

# Short-Term Contrarian Investing – Is it Profitable? ... Yes and No

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## *Abstract:*

In this paper we investigate short-term contrarian investment strategies in the Australian stock market using weekly data of those stocks comprising the All Ordinaries Index during the period 1994 to 2001. We find both the Lo and MacKinlay (1990) equal-weighted strategy and a new value-weighted strategy yield statistically significant short-term contrarian profits. Importantly, these observed profits could not be fully explained by measurement errors such as bid-ask bounce or by risk, seasonality or volume. Profits are largely related to firm size with overreaction to firm specific information being the primary source of short-term contrarian profits in Australia. However, when a 'practical' short-term contrarian strategy including reasonable transaction costs is implemented, all profits vanish. Thus, while the contrarian approach is not viable as a stand-alone strategy, we argue that it is value-enhancing when employed as an overlay strategy, particularly in the context of managed funds.

*JEL Classification:* G14

**Keywords:** Short-term contrarian investing; return reversals; market efficiency, market overreaction.

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## *Abstract:*

In this paper we investigate short-term contrarian investment strategies in the Australian stock market using weekly data of those stocks comprising the All Ordinaries Index during the period 1994 to 2001. We find both the Lo and MacKinlay (1990) equal-weighted strategy and a new value-weighted strategy yield statistically significant short-term contrarian profits. Importantly, these observed profits could not be fully explained by measurement errors such as bid-ask bounce or by risk, seasonality or volume. Profits are largely related to firm size with overreaction to firm specific information being the primary source of short-term contrarian profits in Australia. However, when a 'practical' short-term contrarian strategy including reasonable transaction costs is implemented, all profits vanish. Thus, while the contrarian approach is not viable as a stand-alone strategy, we argue that it is value-enhancing when employed as an overlay strategy, particularly in the context of managed funds.

## 1. Introduction

Evidence of stock prices exhibiting negative serial correlation has been well known for over 30 years (see for example, Fama, 1965; Cootner, 1964; French and Roll, 1986; Lo and MacKinlay, 1988 and 1990; Lehmann, 1990; Jegadeesh and Titman, 1993). When negative serial correlation is found to exist it may be possible to develop econometric models to profitably forecast future prices merely from observing historical prices. The question of whether such contrarian investment strategies have merit has fostered a somewhat controversial area of finance research. While there exists a significant body of literature detailing the abnormal profits generated from the short-term contrarian investment strategy (see for example, Lehmann, 1990, Lo and MacKinlay, 1990, Jegadeesh, 1990 and Jegadeesh and Titman, 1995), there is considerable evidence that refutes the ‘overreaction hypothesis’ as a primary source of observed profits.

To address some of the issues surrounding the potential sources of short-term contrarian profits, Lo and MacKinlay (1990), henceforth LM, analysing US weekly stock prices, introduced a decomposition process so as to determine whether the lead-lag effect or an overreaction to firm specific information was the primary source of short-term contrarian profits. Based on their research, LM concluded that a lead-lag relationship of size-sorted portfolios explained most of the contrarian profits. LM postulated that the source of short-term contrarian profits was not a result of the overreaction hypothesis but rather was the result of a lead-lag effect on stock prices. In their findings they attributed less than 50% of the profits to overreaction and argued that a lead-lag effect generates the majority of the observed short-term contrarian profits.<sup>1</sup>

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<sup>1</sup> A lead-lag effect exists for example when some stocks react more quickly to information (‘leading’ stocks) than others (‘lagging’ stocks). Negative serial correlation witnessed in these stocks may therefore be a result of this lead-lag phenomenon.

Jegadeesh and Titman (1995), henceforth JT, examine the New York and American stock exchanges for the presence and possible sources of short-term contrarian profits. Like LM, JT sought to decompose profits into two main components, a component due to the lead lag effect as proposed by LM and a component due to an overreaction to firm specific information. After detailing some disagreement with LM's decomposition methodology, JT employ an alternative methodology to that used by LM. JT find that observed short-term contrarian profits are predominantly the result of an overreaction to firm specific information and not the result of lead-lag effects as suggested by LM. Furthermore, JT find only a very small fraction (less than 1%) of the short-term contrarian profits can be attributed to the lead-lag effect. Mun, Vasconcellos and Kish (1999) and Ni, Lui and Kang (2002) also conclude that the primary source of short-term contrarian profits is an overreaction to firm specific information.

Others argue the existence of short-term contrarian profits is not the result of lead-lag effects or an overreaction to firm specific information. The main strands of this literature have debated the following as possible alternative (partial) explanations: measurement errors such as those induced by bid-ask bounce (eg. Conrad and Kaul, 1993, Boudoukh, Richardson and Whitelaw, 1994 and Conrad, Kaul and Gultekin, 1997),<sup>2</sup> firm size effects (eg. Zarowin, 1990 and Chopra, Lakonishok and Ritter, 1992), time varying market risk (eg. Chan, 1988, Ball and Kothari, 1989, Conrad and Kaul, 1989, LM, Chang, McLeavey and Rhee, 1995 and Hameed, 1997), seasonality effects (eg. Zarowin, 1990 and Chopra, Lakonishok and Ritter, 1992), trading volume (eg Conrad, Hameed and Niden, 1994, Chordia and Swaminathan, 1999 and Hameed and Ting, 2000), and failing to account for transaction costs required to implement the strategy (eg. Conrad and Kaul, 1993).

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<sup>2</sup> Notwithstanding the numerous studies that have attempted to control for bid-ask bounce and nonsynchronous trading, researchers are still able to demonstrate that significant short-term contrarian profits exist after controlling for bid-ask bounce (see JT, Chang, Mcleavey and Rhee, 1995 and Hameed and Ting, 2000). Similar counter evidence exists in relation to the other issues raised in this paragraph, but to conserve space, details are suppressed.

