. (1998), among others, suggest that such contrarian profits result from investors' overreaction to past firm performance. That is, when investors forecast future earnings, they tend to over-extrapolate a firm's past earnings performance. As a result, stock prices of firms with poor past earnings tend to be undervalued. When the actual earnings are realized, price recovers due to the higher earnings for these firms. In contrast, stock prices of firms with good past earnings tend to be overvalued. Again, price reversals will occur when the realized future earnings turn out to be lower than expected. Lakonishok et al. (1994) note that these loser firms tend to have lower market-to-book ratios while winner firms tend to have higher market-to-book ratios. Daniel and Titman (1997) suggest that firm characteristics such as book-to-market ratios and size appear to explain the variation of stock returns, which reject the Fama and French (1995) three-factor model. Daniel et al. (2001) examine Japanese stock returns and find that the results support the characteristics models. Chou et al. (2007) use Japanese stocks in the 1979 - 1997 period to examine whether contrarian profits can be explained by the Fama-French's (1995) three-factor model. They find that the contrarian profits are mostly attributed to the lead-lag effect rather than the pricing errors of the Fama-French's three-factor model.

METHODOLOGY

The data

To examine the impact of firm-specific attributes on contrarian profits, all listed stocks on the Taiwan stock exchange over the sample period 1990 - 2008 are examined. The number of sample firms ranges from 131 in 1990 to 717 in 2008. Firm-specific attributes are obtained for the sample firms from the Taiwan Economic Journal. Firm-specific attributes involve market-to-book ratios, price-to-earnings ratios and firm sizes.

The single-sort methodology

We first examine contrarian profits using the single-sort methodology similar to that in De Bondt and Thaler (1985; 1987). Sample firms are ranked by cumulative abnormal returns in the non-overlapping three-year *formation period* over the whole sample period 1990 - 2008. Thus, the first three-year formation period is 1990 - 1992, and the last formation period is 2005 - 2007. The cumulative abnormal return is computed by summing up the monthly abnormal returns for each firm in the formation period, where the monthly abnormal return for firm i in month t , $AR_{i,t}$, is estimated by the market-adjusted model as follows:

$$AR_{i,t} = R_{i,t} - R_{m,t}$$

Where, $R_{i,t}$ is the monthly return for firm i at month t , and $R_{m,t}$ is the

corresponding market return at month t. The cumulative abnormal return, CAR_{i,t}, for firm i in the formation period is estimated as follows:

$$CAR_{i,t} = \sum_{t=1}^T AR_{i,t} \dots\dots\dots (2)$$

The winner portfolio is formed by equally investing in the top 10% (as well as 20%) sample firms ranked by the cumulative abnormal return in the three-year formation period. Similarly, the loser portfolio is made up of the bottom 10% (as well as 20%) sample firms ranked by the cumulative abnormal return in the formation period. The contrarian strategy involves a long position in the loser portfolio and a short position in the winner portfolio. The performance of the contrarian strategy is evaluated in the one-year holding period subsequent to the formation period. Thus, the first holding period is 1993, and the last holding period is year 2008. The cumulative abnormal return for each sample firm in the holding period is evaluated by the same method as in Equations (1) and (2). The performance for the contrarian strategy is estimated by taking the difference between the average cumulative abnormal returns for the loser and the winner portfolios, where the average cumulative abnormal returns for the loser and the winner portfolios are estimated by averaging the holding-period cumulative abnormal returns of the constituent stocks in the winner and the loser portfolios respectively as follows:

$$ACAR_W = \frac{\sum CAR_W}{N_W} \dots\dots\dots (3)$$

$$ACAR_L = \frac{\sum CAR_L}{N_L} \dots\dots\dots (4)$$

Where, CAR_w and CAR_L denote the cumulative abnormal returns for sample stocks in the winner and the loser portfolios respectively. N_w and N_L denote the number of observations in the winner and the loser portfolios respectively. Finally, the t values of the cumulative abnormal returns are estimated to evaluate the significance of the contrarian strategy performance as follows:

