Long Run Overreaction on the New Zealand Stock Exchange

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Abstract

The purpose of this paper is to determine whether New Zealand capital markets are efficient. To do this we investigate two competing models of investor decision making in the context of the New Zealand Stock Exchange. The first model views investors as economically rational individuals who make decisions based on all available information. The second model proposes that investors systematically overreact to good and bad information events. The results are consistent with the notion of overreaction, showing that investors overreact to both good and bad news.
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1 The buy and hold returns are calculated separately at the end of each year. Therefore, the first year represents the average of the buy and hold returns in the first year after formation. The second year represents the returns for the first two years from a buy and hold strategy that would buy the shares immediately after the formation period and sell them at the end of the second year. Similarly, the three year strategy would buy the shares after formation and sell them at the end of the third year. So the yearly returns are not cumulated but separately assessed.
1. Introduction

Traditional economic literature has viewed sharemarket investors as rational decision makers (Fama, 1970) who - when faced with uncertainty - apply Bayesian decision making criteria (Brown, Harlow and Tinic, 1988). Under Bayesian decision making previous information is used to give probabilities to likely outcomes. Decision making then proceeds on the basis of these probabilities. However, Tversky and Kahneman (1974) provide evidence that people do not always follow the “laws” of mathematical statistics. Rather, people rely on a limited number of heuristic principles, thereby reducing the complex tasks of assessing probabilities and predicting values to more simple judgemental operations. In general these heuristics are very useful but they may lead to serious systematic errors. If sharemarket investors apply heuristics when making investment decisions, then this could lead to systematic error in the sharemarket. The possibility of this error provides the impetus for the research presented in this paper.

Following early speculation of overreaction in financial markets (Keynes, 1930), a substantial body of literature on overreaction has developed. DeBondt and Thaler (1985, 1987) were the first to attempt to use a behavioural principle i.e., overreaction to explain a market anomaly (why the volatility of stock increased after information releases). They sought to test two hypotheses, namely that: (1) extreme movements in stock prices would be followed by a subsequent adjustment in the opposite direction; (2) the more extreme the initial price movement, the greater the subsequent adjustment would be. DeBondt and Thaler’s hypotheses differed from previous hypotheses on overreaction (Arrow, 1982; Einhorn and Hogarth, 1978) in that they sought to investigate whether overreaction was predictive. That is, they sought to establish whether initial overreaction was followed by a subsequent mean reversion of the stock price and - if this was the case - how quickly the reversion occurred. Therefore, the initial assumption of DeBondt and Thaler (1985) implied that at sometime in the future the true situation is revealed to all - that is, Bayesian and non-Bayesian - investors.

In order to test their hypotheses DeBondt and Thaler (1985) formed portfolios based on previous stockmarket performance and then subsequently measured the performance of these portfolios. The portfolios consisted of stocks that were considered winners and stocks that were considered losers. These stocks can be considered the equivalent of what Keynes
(1930) referred as good news (winners) and bad news (losers). However, the important distinction is that DeBondt and Thaler (1985) formed winner and loser portfolios conditional on past excess returns, rather than firm-generated informational variables such as earnings, used by Keynes (1930) and Arrow (1982). DeBondt and Thaler create a trading strategy that would be in violation of the weak-form EMH (efficient markets hypothesis) which states that all previous stock return information is fully reflected in the current stock price (Fama, 1970). DeBondt and Thaler (1985) hypothesised that the reason for this asymmetry was that winner shares had established a reputation that is generally based on several years of outstanding and widely publicised growth. This good reputation is not easily dissipated, and the company could be looking to consolidate on the position that it has gained. However, the loser shares have experienced years of disappointing results which leads to a stereotyping of the company. This stereotype takes time for the company to overcome. However, the expectations of the company are not as high as companies that perform well, therefore, the good results for loser companies would be treated with more optimism, while bad results for winner companies might initially be passed off by investors as an anomaly. It was for these reasons that DeBondt and Thaler (1985) believed that most of the abnormal returns occurred in the later years of the portfolio.

Subsequent research by Fama and French (1988), Poterba and Summers (1988) and Keim and Stambaugh (1986) also find predictability in long-term stock-returns, corroborating the findings of DeBondt and Thaler (1985). In fact, Fama and French (1988) report that between 25 and 45 per cent of the variation in three to five year monthly returns could be predicted from past returns.