While contrarian profits are often found to be statistically significant, even after controlling for the factors listed above, it is important to ask whether these profits remain positive and statistically significant after the allowance for plausible values of transaction costs. The evidence of economically significant short-term contrarian profits after the inclusion of transaction costs remains mixed. For example, Lehmann (1990) finds economically significant short-term contrarian profits even after controlling for transaction costs. Likewise, Hameed and Ting (2000) demonstrate economically significant short-term contrarian profits can be generated in the Malaysian stockmarket after accounting for transaction costs. However, they find transaction costs of one percent or more, would remove any observed short-term contrarian profits. In contrast, Conrad et al. (1997) find that when transaction costs are taken into account, all the short-term contrarian profits are completely eliminated.

There is now growing empirical evidence of profitable short-term contrarian strategies in markets other than the US. For example, Chang, Mcleavey and Rhee (1995) investigate the Japanese market and find evidence of economically significant short-term contrarian profits even after controlling for risk and size. Hameed and Ting (2000) analyse the Malaysian stock market and find significant short-term contrarian profits and note that trading activity (volume) plays an important role in predicting short horizon returns. Ni, Lui and Kang (2000) analysing China, find significant contrarian profits and conclude that the sole source is an overreaction to firm specific information. Bowman and Iverson (1998) find that the New Zealand stock market systematically overreacts to news and events, especially so in the case of price declines. After controlling for risk, size, seasonal anomalies and bid-ask bounce effects they continue to find significant short-term contrarian profits.<sup>3</sup>

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<sup>3</sup> Other international studies include: Schiereck, Debondt and Weber (1999) – Germany; Mun, Vasconcellos and Kish (1999) – US versus Canada; and Antoniou, Galariotis and Spyrou (2001) – Greece.

While there exists some research on the overreaction hypothesis in Australia with respect to the long-term contrarian philosophy, the profitability of short-term contrarian strategies remains unexplored.<sup>4</sup> Accordingly, in this paper we seek to determine whether short-term contrarian profits exist in an Australian context, whilst recognising such profits may be a result of factors other than the systematic overreaction to firm specific information.

A major contribution of our work is the application of a value weighted short-term contrarian investment strategy, as opposed to the equal weighting approach that is the norm in the extant literature. Specifically, our approach possesses some significant enhancements. First, it allows us to compare the profits of the strategy with a highly accessible and followed market index, the All Ordinaries Accumulation Index. Second, we are less likely to overstate the relative importance of smaller stocks, which could bias any observed profits (see Zarowin, 1990). Third, this strategy should assist in decreasing the impact of bid-ask bounce by providing a greater weighting to large stocks which are less susceptible to bid-ask bounce.

A second key contribution relates to the battery of sensitivity checks employed to establish the robustness of our findings. In particular, we re-evaluate the contrarian profit measure: (a) using the midpoint of bid / ask prices; (b) using volume weighted average prices (VWAP); (c) controlling for size; (d) controlling for risk; (e) controlling for monthly seasonality; and (f) controlling for trading volume effects. In the case of the trading volume analysis we improve on existing methods in that we employ a relative trading volume

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<sup>4</sup> Brailsford (1992) researched the Australian sharemarket and the performance of long-term (3 year) winner loser portfolios from 1958-1987. The study, although focusing on longer-term reversals, is still very useful to draw an inference on the characteristics of the Australian equity market. Brailsford (1992) does not find much evidence supporting price reversals on loser portfolios, whilst winner portfolios demonstrated significant price reversals in the test period. Similar findings were later found in Allen and Price (1995). In a later study that builds on the methodology of Brailsford (1992), Gaunt (2000) finds evidence of price reversal where monthly portfolio rebalancing is employed but this reversal disappears when a buy and hold strategy is used. Further analysis revealed that small firms dominate the loser portfolio and that abnormal returns are not exploitable given the lack of liquidity in small capitalisation stocks.

measure that controls for the number of outstanding shares for each security. A final key contribution of our work relates to the realistic perspective we bring to the combined issue of short selling and transaction costs. Specifically, this relates to our adoption of a ‘seeding’ portfolio approach which would be extremely relevant to the fund management industry. In this analysis we solve for the level of transaction costs that eliminate profits on an index portfolio investment with a short-term contrarian overlay strategy.

We investigate short-term contrarian investment strategies in the Australian stock market using weekly data of those stocks comprising the All Ordinaries Index during the period 1994 to 2001. We find both the Lo and MacKinlay (1990) equal-weighted strategy and our value-weighted strategy yield statistically significant short-term contrarian profits, though the latter are smaller in magnitude. Importantly, in our battery of robustness checks these observed profits could not be fully explained by measurement errors such as bid-ask bounce or by risk, seasonality or volume. Profits are largely related to firm size with overreaction to firm specific information being the primary source. However, when our ‘practical’ short-term contrarian strategy including reasonable transaction costs is implemented, all profits vanish. Thus, while the contrarian approach is not viable as a stand-alone strategy, we argue that it is value-enhancing when employed as an overlay strategy, particularly in the context of managed funds. In this context transaction costs effectively have zero incremental cost, and thus, fund managers could augment portfolio returns by using the short-term contrarian strategy to better time the sales and purchases of stocks that would have been traded in the normal course of business.

Our paper is organised as follows. Section two presents the empirical framework. In section three we outline the data and research method. Section four presents the results, while the final section concludes the paper.

## 2. Empirical Framework

We employ the portfolio formation and decomposition methodologies presented by LM and JT, respectively. Two portfolio formation strategies are undertaken in this study. First, we employ the equal-weighted portfolio formation methodology of LM and JT to allow for a meaningful comparison of our results with similar studies. Second, we develop a more practical and realistic value-weighted methodology as an extension and subsequent improvement to the LM and JT portfolio formation strategy.