$$\overline{AR}_W = \frac{\sum_{k=1}^K ACAR_W}{K} \quad S_W = \sqrt{\frac{\sum_{k=1}^K [ACAR_W - \overline{AR}_W]^2}{\sum_{k=1}^K n_{W_k} - 1}}$$

$$\overline{AR}_L = \frac{\sum_{k=1}^K ACAR_L}{K} \quad S_L = \sqrt{\frac{\sum_{k=1}^K [ACAR_L - \overline{AR}_L]^2}{\sum_{k=1}^K n_{L_k} - 1}}$$

$$Sp = \sqrt{\frac{\left(\sum_{k=1}^k n_{W_k} - 1\right) S_W^2 + \left(\sum_{k=1}^k n_{L_k} - 1\right) S_L^2}{\sum_{k=1}^K n_{W_k} + \sum_{k=1}^K n_{L_k} - 2}}$$

$$T_W = \frac{\overline{AR}_W}{S_W / \sqrt{k}} \quad T_L = \frac{\overline{AR}_L}{S_L / \sqrt{k}}$$

$$T = \frac{ACAR_L - ACAR_W}{Sp \sqrt{\frac{1}{k} + \frac{1}{k}}}$$

Where, \overline{AR}_W and \overline{AR}_L denote the mean of average cumulative abnormal returns for the winner and the loser portfolios, respectively. S_w and S_L denote the standard deviation of average cumulative abnormal returns for the winner and the loser portfolios respectively. S_p denote the standard deviation of the difference of sample means.

Aside from forming winner and loser portfolio according to cumulative abnormal return in the formation period, an alternative way to construct the winner and loser portfolio is to rank firms by the buy-and-hold abnormal returns. The buy-and-hold abnormal returns are estimated by subtracting the buy-and-hold market return from the buy-and-hold firm returns for sample firms over the three-year formation period. Winner and loser portfolios are then formed according to the buy-and-hold abnormal returns. Contrarian profits based on portfolios formed by the buy-and-hold abnormal returns provide a sensitivity test of the estimated contrarian strategy performance.

The double-sort methodology

To examine whether contrarian profits are affected by firm-specific attributes, a double-sort methodology is adopted to form the winner and the loser portfolios. This double-sort methodology first ranks firms according to firm-specific attributes, then ranks firms by the cumulative abnormal returns in the formation period. Specifically, the double-sort methodology first uses each of the firm-specific attributes to sort the sample firms into quartiles. The firm-specific attributes involves market-to-book ratios, price-to-earnings ratios, and firm size.

Following the sorting of sample firms into quartiles by each of the firm-specific attributes, winner and loser portfolios are formed within the top and the bottom quartiles respectively obtained from the first sorting. For the top quartile, ranked by firm-specific attributes, for example, sample firms are then sorted by cumulative abnormal returns into winners and losers respectively in the formation period. Winners and losers are the top and the bottom 10% (as well as 20%) respectively by the cumulative abnormal returns in the formation-period. The winner portfolio returns are estimated as the equally weighted average of the top 10% (as well as top 20%) of sample firms sorted by cumulative abnormal returns in the formation period. Similarly, the loser portfolio returns are estimated as the equally weighted average of the bottom 10% (as well as bottom 20%) of sample firms by the cumulative abnormal returns in the formation period. Finally, the contrarian strategy profit is estimated by holding a long position in the loser portfolio and a short position in the winner portfolio. The significance of the contrarian profits is evaluated by examining the t-values of the profits earned by the contrarian strategies. Finally, we compare the contrarian profits from the single-sort methodology with those from the double-sort methodology to assess whether firm-specific attributes play a role in affecting the contrarian profits.