Vermaelen and Verstringe (1986), Dark and Kato (1986), Clare and Thomas (1992), Alonso and Rubio (1990) and Stock (1990) all use the same empirical method as DeBondt and Thaler (1985) to document overreaction on the Belgian, Japanese, English, Spanish and German stock markets respectively. Dark and Kato (1986) find that the three year returns for loser portfolios exceed the comparable winner portfolios by, on average, 70 per cent. These studies present compelling evidence that the overreaction effect is not isolated to the United States.
The aim of this paper is to investigate the overreaction effect on the New Zealand Stock Exchange and in doing so provide evidence as to the efficiency of the local sharemarket.¹

From the preceding studies we derived the following hypotheses. $H1$ can be thought of as a directional effect hypothesis, whereas $H2$ can be thought of as a magnitude effect hypothesis:

$H1$: Extreme movements in price will be followed by subsequent adjustments in the opposite direction.

$H2$: The more extreme the initial movement the more extreme the subsequent adjustment will be.

The small firm effect
A widely investigated anomaly in the area of sharemarket efficiency is the small firm effect (Pettengill and Jordan, 1990). In essence the small firm effect states that investments in a portfolio of small firms yield greater returns than large firms, even following adjustments for risk (Chan, 1988). It has been proposed that overreaction does not exist as it is subsumed by the small firm effect (Zarowin, 1990). The rationale for this is that portfolios of losers are typically comprised of stocks of smaller firms than are portfolios of winners. Thus in order to ascertain whether there is an independent overreaction effect, a size adjustment is necessary (Zarowin, 1990; Reinganum, 1992; Kryzanowski and Zhang 1992).

However, DeBondt and Thaler (1987) have debated the small firm effect, feeling that their own requirement that 85 subsequent returns must be available shows sample bias towards large, established firms. Subsequent studies (see Chopra, Lakoniskok and Ritter, 1992) have confirmed an overreaction effect independent of the size effect. Therefore, our third hypothesis is that:

¹ It has been noted that “The NZSE is generally accepted by investment analysts to be efficient in the semi-strong form, despite a public opinion survey which showed that forty-four per cent of respondents believe that the sharemarket is manipulated, compared to sixteen per cent who did not. A total of seventy-seven per cent said that big investors can manipulate the market, and only three per cent stated that all shareholders were treated fairly”: B. Birchall, “The New Zealand Stock Exchange and the Securities Markets in New Zealand” in G. Walker and B. Fisse, eds., Securities Regulation in Australia and New Zealand (1994), 113, 123.
H3: Even after firm size has been controlled for, there will exist a persistent overreaction in the New Zealand Stock Exchange.

2. Method

In order to test the propositions of overreaction, all New Zealand Stock Exchange companies were examined over a twenty year period (August 1975 to July 1995). The following model was applied to all the share price data in the sample to determine the returns on the stock:

\[ R_{jt} = \ln \left( \frac{P_{jt}}{P_{jt-1}} \right) \cdot 100 \]  

where:  
- \( R_{jt} \) is the monthly return for month \( t \) (including dividends)  
- \( P_{jt} \) is the share price on month \( t \)  
- \( P_{jt-1} \) is the share price on month \( t-1 \)  
- \( t \) is the month.

Therefore, the returns data would approximate the monthly percentage increase or decrease experienced by the stock. The arithmetic mean of these returns provides a monthly market return that can be used for the purposes of analysis. Once this market return had been created then the analysis of the abnormal returns can take place. The abnormal returns are then given by Equation 2:

\[ \hat{u}_{jt} = R_{jt} - R_{mt} \]  

where:  
- \( \hat{u}_{jt} \) is the abnormal monthly return for month \( t \) (including dividends)  
- \( R_{jt} \) is the share return for month \( t \)  
- \( R_{mt} \) is the equally weighted market return for month \( t-1 \)