### 2.1 The Equal-Weighted Index Model

Following LM and JT, we employ a strategy that involves buying and selling stocks based on their returns in week  $t-1$  and holding the stocks in week  $t$ . The weights assigned to each stock are inversely proportional to the stock's excess returns relative to the equally weighted market index:

$$w_{i,t} = -\frac{1}{N}(r_{i,t-1} - r_{m,t-1}) \quad (1)$$

where:  $w_{i,t}$  is the weight of stock  $i$  at time  $t$ ,  $N$  = number of stocks in the portfolio at time  $t$ ,  $r_{i,t-1}$  = return on security  $i$  at time  $t-1$  and  $r_{m,t-1}$  is the return on the equal-weighted market index at time  $t-1$ . The total investment at any time is zero, that is, it is a self-financing strategy. Profits from this strategy are defined as follows:

$$p_t = -\frac{1}{N} \sum_{i=1}^N (r_{i,t-1} - r_{m,t-1}) r_{i,t} \quad (2)$$

The profits or losses arising from this strategy are excess returns relative to the return on the market index.

## 2.2 The Value-Weighted Index Model

To overcome some of the inherent shortcomings of an equal-weighted index return series, we also investigate a value-weighted index methodology as an extension to the strategy employed by LM and JT. The weights for the (self-financing) value-weighted strategy are as follows:

$$w_{i,t} = -(MV_{i,t-1} / TMV_{t-1}) \times (r_{i,t-1} - r_{m,t-1}^*) \quad (3)$$

where:  $MV_{i,t-1}$  is the market value of stock  $i$  at time  $t-1$ ,  $TMV_{t-1}$  is the total market value of all the stocks included in the sample for period  $t$ ,  $r_{m,t-1}^*$  is the value-weighted market return for period  $t$ . The profit from the value-weighted model is given as:

$$P_t^* = - \sum_{i=1}^N [(MV_{i,t-1} / TMV_{t-1}) \times (r_{i,t-1} - r_{m,t-1}^*)] r_{i,t} \quad (4)$$

As a result, we are able to provide a strategy similar to that employed by LM and JT, which possesses some significant enhancements. First, our model allows us to compare the profits of the strategy with a highly accessible and followed market index, in our case the All Ordinaries Accumulation Index. In addition, we are able to compare our portfolios' performance with the performance of active Australian equity fund managers over the same time period.<sup>5</sup> Second, we are no longer overstating the relative importance of smaller stocks, which could bias any observed profits (see Zarowin, 1990). Third, this strategy should assist in decreasing the impact of bid-ask bounce by providing a greater weighting to large stocks which are less susceptible to bid-ask bounce.

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<sup>5</sup> Short-term contrarian profits reported are in excess of the returns generated by the market (AOI).

### 2.3 Decomposition Framework

Earlier interpretations of the potential sources of short-term contrarian profits focused predominately on the return reversals of stocks (i.e. overreaction). LM argue that contrarian profits might arise when some stocks react more quickly to information than do other stocks, as such the returns of some stocks “lead” the returns of others. In this environment, a contrarian strategy may prove profitable even if neither stock over nor underreacts to firm specific information. JT further develop the decomposition methodology as proposed by LM. JT argue that the LM methodology suffers from a tendency to overstate the relative importance of the lead-lag structure as a means of explaining the potential sources of contrarian profits. Accordingly, we employ the JT decomposition methodology.

The first stage of JT the decomposition is to estimate the following linear regression for each stock covering the test period (1994-2001).

$$r_{i,t} = \mathbf{a}_i + b_{0,i}r_{m,t}^* + b_{1,i}r_{m,t-1}^* + e_{i,t} \quad (5)$$

Equation (5) has the following attributes. If stock  $i$  overreacts to firm specific information, this will induce negative serial-covariance in the stock’s price and if underreaction occurs, this will induce positive serial-covariance in the stock’s price. In addition, if stock  $i$  reacts with a delay to the common factor, then  $b_{1,i} > 0$  and if stock  $i$  overreacts to the common factor, then  $b_{1,i} < 0$ . This lead-lag structure in stock returns arises because of the differences in the timeliness and magnitude of stock price reactions to the common factor. Lead stocks tend to react to information more quickly than do lagged stocks. Therefore, stocks with larger than average contemporaneous betas ( $b_{0,i} > \bar{b}_0$ ) are defined as lead stocks whilst stocks with lower than average contemporaneous betas ( $b_{0,i} < \bar{b}_0$ ) are classified as lag stocks.

The decomposition process of contrarian profits calculated using equation (2) is given as:

$$E(\mathbf{p}_t) = -E\left(\frac{1}{N} \sum_{t=1}^N (r_{i,t-1} - r_{m,t-1})r_{i,t}\right) \\ = -\mathbf{s}_a^2 - \Omega - \hat{\mathbf{d}} \mathbf{s}_m^2 \quad (6)$$

$$-\mathbf{s}_a^2 = \frac{1}{N} \sum_{i=1}^N (\mathbf{a}_i - \bar{\mathbf{a}})^2 \quad (7)$$

$$\Omega \equiv \frac{1}{N} \sum_{i=1}^N \text{cov}(e_{i,t}, e_{i,t-1}) \quad (8)$$

$$\hat{\mathbf{d}} \equiv \frac{1}{N} \sum_{i=1}^N E((b_{0,i} - \bar{b}_0)(b_{1,i} - \bar{b}_1)) \quad (9)$$

Equation (6) above decomposes expected contrarian profits into three components. The first component ( $\mathbf{s}_a^2$ ) provides the cross-sectional variance of expected returns. When stocks have higher than expected returns, they tend to experience higher than average returns during both portfolio formation and holding periods and subsequently demonstrate reduced contrarian profits. The second component ( $-\Omega$ ) is the negative of the average serial-covariance of the idiosyncratic component of returns. If stock prices tend to overreact to firm specific information and subsequently correct the overreaction in the following period, the average serial-covariance will be negative and thereby contribute to contrarian profits. This provides a measure of the stock's overreaction to firm specific information. The third component is driven by the cross-sectional covariance of contemporaneous and lagged betas ( $\mathbf{d}$ ) which provides an estimate of contrarian profits resulting from the difference in the timeliness of stock price reactions to common factors. If the cross-sectional covariance of contemporaneous and lagged betas is negative,  $\mathbf{d} < 0$ , then

common factor realisations contribute positively to contrarian profits. Finally, if we take the product of the cross sectional covariance of contemporaneous and lagged betas and the variance of the common factor ( $-\mathbf{d} \mathbf{s}_m^2$ ), we are able to obtain an estimate of the part of contrarian profits due to the lead-lag effect.