RESULTS

Contrarian profits from single-sort methodology

We first examine the profits of contrarian strategies

Table 1. Cumulative abnormal returns of contrarian strategies base on different formation and holding periods

Formation period in years	Portfolio (%)	Holding period in years			
		1	2	3	
1.	Loser	-53.5969 (-44.62)	9.7559 (5.60)		
	Winner	101.0612 (53.60)	0.3253 (0.31)		
	Loser-Winner		9.4305 (4.62)		
2.	Loser	-70.2599 (-37.40)	18.6405 (8.12)	19.4288 (6.15)	
	Winner	142.8147 (58.11)	5.3218 (9.10)	7.2905 (7.03)	
	Loser-Winner		13.3187 (5.62)	12.1383 (3.65)	
3	Loser	-82.1482 (-41.23)	11.6460 (4.32)	37.4926 (11.17)	38.3298 (9.42)
	Winner	175.7851 (71.65)	-7.2425 (-7.82)	4.2321 (3.49)	8.0247 (3.71)
	Loser-Winner		19.3884 (6.75)	33.2607 (9.32)	30.3051 (6.58)

Note: t-values are in parentheses. The contrarian portfolios are formed by a single-sort methodology based on the non-overlapping n-year cumulative abnormal returns in the different formation period and holding period over the sample period. The winner and the loser portfolios are firms that are ranked as the top and the bottom 10% of the cumulative abnormal returns in the formation period.

across various lengths of formation and holding periods. The contrarian portfolios are formed by a single-sort methodology based on the non-overlapping period (ranging from one to three years) cumulative abnormal returns in the different formation period and holding period over the sample period. The winner and the loser portfolios are firms that are ranked as the top and the bottom 10% of the cumulative abnormal returns in the formation period. The results in Table 1 show that the major source of contrarian profits comes from price reversals in loser portfolios. In particular, the reversals in loser portfolios persist for all cases. While the winner portfolios experience reversals following the formation period, the reversals occur only in the first year following the three-year formation period. Therefore, we only report the contrarian strategy profits for winners and losers formed by ranking cumulative abnormal returns in the three-year formation period and the one-year holding period.

Table 2 reports contrarian strategy profits for winners and losers formed by ranking cumulative abnormal returns in the three-year formation period. Panel A reports results for the contrarian strategy in the one-year holding period. The results indicate a significant pattern of price reversals in the holding period. For the top 10% losers,

the average cumulative abnormal return is 11.65% in the one-year holding period. In contrast, the corresponding average cumulative abnormal return is -7.74% for the winners. The price reversals result in a significant average cumulative abnormal return of 19.39% with a t-value of 6.75 for the contrarian strategy. Similarly, when the 20% screening criterion is applied to the winners and losers, the contrarian strategy yields a significant average cumulative abnormal return of 17.21% with a t-value of 9.23.

Panel B reports contrarian strategy profits for winners and losers formed by ranking the buy-and-hold abnormal return in the formation period. The results are consistent with those in Panel A. The average contrarian profit in the one-year holding period is 23.47% with a t-value of 6.99 for the top 10% winners and losers. Similarly, the average contrarian profit is 18.12% with a t-value of 9.18 for the top 20% winners and losers. Thus, the results in Table 2 support the notion of price reversals for winners and losers. Since the results in Panels A and B are similar, we only report the results based on the contrarian strategy profits for winners and losers formed by ranking cumulative abnormal returns in the three-year formation period.

Table 2. Contrarian strategy returns: the single-sort methodology

Ranking criterion	Loser ACAR _L	Winner ACAE _W	Contrarian ACAR	Obs n _{w+L}
Panel A. Contrarian strategy returns for winners and losers ranked by cumulative abnormal returns in the formation period				
10%	11.6460% (4.32)	-7.7425% (-7.82)	19.3884% (6.75)	550
20%	8.1196% (4.46)	-9.0950% (-22.28)	17.2147% (9.23)	1100
Panel B. Contrarian strategy returns for winners and losers ranked by buy-and-hold abnormal returns in the formation period				
10%	13.9411% (4.34)	-9.5287% (-9.68)	23.4698% (6.99)	550
20%	9.7106% (5.06)	-8.4111% (-18.59)	18.1218% (9.18)	1100