Equation 2 presents a simple market adjustment procedure that does not involve relative weightings of the stocks to the index. That is, the adjustment made is the same for all stocks. The simplicity of the model means that it does not suffer from any of the methodological drawbacks involved in applying beta to stock that are associated with other models such as CAPM (Capital Asset Pricing Model). Furthermore, DeBondt and Thaler (1985) state that “... whichever of the ... residuals are used [either CAPM or simple market adjustments], the results of the empirical analysis are similar and that the choice does not effect our main conclusions” (pp.796-797). Therefore, the analysis proceeds based on the residuals produced by Equation 2.
In order to test for long-run overreaction a similar method to that of DeBondt and Thaler (1985) was used. This is achieved through the following procedures: For every stock \( j \), starting in July 1978, (the “portfolio formation” period, months 1 through 36) \( (t = 0) \) the cumulative excess returns \( C_u_j = \sum_{j=-35}^{t=0} u_j \) for the prior 36 months are computed. The step is repeated 15 times for each year until July 1992, therefore, the three year formation periods overlap. On each of the relevant portfolio formation dates (July 1978, July 1979, ..., July 1992), the \( C_u_j \)’s are ranked from low to high and portfolios are formed. Firms in the top 6 stocks are assigned to the winner portfolio \( W \); firms in the bottom 6 stocks to the loser portfolio \( L \). Thus, the portfolios are formed conditional upon past excess return behaviour prior to \( t = 0 \), the portfolio formation date.

For both portfolios in each of the 15 overlapping three-year periods \( (n = 1, \ldots, N; N = 15) \), starting in August 1978 and finishing in August 1992, the cumulative average returns of all securities in the portfolio, for the next 36 months (the “test period,” months 85 through 120), i.e., from \( t = 1 \) through \( t = 36 \), are computed. This provides \( CAR_{W,n,t} \) and \( CAR_{L,n,t} \). If a security’s return was missing in a month subsequent to the portfolio formation then, from that moment on, the stock is permanently dropped from the portfolio and the \( CAR \) is an average of the available residual returns. This, therefore, implies a rebalancing of the portfolio. If the stock dropped out because of bankruptcy then the returns were recorded as minus 100 per cent. That is, no returns were further available.

Then using the \( CAR \)’s from the 16 test periods, average \( CAR \)’s were calculated for both portfolios and each month from \( t = 1 \) to \( t = 36 \). These were denoted \( ACAR_{W,t} \) and \( ACAR_{L,t} \). The overreaction hypothesis then predicted that, when \( t > 0 \), \( ACAR_{W,t} < 0 \) and \( ACAR_{L,t} > 0 \), so that, by implication a portfolio that went long on losers and short on winners would give returns greater than zero, i.e., \( (ACAR_{L,t} - ACAR_{W,t}) > 0 \).

Conrad and Kaul (1993) challenged the method employed by DeBondt and Thaler (1985), stating that “their long-term strategies suffer from methodological drawbacks that spuriously inflate their profitability” (p.40). Conrad and Kaul (1993) demonstrate that the measurement

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2 While DeBondt and Thaler (1985) use 35 stocks in each of their winner and loser portfolios, the small number of stocks listed on the New Zealand Stock Exchange would preclude this level from the study. The use of 6 stocks is considered proportional, with reference to the New Zealand Stock Exchange, to the 35 used in DeBondt and Thaler, with reference to the New York Stock Exchange.
errors in observed prices due to bid-ask errors, non-synchronous trading, and/or price discreteness, lead to substantial spurious returns to the long-term zero investment contrarian strategies because single-period returns are upwardly biased. In order to correct for this error Conrad and Kaul advocate the use of a buy and hold strategy over the three year subsequent period. Therefore, this technique is also used in this study as a comparison to the method of DeBondt and Thaler.

3. Results

3.1 Preliminary analysis

The results of the tests, as developed from the DeBondt and Thaler method, are shown in Figure 1. Over the past twenty years, loser portfolios are shown to outperform the market by an average of 34.5 per cent, thirty-six months after portfolio formation. In contrast, the winners outperform the market by only 1.5 per cent. Furthermore, for most of the three year periods after formation (27 out of 36 months) the winners actually underperform the market. These results appear to support the contention of DeBondt and Thaler (1985) that extreme movements in share price will be followed by subsequent adjustments in the opposite direction. The other notable aspect of the results is the apparent agreement with Graham’s (1959) proposition that the interval required for a substantial underevaluation to correct itself averages approximately one and a half to two and a half years. The results show that the majority of the loser returns occur between the first year and the second and a half year.
While these initial results appear to provide compelling evidence of overreaction amongst loser shares on the New Zealand Stock Exchange, the results may be attributable to an upward drift bias. Therefore, we decided to contrast these results with those of a buy and hold strategy - see Table 1. The results of this analysis demonstrate that the overreaction experienced by losers under a buy and hold strategy would be even greater than that experienced following the DeBondt and Thaler method. This difference is apparent in each of the three years for which data were analysed. Thus, the cumulation of average returns actually lessens the returns experienced by losers. This directly contrasts the assertion of Conrad and Kaul (1993) who hold that the loser returns are caused by an upward drift in the stocks caused by the cumulation method. (The use of cumulative average returns in the New Zealand Stock Exchange actually lessens the overreaction effect, biasing the results in favour of market efficiency). The winner portfolios, however, actually experience smaller negative results for year's one and two and a slightly smaller positive result at the end of the third year, although the differences are not significant.
Table 1
Average returns for winner and loser portfolios and portfolio differences at the end of years 1, 2, and 3, for the Conrad and Kaul method and the DeBondt and Thaler method