### **3. Data and Research Method**

#### **3.1 Data**

In this paper, short-term contrarian investing will be examined using only those stocks belonging to the All Ordinaries Index (AOI). The AOI is a value-weighted index that is comprised of the largest and most heavily traded stocks on the ASX. Although the number of companies included within the AOI has represented only 28% of the total number of companies listed on the ASX over this period, the AOI has on average represented 93% of the total ASX market capitalisation over the 1994 to 2001 test period.

The rationale behind using only those stocks listed in the AOI, as opposed to the full market, is that by using the AOI we remove all the smaller stocks not included in the AOI. This is advantageous because stocks in the AOI, when compared to the ‘full’ ASX market, are less susceptible to a range of problems, including: the presence of high levels of bid-ask spreads (i.e. bid-ask bounce), low volume and trading levels, non-synchronous data, a lack of market depth and coverage. As a result, in many ways the stocks inside the AOI provide a superior sample of companies with which to study the existence and potential sources of short-term contrarian profits in Australia.

The data employed for this study are sourced from SIRCA and consist of Wednesday weekly closing prices, trading volumes, shares on issue, market capitalisation, bid-ask and volume weighted average closing prices (VWAP) for all AOI stocks during the period January 1994 to December 2001. In addition, stocks were required to have at least

52 consecutive weeks of trading to remain in the sample. This restriction was imposed to limit the downward bias in auto-correlation calculations inherent in small samples and to provide a sufficient number of observations for market model calculations. As a further data screen, stocks with share prices below or equal to ten cents were removed from the sample. We removed low priced stocks because bid-ask bounce is frequently more prevalent in small priced (penny) stocks (see for example JT).

### **3.2 Short-selling**

Both equations (1) and (3) assume the ability to engage in short-selling securities. In Australia short-selling is generally prohibited or highly restrictive when employing the short-term contrarian strategy. The ASX provides investors with an ‘approved list’ which may be sold short. As such, the process of short-selling becomes overly restrictive, and potentially expensive and impracticable with regard to the short-term contrarian strategy employed. As a result, we cannot unconditionally argue that short-selling is a practical option available to investors undertaking the short-term contrarian strategy in Australia. Accordingly, we develop a simple ‘practical’ process involving ‘seeding’ a portfolio to create a market portfolio to overcome the short-selling requirement of the short-term contrarian strategy.

### **3.3 Basic Approach**

The basic methodology we employ in the current paper involves hypothetically forming self-financing portfolios based on equations (1) and (3) and recording profits using equations (2) and (4). Specifically, following JT, six portfolios are formed over the full test period (1994 to 2001). The first is the full portfolio consisting of all the stocks included in the sample period. The remaining five portfolios comprise the five size-sorted portfolios formed on the basis of firm size (as measured in the first week of each year). To examine

whether other factors contribute to observed short-term contrarian profits, we undertake a sensitivity analysis to assess the impact of pricing measurement error, such as bid-ask bounce, on the reported profits. In addition we consider size, risk, seasonality, and volume as possible sources of short-term contrarian profits. Finally, we address some of the practical issues when implementing the short-term contrarian strategy by including transaction costs into the strategy and by overcoming the inability to engage in short-selling.

### **3.4 Bid-ask Bounce**

A common source of measurement error in transaction prices is the bid-ask spread, which frequently leads to a bid-ask bounce effect in security prices and thus returns (Roll, 1984). Kaul and Nimalendran (1990), and Conrad et al. (1997) find that bid-ask errors (bounce) in transaction prices can explain much of the observed price reversals of short-term contrarian strategies. To overcome the effects of bid-ask bounce, we calculate returns based on the mid point of the bid and ask prices, as this has been shown to contain virtually no measurement error resulting from bid-ask bounce (see Conrad et al, 1997).

### **3.5 Volume Weighted Average Price (VWAP)**

As a practical extension of attempting to control for measurement error induced by bid-ask bounce, we have obtained volume weighted average prices (VWAP) for all the stocks included in the sample over the full test period. VWAP is calculated by dividing the stock's total turnover value by its total volume (total number of shares traded). This represents the average price of a security weighted by both the volume and the value of the trades. VWAP intuitively provides the "most likely" price at which an investor would trade during a particular trading day. As such, we argue that the returns generated by this strategy should

provide a more accurate estimate of the returns that a fund manager or professional investor implementing the short-term contrarian strategy could expect to receive.

### **3.6 Firm Size**

Reported profits arising from short-term contrarian strategies are typically larger for small stock portfolios when compared to large stock portfolios (see JT and Zarowin, 1989 and 1990). In order to provide some insight regarding the size effect, we compare the returns of the smallest and largest stock portfolios to determine if small stock portfolios provide statistically higher returns when compared to large stock portfolios.

### **3.7 Risk**

One possible explanation for the observed profits arising from the short-term contrarian strategy is the risk associated with undertaking the strategy. Chan (1988) proposes that the risks of undertaking the contrarian strategy are not constant over time and if risk is controlled for, only small abnormal returns from a contrarian strategy remain. Following Zarowin (1989 and 1990), we use the CAPM based model to investigate whether risk plays an important role in explaining and thus generating short-term contrarian profits.