Note: t-values are in parentheses. The contrarian portfolios are formed by a single-sort methodology based on the non-overlapping three-year cumulative abnormal returns in the formation period over the 18-year sample period 1990-2007. The winner and the loser portfolios are firms that are ranked as the top and the bottom 10% (as well as 20%) of the cumulative abnormal returns in the 3-year formation period. The performance of the contrarian strategies are examined in the one-year holding period following each of the 3-year formation periods in the sample period.

Firm-specific attributes and contrarian profits

Table 3 examines the relationship between the market-to-book ratio and the contrarian strategy profit. Sample firms are first ranked by market-to-book ratio into quartiles. Then, winner and loser portfolios are formed by choosing the sample firms with the highest and the lowest 10% (as well as the 20%) cumulative abnormal returns respectively in the formation period for the top and the bottom quartiles respectively. Panel A of Table 3 reports results for winners and losers with the highest and the lowest 10% cumulative abnormal returns in the top and the bottom market-to-book quartiles respectively. The results indicate that the contrarian strategy yields a significant abnormal return of 29.01% with a t-value of 3.33 in the bottom quartile ranked by the market-to-book ratio. In contrast, the contrarian strategy profit is only 6.38% with a t-value of 1.65 in the top quartile ranked by the market-to-book ratio.

At a first glance, the results in Panel A of Table 3 may suggest that price reversals are more significant in the low market-to-book quartile than that in the high market-to-book quartile. A further look into the loser and winner performance indicates that price reversals are more significant in the low market-to-book quartile for the loser portfolio, but more significant in the high market-to-book quartile for the winner portfolio. In the bottom market-to-book quartile, the average cumulative abnormal return is 29.77% for the loser portfolio, but only 0.76% for the winner portfolio. Thus, the contrarian strategy profit of 29.01% is contributed mainly by the price reversals of the

loser portfolio. In contrast, the contrarian strategy profit in the top market-to-book quartile is contributed mainly by the price reversal of the winner portfolio. In this top market-to-book quartile, the average cumulative abnormal return is -11.41% for the winner portfolio and -5.03% for the loser portfolio. Thus, the results in Panel A of Table 3 suggests that a contrarian strategy that buy losers in the low market-to-book quartile and sell winners in the higher market-to-book quartile would yield a more significant average cumulative abnormal return of 41.18% in the one-year holding period subsequent to the formation period. The results in Panel A of Table 3 also indicate that the double-sort methodology of ranking market-to-book ratio first results in a much better contrarian profits than the single-sort methodology as reported in Table 2.

Panel B of Table 3 reports results for winners and losers with the highest and the lowest 20% cumulative abnormal returns in the top and the bottom market-to-book quartiles respectively. The results are similar to those in Panel A of Table 3 in that price reversals occur more significant for the loser portfolio in the low market-to-book quartile and for the winner portfolio in the high market-to-book quartile. For the bottom market-to-book quartile, the loser portfolio earns a significant abnormal return of 18.79%. For the top quartile, the winner portfolio earns a significant abnormal return of 9.31%. Thus, the contrarian strategy that buys losers in the low market-to-book quartile and sells winners in the higher market-to-book quartile yields a significant average cumulative abnormal return of 28.09% in the one-year performance

Table 3. The double-sort contrarian strategy returns: ranked first by market-to-book ratio, then by cumulative abnormal returns in the formation period.