<table>
<thead>
<tr>
<th>Method</th>
<th>Returns</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year 1</td>
<td>Year 2</td>
<td>Year 3</td>
</tr>
<tr>
<td>Conrad and Kaul</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loser</td>
<td>14.2**</td>
<td>30.3**</td>
<td>40.7**</td>
</tr>
<tr>
<td>Winner</td>
<td>-1.4</td>
<td>-1.6</td>
<td>1.4</td>
</tr>
<tr>
<td>Difference</td>
<td>15.6**</td>
<td>31.9**</td>
<td>39.3**</td>
</tr>
<tr>
<td>DeBondt and Thaler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loser</td>
<td>11.7*</td>
<td>25.3**</td>
<td>34.5**</td>
</tr>
<tr>
<td>Winner</td>
<td>-1.6</td>
<td>-2.1</td>
<td>1.5</td>
</tr>
<tr>
<td>Difference</td>
<td>13.3*</td>
<td>27.4**</td>
<td>33.0**</td>
</tr>
</tbody>
</table>

*Note: Conrad and Kaul denotes a buy and hold strategy based on a number of years after formation; DeBondt and Thaler denotes A cumulative average residual strategy based on monthly returns; *denotes significance at the 10% level, and **denotes significance at the 5% level.

3.2 The directional effect

The directional effect, refers to hypothesis \( H1 \) developed previously and - as already mentioned - is supported by the findings. However, the results are worthy of elucidation as the winners do start to experience a reversal of fortune toward the end of the three year period investigated. Furthermore, the actual negative returns experienced by losers are not vastly significant and never reach in excess of negative 2.5 per cent. This suggests that the winner shares may not be prone to overreaction, as the loser shares obviously are. Thus the results indicate that the directional effect may only exist for loser shares in the New Zealand Stock Exchange. However, this only minimally effects the findings, as the lack of short sales in the New Zealand Stock Exchange means that no trading strategy can be developed to exploit any potential downside falls in the winner stock. It could be this lack of short sales that actually causes the lack of return reversal in winner stocks.

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The buy and hold returns are calculated separately at the end of each year. Therefore, the first year represents the average of the buy and hold returns in the first year after formation. The second year represents the returns for the first two years from a buy and hold strategy that would buy the shares immediately after the formation period and sell them at the end of the second year. Similarly, the three year strategy would buy the shares after formation and sell them at the end of the third year. So the yearly returns are not cumulated but separately assessed.
3.3 The magnitude effect

The magnitude effect is perhaps of the most interest in this study. The hypothesis (H2) states that more extreme initial movements will be followed by more extreme adjustments. The results demonstrate that when winners and losers are compared that this is not the scenario. The average initial cumulative returns of winners is 99 per cent, whereas the average initial cumulative returns of losers is -51 per cent. In the first instance winners almost double in value, while losers lose over half their value. Therefore, a loose interpretation of these results is that the winners and losers moved by the same amount only in opposite directions. Given the similarity in initial movements it is reasonable to expect that the overreaction present in both the winner and losers would be similar. Rather, as seen before, overreaction is present only in losers. Given the asymmetry of overreaction in New Zealand, the magnitude effect can only be studied with respect to the loser shares.

In order to test for the magnitude effect, with respect to the loser portfolios, two techniques are employed. First, the formation period is shortened, so that abnormal returns experienced are greater relative to time. Second, the number of stocks that qualify for entry into the portfolio is reduced, hence only those stocks with higher abnormal returns will be selected. The results of each technique are presented in Table 2.