### **3.8 Seasonality**

Zarowin (1990), Chopra et al (1992) and Ball et al (1995) find evidence that long run overreaction is largely the result of seasonal effects, namely the January effect. The evidence surrounding seasonality as a potential source of short-term contrarian profits however indicates that seasonality explains little of the observed profits (see for example, Zarowin, 1990; and Bowman and Iverson, 1998). To assess if seasonality is a potential source of contrarian profits, we adopt a methodology similar to Zarowin (1989) and remove

January and July observations from the reported profits calculated using equations (2) and (4), which may contain a seasonality component.<sup>6</sup>

### 3.9 Trading Volume

It has been argued that there exists a relationship between trading volume and predictable return patterns (Blume, Easley and O'Hara, 1994 and Campbell, Grossman, and Wang, 1993). In addition, Hameed and Ting (2000) construct short-term contrarian portfolios using the security's past volume and find high (low) volume portfolios are more likely to provide higher (lower) short-term contrarian profits. Accordingly, we explore the possibility that volume contributes to short-term contrarian profits and whether volume is a potential source for short-term contrarian profits.

To examine the role of trading volume we build on the methodologies of Conrad, Hameed and Niden (1994) and Hameed and Ting (2000). Like Hameed and Ting (2000), we find Conrad et al's (1994) methodology does not adequately distinguish between high and low volume securities.<sup>7</sup> Hameed and Ting (2000) sort stocks into low, medium and high volume portfolios based on the stocks average daily trading volume relative to other stocks in the sample (rather than on the basis of the stocks historical volume levels, as in Conrad et al, 1994).

Although this portfolio formation methodology improves on Conrad et al.' (1994), it suffers from one potential problem. Portfolios formed using the above methodology observe the number of shares traded in year  $t-1$ . However, they do not account for the number of shares outstanding for each security. As a result, companies that have a

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<sup>6</sup> The seasonal effects in Australia have been largely attributed to the month of July, which like the US January seasonal, is the month following financial year-end (see for example, Brown, Keim, Kleidon and Marsh, 1983; Brailsford and Easton, 1991; Gaunt, Gray and McIvor, 2000). We remove January in addition to July so as to control for any possible seasonality 'spillover' from US markets.

<sup>7</sup> Conrad et al (1994) classify a security as high volume (low volume) if the security's trading volume is higher (lower) than its own historical average. When using the Conrad et al (1994) methodology, it is possible that a security is classified as high (low) volume even though the security is in fact only heavily (thinly) traded relative to other securities. This potentially does not exploit the predictability of returns when conditioned on the basis of trading volume relative to the market in general.

relatively large number of issued shares, but have only traded lightly throughout the year (i.e. only a relatively small volume of their securities were traded), may be poorly classified as high volume relative to a smaller company that has only a small number of issued shares, but has experienced heavy (high volume) trading.

Accordingly, we develop an extension of the two methodologies presented above which seeks to overcome some of the problems discussed, whereby volume sorted portfolios are formed on the following basis:

$$V_i = \frac{\sum_{t=1}^N (NST_t / TNS_t)}{N} \quad (10)$$

where:  $V_i$  = the average annual relative trading volume of security  $i$ ,  $NST_t$  = the number of shares traded in week  $t$ ,  $TNS_t$  = the total number of shares outstanding in week  $t$ ,  $N$  = the number of weekly observations over the year.

This measure provides us with an average percentage of shares traded for each stock over the year. Stocks are subsequently ranked by their average trading volume for year  $t-1$  and placed into one of three high, medium and low volume portfolios in the following year. This process is repeated each year until we have high, medium and low volume portfolios for the full test period (1994-2001).

### **3.10 A Practical Approach To Short-Term Contrarian Investing**

The acid test for any trading model is whether it is successful in practice. The portfolio models developed above exclude transaction costs associated with implementing the contrarian strategy whilst assuming an ability to engage in short-selling throughout the strategy. Clearly this is an unrealistic assumption. The inclusion of transaction costs frequently leads to the complete elimination of any observed short-term contrarian profits

(see Lehmann, 1990; Conrad et al, 1997). In response to this concern we utilise a practical portfolio formation strategy that enables both short-selling and transaction costs to be incorporated into the strategy. Specifically, we adopt a ‘seeding’ portfolio approach whereby we hypothetically invest an initial nominal dollar amount (\$10 million) in the market portfolio.

As a result of seeding our market portfolio we have created an index portfolio that replicates the market index via holding the same proportion of each security that comprises the market (index). The expected returns of our portfolio would be the same as the market portfolio. Once the market portfolio is replicated, we can begin the strategy. At this point, it may clarify the process by thinking of the strategy as that of holding an index portfolio with a short-term contrarian overlay. When we hold all the securities in the market portfolio, we overcome the problem of short-sales. Winner securities are no longer required to be sold short in order to implement the strategy, as they are already owned.

### **3.11 Transaction Costs**

Using a similar model developed by Lehmann (1990), we are able to calculate transaction costs when implementing the contrarian strategy. Our methodology differs slightly from Lehmann (1990) in that we also hold the total market (index) portfolio as described above.<sup>8</sup> Therefore we could expect to incur slightly higher transaction costs than if we did not hold the market portfolio. However, we would no longer be able to undertake the zero investment strategy, as we would be unable to engage in short-selling if we did not hold the market portfolio. Plausible transaction costs expected from implementing the short-term

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<sup>8</sup> As a result, if a security enters the AOI index we are required to purchase the new stock and if a stock leaves the index it is subsequently sold. It should be pointed out that if a stock leaves the index we assume a zero percent return for that stock for that week. The number of stocks to be removed from the AOI index per calendar year by the ASX has on average been only 30 stocks per year over the period 1992 - 1999 (source: A Review of the All Ordinaries Index, Consultation paper January 1999, ASX). The impact on our results of assigning a zero return to stocks leaving the index within our sample of over 15,600 return observations per year is immaterial.

contrarian strategy are between 0.30% as an optimistic minimum and 0.70% as the expected maximum. We do not employ a particular transaction cost value in our model, rather we solve for a percentage value in transaction costs that forces observed contrarian profits to equal zero.