First ranking variable Market-to book ratio	Second ranking variable CAR in the formation period			Obs n _{w+L}
	Loser ACAR _L	Winner ACAE _w	Contrarian ACAR	
Panel A. Winners and losers are top and bottom 10% sample firms respectively ranked by CARs in the formation period				
Bottom quartile	29.7702% (4.60)	0.7573% (0.13)	29.0130% (3.33)	260
Top quartile	- 5.0311% (-2.40)	- 11.4128% (-3.50)	6.3817% (1.65)	260
Difference between bottom and top quartiles			22.6312% (5.81)	
Difference between bottom-quartile loser and top-quartile winner			41.1830% (5.68)	
Panel B. Winners and losers are top and bottom 20% sample firms respectively ranked by CARs in the formation period				
Bottom quartile	18.7866% (4.52)	2.8458% (0.70)	15.9408% (2.75)	524
Top quartile	- 3.7901% (-2.07)	- 9.3093% (-4.85)	5.5192% (2.08)	524
Difference between bottom and top quartiles		10.4216% (4.00)		
Difference between bottom-quartile loser and top-quartile winner			28.0959% (6.13)	

Note: t-values are in parentheses. The contrarian portfolios are formed by the double-sort methodology based on the firm-specific attributes, then by the cumulative abnormal returns in the formation period. Sample firms are first ranked into quartiles by market-to-book ratio. Winner and loser portfolios are then formed by ranking cumulative abnormal returns for the top and the bottom quartiles. The winner and the loser portfolios are firms that are ranked as the top and the bottom 10% (as well as 20%) of the cumulative abnormal returns in the top and the bottom quartiles respectively over the non-overlapping three-year formation periods in 1990-2007. The performance of the contrarian strategies are examined in the one-year holding period following each of the 3-year formation periods in the sample period.

period subsequent to the formation period.

Table 4 examines the relationship between the price-to-earnings ratio and the contrarian strategy profit. Sample firms are first ranked by price-to-earnings ratio into quartiles. Then, winner and loser portfolios are formed by choosing the sample firms with the highest and the lowest 10% (as well as the 20%) cumulative abnormal returns respectively in the formation period for the top and the bottom quartiles respectively. Panel A of Table 4 reports results for winners and losers with the highest and the lowest 10% cumulative abnormal returns in the top and the bottom market-to-book quartiles respectively. The results indicate that the contrarian strategy yields a significant abnormal return in both the bottom and the top quartile ranked by price-to-earnings ratio. In the bottom quartile, the contrarian strategy earns a significant

abnormal return of 25.23% with a t-value of 4.49. In the top quartile ranked by the price-to-earnings ratio, the contrarian strategy yields a significant abnormal return of 32.57% with a t-value of 6.04. Again, price reversals are more significant for the loser portfolio in the bottom price-to-earnings quartile and for the winner portfolio in the top price-to-earnings quartile. The cumulative abnormal return is 14.16% for the loser portfolio in the bottom price-to-earnings quartile and -19.76% for the winner portfolio in the top price-to-earnings quartile. Thus, the contrarian strategy of buying the loser in the bottom quartile and selling the winner in the top quartile yields a significant cumulative abnormal return of 33.92% with a t-value of 6.20. Thus, by utilizing the information of price-to-earnings ratio, the contrarian strategy yields a more significant profit than that based solely on the single-sort

Table 4. The double-sort contrarian strategy returns: ranked first by price-earnings ratio, then by cumulative abnormal returns in the formation period.

First ranking variable Price-earnings ratio	Second ranking variable CAR in the formation period			Obs n_{w+L}
	Loser ACAR _L	Winner ACAE _w	Contrarian ACAR	
Panel A. Winners and losers are top and bottom 10% sample firms respectively ranked by CARs in the formation period				
Bottom quartile	14.1631% (2.97)	-11.0717% (-3.21)	25.2348% (4.49)	196
Top quartile	12.8092% (2.74)	-19.7572% (-7.34)	32.5663% (6.04)	196
Difference between bottom and top quartiles			-7.3315% (-2.25)	
Difference between bottom-quartile loser and top-quartile winner			33.9203% (6.20)	
Panel B. Winners and losers are top and bottom 20% sample firms respectively ranked by CARs in the formation period				
Bottom quartile	15.4112% (4.08)	-11.7306% (-4.48)	27.1418% (5.91)	404
Top quartile	3.3535% (1.01)	-15.8270% (-13.39)	19.1805% (5.44)	404
Difference between bottom and top quartiles			7.9613% (3.37)	
Difference between bottom-quartile loser and top-quartile winner			31.2382% (7.89)	