The results confirm the magnitude hypothesis - that is, as the loser returns become more extreme the subsequent returns also increase in magnitude. Furthermore, this increase occurs both when the formation period is shortened, and when the number of stock in each portfolio is decreased. However, the reduction stock contained within each portfolio may not be as sound a method as reducing the time span, as the portfolios may be left containing only highly volatile stock. The use of three stocks in long-run portfolios is low when practitioners suggest the use of at least 30 stocks in a long-run market portfolio (Reilly, 1989).
Table 2
Average returns for winner and loser portfolios and portfolio differences for differing formation strategies

<table>
<thead>
<tr>
<th>Formation Strategy</th>
<th>Returns (%)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Year 1</td>
<td>Year 2</td>
</tr>
<tr>
<td>3 Year Formation</td>
<td>Winner</td>
<td>-1.6</td>
<td>-2.1</td>
</tr>
<tr>
<td></td>
<td>Loser</td>
<td>11.7**</td>
<td>25.3**</td>
</tr>
<tr>
<td></td>
<td>Difference</td>
<td>13.3*</td>
<td>27.4**</td>
</tr>
<tr>
<td>1 Year Formation</td>
<td>Winner</td>
<td>-2.2</td>
<td>-3.5</td>
</tr>
<tr>
<td></td>
<td>Loser</td>
<td>12.3*</td>
<td>27.6**</td>
</tr>
<tr>
<td></td>
<td>Difference</td>
<td>14.5*</td>
<td>31.1**</td>
</tr>
<tr>
<td>Three stock per portfolio</td>
<td>Winner</td>
<td>-3.1</td>
<td>-3.8</td>
</tr>
<tr>
<td></td>
<td>Loser</td>
<td>16.5**</td>
<td>40.3**</td>
</tr>
<tr>
<td></td>
<td>Difference</td>
<td>19.6**</td>
<td>44.1**</td>
</tr>
</tbody>
</table>

Note: * denotes significance at the 10 per cent level, ** denotes significance at the 5 per cent level.

3.4 The small firm effect

In order to test the hypothesis $H_3$, i.e., that small firms featured predominantly in the overreaction sample a simple test was devised. The test coded all 180 stock from the 15 winner and 15 loser portfolios with a 1 if they were in the top forty firms, by market capitalisation, at the time of formation. Otherwise the firms were coded 0 to indicate that they were small firms. Therefore, a 1 represented a large firm and 0 a small firm. The columns of ones and zeros were then summed for each the winners and losers. If the sum of the columns was greater than 45 then this would suggest a predominance of large firms, and vice versa for a sum of less than 45.

The scores were for winners was 28 and for losers 24; that is, the winner portfolios contained 28 large firms and 62 small firms, while the loser portfolios contained 24 large firms and 66 small firms. Therefore, apparently small firms dominate the sample used in this study. Moreover, the predominance of small firms in both the winner and loser portfolios suggests that small firms probably do not cause the overreaction found in the loser shares. In order to test this hypothesis, the large firms, those denoted by a one were analysed separately and the returns after formation were plotted in Figure 2. The results demonstrate that the large firms exhibit classic mean reverting tendencies typical of overreaction. The losers, in the first year

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4 The average abnormal return value of the loser and winner portfolio formation periods are -57.8 per cent and 112.6 per cent respectively.

5 The average abnormal return value of the loser and winner portfolio formation periods are -65.4 per cent and 128.9 per cent respectively.
after formation, outperformed the market by over 30 per cent. Additionally the winners actually significantly underperform the market in the first year after portfolio formation.

These results indicate that overreaction is more significant among large firms in the New Zealand Share Market although the portion of large firms experiencing overreaction is greatly less than small firms. Therefore, the results also confirm the hypothesis \( H3 \) that states that “even after firm size has been controlled for, there will exist a persistent overreaction in the New Zealand Stock Exchange”.

**Figure 2**
Cumulative average residuals for high market capitalisation winner and loser stocks with the test period lasting 36 months after portfolio formation
4. Summary

The results of this research indicate that New Zealand can be included among those countries that exhibit long-run overreaction in their stock exchanges. However, only losers experience significant overreaction; winner portfolios show almost no abnormal market returns. Consistent with the literature it is also shown that the more extreme the initial movements the greater the subsequent rebound. Furthermore, overreaction is shown to exist independently of the small-firm and seasonal effects, however, there is a predominance of small firms in both the winner and loser portfolios.

The results also show that the methodological criticisms of the DeBondt and Thaler method by Conrad and Kaul may be unfounded, as a buy and hold strategy actually yields higher returns than the cumulation of average residuals. Furthermore, the employment of the buy and hold strategy would over the last twenty years have yielded the investor abnormal returns of, on average, 39.7 per cent after transaction costs.
References