## **4. Results**

### **4.1 Basic Results from the Short-Term Contrarian Strategy**

The results for the equal and value-weighted contrarian strategies as derived from equation (2) and (3), respectively, covering the full sample period, 1994 to 2001, are exhibited in Table 1. Results are presented for the combined full and size-sorted portfolios. In addition, we present the disaggregated results for the winner and loser strategies for both the full and size-sorted portfolios.

The short-term contrarian profits reported in Table 1 are both positive and statistically significant at the 5% level for all equal-weighted portfolios. The only exceptions are the equal weighted loser portfolios 3 and 4, which have positive contrarian profits but are not statistically significant at the 5% level. One aspect that immediately presents itself is that the observed returns would appear to be related to firm size. Small stock portfolios provide larger profits when compared to larger stock portfolios. The average weekly profits for the equal-weighted small stock portfolio (0.049%) are 3.5 times larger than the average weekly profits (0.014%) recorded for the equal-weighted large stock portfolio. This translates into an annualised return of approximately 2.58% p.a. (per annum) for the small portfolio, 0.78% p.a. for the large portfolio and 1.20% p.a. for the full combined portfolio.<sup>9</sup> In addition, we find contrarian profits are not necessarily monotonically related to size. Our results are largely consistent with those of JT.

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<sup>9</sup> It is worth noting that the annualised returns reported here are in excess of the market returns used in the analysis. As a result, the returns for the equal-weighted strategy are in excess of the equal-weighted market

One possible shortcoming of the equal-weighted portfolio methodology is that we do not have a meaningful benchmark with which to compare the performance of the strategy. The value-weighted approach allows us to compare the results of the strategy with a published and recognised index, namely the AOI. Table 1 presents the results for the value-weighted strategy. Short-term contrarian profits are both positive and statistically significant at the 5% level for all portfolios. In addition, the reported profits are all, with the exception of portfolio 3, lower than those of the equal-weighted strategy. These results are not surprising and form part of the rationale for why we use a value-weighted strategy.

Once again profits appear to be related to size, with the small stock portfolios providing larger profits when compared to larger stock portfolios. For example, the average weekly profit for the small stock portfolio (0.038%) is approximately 3.5 times larger than the average weekly profit recorded for the large stock portfolio (0.011%). The annualised returns (profits) for the small stock portfolio and the large stock portfolio are 2.00% p.a. and 0.57% p.a., respectively. These results are consistent with the results found by JT and those presented for our equal-weighted strategy.

One of the attractive features of the value-weighted strategy is that it allows us to compare the profits of the value-weighted strategy recorded in Table 1 with an industry benchmark, namely the AOI, and with the performance of other investment managers operating in the Australian equity markets. The total return for the full combined value-weighted short-term contrarian strategy is 13.56% p.a. over the full eight-year sample period.<sup>10</sup> This compares with a return of 9.6% p.a. for the AOI Accumulation Index, 11.30% p.a. for the median wholesale Australian equity fund manager and 13.00% p.a. for

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returns whilst the returns of the value-weighted strategy are in excess of the value-weighted market returns, namely the AOI.

<sup>10</sup> The short-term contrarian profits recorded here are in excess of the market (AOI) returns. As a result, the total short-term contrarian portfolios return is the sum of return of the AOI benchmark and the returns generated by the short-term contrarian strategy.

the upper quartile performance of wholesale Australian equity fund managers over the sample period.<sup>11</sup>

It must be pointed out however, that our AOI return, which was generated from the sampling procedure discussed above, has a return of 12.93% p.a. It would appear our data sampling and selection process has in itself added 3.44% p.a. If we take into account the relative differences in the AOI returns and focus only on the value added by the short-term contrarian strategy, we have created 0.70% p.a. from undertaking the strategy and 3.44% p.a. from the sampling procedure. Although the 0.70% p.a. out-performance is not relatively large and only amounts to 10.30% p.a.,<sup>12</sup> which is less than the median managers return of 11.30%, the strategy has still outperformed the benchmark (AOI) and at least 25% of the wholesale Australian equity fund managers.<sup>13</sup>

## 4.2 Decomposition Of Contrarian Profits

Following JT's methodology, we present the results of a single factor model used to decompose the observed short-term contrarian profits into two main components. The first component measures the proportion of short-term contrarian profits due to the lead-lag effect, whilst the second component provides an estimate of the profits arising from an overreaction to firm specific information. Estimates of weekly individual stock returns to contemporaneous and lagged factor returns are calculated using equation (5). From these estimates, the average slope coefficients  $(\bar{b}_0, \bar{b}_1)$  are calculated for the full sample and for the five size-sorted sub samples. The results are presented in Table 2.

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<sup>11</sup> The performance data for the median and upper quartile Australian equity (wholesale) fund managers is provided by the William M. Mercer surveys as at 31 December 2001. Wholesale performance figures are before fees and taxes.

<sup>12</sup> The value of 10.30% p.a. is the sum of the AOI index return of 9.60% p.a. and the profit from the short-term contrarian strategy of 0.70% p.a.

<sup>13</sup> Note the return of 10.30% p.a. is slightly larger than the lower quartile manager's median performance of 10.00% p.a. over the test period.