The contrarian portfolios are formed by the double-sort methodology based on the firm-specific attributes, then by the cumulative abnormal returns in the formation period. Sample firms are first ranked into quartiles by price-earnings ratio. Winner and loser portfolios are then formed by ranking cumulative abnormal returns for the top and the bottom quartiles. The winner and the loser portfolios are firms that are ranked as the top and the bottom 10% (as well as 20%) of the cumulative abnormal returns in the top and the bottom quartiles respectively over the non-overlapping three-year formation periods in 1990-2007. The performance of the contrarian strategies are examined in the one-year holding period following each of the 3-year formation periods in the sample period.

methodology as reported in Table 2.

Panel B of Table 4 reports results for winners and losers with the highest and the lowest 20% cumulative abnormal returns in the top and the bottom price-to-earnings quartiles respectively. The results are similar to those in Panel A of Table 4. The contrarian strategy yields a significant abnormal return of 27.14% with a t-value of 5.91 in the bottom quartile ranked by the price-to-earnings ratio. For the top quartile ranked by the price-to-earnings ratio, the contrarian strategy earns a significant average cumulative abnormal return of 19.18% with a t-value of 5.44. Again, the contrarian strategy of buying the loser in the bottom quartile and selling the winner in the top quartile yields a more significant cumulative abnormal

return of 31.24% with a t-value of 7.89. Thus, the results in Table 2 indicate that price reversals are evident for prior winners and losers. However, Tables 3 and 4 indicate that the performance of contrarian strategies can be enhanced by incorporating firm-specific attributes such as market-to-book ratio and price-to-earnings ratio. That is, price reversals are more pronounced for losers in the low market-to-book quartile as well as in low price-to-earnings quartile. Similarly, price reversals are more pronounced for winners in the high market-to-book quartile as well as in the high price-to-earnings quartile. This result indicates that investors may overreact in the prior period, which will be corrected in the subsequent period. Moreover, investors may take market-to-book

Table 5. The double-sort contrarian strategy returns: ranked first by firm size, then by cumulative abnormal returns in the formation period.

First ranking variable Firm size	Second ranking variable CAR in the formation period			
	Loser ACAR _L	Winner ACAE _W	Contrarian ACAR	Obs n _{w+L}
Panel A. Winners and losers are top and bottom 10% sample firms respectively ranked by CARs in the formation period				
Bottom quartile	17.0592% (2.30)	1.1991% (0.37)	15.8601% (1.96)	260
Top quartile	2.2471% (0.60)	-11.4334% (-5.12)	13.6751% (3.10)	260
Difference between bottom and top quartiles			2.1851% (0.58)	
Difference between bottom-quartile loser and top-quartile winner			28.4926% (3.68)	
Panel B. Winners and losers are top and bottom 20% sample firms respectively ranked by CARs in the formation period				
Bottom quartile	9.9845% (2.19)	4.0461% (1.52)	5.9383% (1.12)	532
Top quartile	0.8449% (0.33)	-9.2027% (-6.39)	10.0476% (3.42)	532
Difference between bottom and top quartiles			-4.1093% (-1.66)	
Difference between bottom-quartile loser and top-quartile winner			19.1872% (4.01)	

Note: t-values are in parentheses. The contrarian portfolios are formed by the double-sort methodology based on the firm-specific attributes, then by the cumulative abnormal returns in the formation period. Sample firms are first ranked into quartiles by firm size. Winner and loser portfolios are then formed by ranking cumulative abnormal returns for the top and the bottom quartiles. The winner and the loser portfolios are firms that are ranked as the top and the bottom 10% (as well as 20%) of the cumulative abnormal returns in the top and the bottom quartiles respectively over the non-overlapping three-year formation periods in 1990-2007. The performance of the contrarian strategies are examined in the one-year holding period following each of the 3-year formation periods in the sample period.

ratio and price-to-earnings ratio into consideration in correcting the overpricing in the prior period.

Other tests

Table 5 reports the performance of the contrarian strategy for the top and the bottom quartiles of sample firms ranked by firm size. The results indicate that price reversals are more significant for losers in the bottom size quartile, and for winners in the top size quartile. Panel A of Table 5 reports results for the top 10% winners and losers in the size quartile. The contrarian strategy of buying losers in the bottom size quartile and selling

winners in the top size quartile yields a significantly positive abnormal return of 28.49%. The results in Panel B of Table 5 for the top 20% winners and losers in the size quartiles are similar to those in the Panel A of Table 5. A comparison of Table 2 and Table 5 indicates that firm size can be utilized to enhance the contrarian profits. As mentioned in Panel A of Table 5, the contrarian profit of buying loser in the bottom size quartile and selling winner in the top size quartile is 28.49%. In comparison, Panel A of Table 2 indicates that the contrarian profit of buying losers and selling winners is only 19.39%. Thus, the information of firm size can be utilized to enhance contrarian profits. However, a comparison of Tables 3 and 5 suggests that market-to-book ratio is more informative

than firm size in enhancing the performance of the contrarian strategies. Panel A of Table 3 indicates that the contrarian strategy of buying losers in the bottom market-to-book quartile and selling winners in the top market-to-book quartile is 41.18%. This result suggests that investors consider market-to-book ratios a better measure of value than firm size in correcting the mispricing in the formation period.

DISCUSSION

Our empirical results indicate a significant profit earned by the contrarian strategies of buying losers and selling winners in the formation period. The results are consistent with the notion suggested in DeBondt and Thaler (1985; 1987) that investors tend to overreact to unexpected information in prior periods, followed by a price correction in subsequent periods. For the Taiwan stock exchange, in particular, one plausible explanation is that individual investors used to account for a relatively large share in the trading volume, although the role played by individual investors decline in recent years. Individual investors tend to be less informed and more likely to overact to unexpected good or bad news. Trading from individual investors also contribute to the heavy trading activity in the Taiwan stock market in the sample period. Moreover, our empirical results indicate that the performance of the contrarian strategies can be significantly enhanced by utilizing firm-specific attributes such as market-to-book ratios and price-earning ratios. Market-to-book ratios and price-earning ratios are linked to firms' growth opportunities. For firms on the Taiwan stock exchange, the value of such growth opportunities is more likely to be affected by supply and demand factors in the world market. As such, it is especially harder for outside individual investors to assess the true value of growth opportunities. Hence, overpricing of unexpected news and subsequent price correction are more likely for firms with such growth opportunities.

Conclusions

This paper examines the performance of contrarian strategies and investigates whether such contrarian profits are related to firm-specific attributes. Using data from all listed stocks on the Taiwan stock exchange over the period 1990 - 2008, we find a significant abnormal return earned by the contrarian strategy of buying losers and selling winners ranked by the cumulative abnormal returns over the three-year performance period. For the top 10% winners and losers respectively, the contrarian strategy earns an abnormal return of 19.39% over the one-year holding period subsequent to the formation period. Moreover, firm-specific attributes can be utilized to enhance the performance of the contrarian strategy.

Firm-specific attributes such as market-to-book ratios and price-earnings ratio are helpful in improving the contrarian profits. For the top 10% losers and winners respectively, the contrarian strategy of buying losers in the bottom market-to-book quartile and selling winners in the top market-to-book quartile earns a significant abnormal return of 41.18%. Again, the contrarian strategy of buying losers in the bottom price-to-earnings quartile and selling winners in the top price-to-earnings quartile earns a significant abnormal return of 33.92%.

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