The results indicate that stock prices on average do not fully react contemporaneously to the common factor, but rather part of the effect of the common factor is incorporated into stock prices with a one-week lag. For example, the average lagged beta for the smallest firms is 0.3175, while for large firms the average lagged beta is only 0.0904, thereby indicating small firms react with more of a delay to the common factor. Moreover, there is a considerable (and monotonic) increase in the lagged coefficient as we move from larger stocks to smaller stocks. These results suggest that large firms tend to lead small firms. Our results are consistent with the findings of JT when using US stocks.

Does the lead-lag structure contribute to contrarian profits? Such an assessment can be made by examining the cross sectional covariance of contemporaneous and lagged betas as defined in equation (9).<sup>14</sup> The cross-sectional covariance of contemporaneous and lagged betas ( $\hat{\mathbf{d}}$ ) for the full sample and the five size sorted sub-samples are reported in the final column of Table 2. The cross-sectional covariance's of contemporaneous and lagged betas ( $\hat{\mathbf{d}}$ ) are negative for size-sorted portfolios 1, 2 and 4, whilst they are positive for the full sample and size-sorted portfolios 3 and 5. This suggests that the lead-lag structure could potentially contribute positively to contrarian profits for size-sorted portfolios 1, 2 and 4 only.<sup>15</sup> Our results differ slightly from those reported by JT. JT find that  $\hat{\mathbf{d}}$  was negative for all portfolios except the largest (5) portfolio, which was slightly positive, thereby suggesting that the lead-lag structure could potentially contribute positively to contrarian profits for all but the largest size-sorted portfolio.

Table 3 provides the results of our decomposition tests on contrarian profits. Since the average sensitivity to the lagged factor is positive, the contribution of the common factor reactions to contrarian profits is due to underreaction. The terms  $-\hat{\mathbf{d}}\mathbf{s}_M^2$ ,  $-\Omega$ , and

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<sup>14</sup> The coefficient  $\hat{\mathbf{d}}$  provides an estimate of  $\mathbf{d}$  (as defined in equation (9)) under the assumption that contemporaneous and lagged betas do not vary over time.

<sup>15</sup> These results suggest that the profits of portfolios 3 and 5 drive the results of the overall full sample.

$-\mathbf{s}_a^2$  in Table 3 provide an estimate of that part of contrarian profits due to delayed reaction, overreaction and that which cannot be explained by the previous two terms, respectively. Observing the results for the full portfolio ( $-\hat{\mathbf{d}}\mathbf{s}_M^2 = -0.0339$ ), we see that delayed reactions reduce rather than increase the contrarian profits. That is, delayed reactions reduce contrarian profits on average by 14.53%. These results contrast those reported by JT, as they find that delayed reactions account for less than 1% of the total profits.<sup>16</sup>

What is of interest is size-sorted portfolio 3 since it typically provides the lowest contrarian profits for all the analyses undertaken in this study. In addition, the negative percentage impact of delayed reactions on contrarian profits for portfolio 3 is 72% and is substantially higher (in magnitude) than any of those reported by JT. Notwithstanding the extreme results reported for portfolio 3, the negative effect of delayed reactions to contrarian profits is only 14.5% overall. Interestingly, when portfolio 3 is removed the average impact of delayed reactions is -0.0168 and the negative impact on contrarian profits is now only 7.2%. Our results are clearly affected by size-sorted portfolio 3. Moreover, our results indicate that underreaction to the common factor affects large stock portfolios more so than small stock portfolios. This is in contrast to JT who find that common factors predominantly contributed positively to contrarian profits, with smaller portfolios affected more noticeably by the common factor.

The negative of the average autocovariance of the error term ( $-\Omega$ ), which provides an estimate of the contrarian profits resulting from overreaction to firm specific information, is quite large and positive for the full sample ( $-\Omega_{Full} = 0.2488$ ) and accounts for 107% of contrarian profits. This result indicates that part of a stock's return in one week is, on average, reversed the following week. Thus stock prices appear to significantly overreact to firm specific information and the effects of firm specific overreaction on

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<sup>16</sup> The values reported in square brackets in Table 3 indicate the percentage impact of the reported components on contrarian profits. Similar to JT, the percentages do not sum to unity due to estimation errors.

contrarian profits are far more prominent than those related to delayed reaction. These results are consistent with those reported by JT. JT find that an overreaction to firm specific information accounted for 110% of contrarian profits, whilst our reported figure is remarkably similar at 107%.

In summary, the results presented here and in JT clearly indicate that the observed short-term contrarian profits are largely the result of an overreaction to firm specific information and are not the result of common factor realisations such as the lead-lag effect.

### **4.3 Sensitivity Analysis**

#### **4.3.1 Bid-Ask Bounce**

Table 4 presents the average percentage weekly short-term contrarian profits over the full test period for the combined full and size-sorted portfolios for both the equal and value-weighted strategies when bid-ask prices are used. After controlling for measurement errors associated with bid-ask bounce, the combined full and size sorted portfolios for both the equal and value-weighted strategies continue to exhibit statistically significant short-term contrarian profits (at the 5% significance level).<sup>17</sup>

The average weekly profits for the equal-weighted full combined portfolios have decreased from 0.023% (see Table 1) to 0.019% (see Table 4) after controlling for bid-ask bounce. Alternatively, annualised returns have decreased from 1.20% p.a. for the equal-weighted price strategy to 0.99% after controlling for bid-ask bounce. A similar outcome is observed for the value-weighted strategy, which saw the full combined price return decrease from 0.012% (see Table 1) to 0.009% (see Table 4) after controlling for bid-ask bounce. As such our results indicate that bid-ask bounce accounts for approximately 18%

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<sup>17</sup> While the purpose of this paper is not to undertake an in-depth analysis of the winner and loser portfolios, it is worth noting that the returns of the winner portfolio for both the equal and value-weighted bid-ask strategies are no longer statistically significant at the 5% level.

to 25% of observed short-term contrarian profits. This is considerably less than the two-thirds (66.66 %) figure reported by Ball et al (1995).

One possible explanation for why the bid-ask effect is less pronounced in our study is that we chose to use the AOI index from which to draw our sample of stocks. By using the AOI, we were hoping to partially limit the effects of bid-ask bounce arising predominately from smaller stocks (see Conrad et al, 1997) and obtain results (profits) that were less likely to be biased by measurement errors. Most stocks within the AOI index are relatively large and are subsequently followed and traded quite heavily by the investment community. Consequently, AOI stocks should in effect not exhibit large bid-ask spreads relative to stocks outside the AOI index. As such, we would expect that this should reduce bid-ask bounce in our smaller portfolios relative to other studies that have used a broader range (hence less liquid stocks) in their analysis.

Another point of interest is that the reduction in profits for winner portfolios is on average approximately 37%, whereas the reduction for loser portfolios is on average only 11%. This would indicate that winner stocks are generally more susceptible to bid-ask bounce when compared to loser stocks. The results presented in Table 4 clearly indicate that bid-ask bounce is only a partial explanation of observed short-term contrarian profits.

#### **4.3.2 Volume Weighted Average Price (VWAP)**

As an extension to the logic of calculating returns using bid-ask prices, Table 5 provides the average weekly short-term contrarian profits for the equal and value-weighted portfolios when VWAP prices are used as transacting prices. In Table 5, we see that the profits for the equal-weighted combined full and size-sorted portfolios remain positive and statistically significant at the 5% level, with the exception of portfolio 3 where both the winner and loser portfolios exhibit returns that are not statistically different from zero. In addition, the

profits for the combined full and size-sorted portfolios for the value-weighted strategy remain positive and statistically significant at the 5% level, with the exception of portfolio 3 that now records statistically insignificant profits.<sup>18</sup>

The returns for the VWAP equal-weighted portfolios have decreased on average by 30% relative to the returns of the counterpart portfolios found in Table 1. The average profit for the full combined VWAP equal-weighted contrarian strategy (0.017%) is 8.5% less than the profit reported by the strategy when using bid-ask prices (0.019%), and 26.6% less than the price strategy (0.023%). However, the full combined VWAP value-weighted profits (0.013%) reveal a marginal increase relative to the equivalent price strategy (0.012%). This is despite a decrease in returns for portfolios 1,2,3 and 4. Our findings suggest that a short-term contrarian strategy using VWAP prices as the transaction price continues to yield significant short-term contrarian profits (at the 5% level) across all portfolios (except portfolio 3) for both the equal and value-weighted strategies.

#### **4.4 Additional Potential Sources of Contrarian Profits**

##### **4.4.1 Firm Size**

As discussed earlier, the previous literature suggests that short-term contrarian profits appear to be significantly associated with firm size (see JT and Zarowin, 1990). The contrarian profits presented in Table 1 indicate that the returns for small stock portfolios (both equal and value-weighted) are considerably higher than the returns for larger stock portfolios. To explore this difference more formally, we conduct a simple ANOVA test to examine whether the large stock portfolio returns are statistically different from the returns of the small stock portfolios. The results presented in Table 6 indicate that small stock portfolios in a contrarian strategy exhibit statistically higher (at the 5% level) returns when

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<sup>18</sup> The poor performance of portfolio 3 in the value-weighted VWAP strategy is largely attributable to the poor performance of its winner portfolio.

compared to the large stock portfolios. These results are consistent whether we use mean or median returns, equal or value-weighted strategies or whether portfolios are formed using returns generated by closing, bid-ask or VWAP prices.<sup>19</sup>

#### **4.4.2 Risk**

Table 7 provides the results for CAPM adjusted returns for the combined full and size-sorted portfolios over the full sample period for both the equal and value-weighted portfolio strategies. The results indicate that when we control for risk the abnormal returns are positive and significant (at the 5% level) for both the equal and value-weighted combined full and size-sorted portfolios over the full test period. Our results for both the equal and value-weighted strategies are consistent with the literature on short-term overreaction (see Chan, 1988; JT and Zarowin, 1989 and 1990).

#### **4.4.3 Seasonality**

Another possible source of contrarian profits has been attributed to seasonal effects. In this regard Table 8, Panel A, provides the mean returns for all combined equal-weighted price portfolios with the January and July portfolio returns included in the sample. Panel B provides the mean returns for all equal price portfolios with the January and July portfolio returns removed from the sample. Our results demonstrate that once seasonal effects are removed from the sample there is only a marginal change in short-term contrarian profits. These results and the corresponding tests indicate that seasonal effects have little to no impact on short-term contrarian profits in Australia.

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<sup>19</sup> The one exception is the value-weighted VWAP strategy, which does not indicate that there is a significant difference (at the 5% level) between the average and median contrarian profits of the small and large portfolios.

#### 4.4.4 Trading Volume

Studies have indicated that high (low) levels of short-term contrarian profits are associated with high (low) levels of trading volume. In this regard Table 9 presents the results for the combined equal-weighted price portfolios over the sample period of the three volume sorted portfolios, low, medium and high. All our volume-sorted portfolios demonstrate significant (at the 5% level) positive short-term contrarian profits over the test period. What is particularly interesting about the results presented in Panel A of the table is that, contrary to most previous studies, we find that low volume formed portfolios provide considerably higher returns than do high volume portfolios. Panel B provides a statistical comparison of the mean returns of the various volume-sorted portfolios and indicates the mean returns of the low and medium volume sorted portfolios are not significantly different from each other (at the 5% level). However, low and medium volume portfolios provide significantly higher (at the 5% level) short-term contrarian profits when compared to the high volume portfolio. This finding contrasts with earlier studies by Hameed and Ting (2000) and Conrad et al. (1994) who find that when volume increases so does the level of return predictability and thus the level of short-term contrarian profits.

One possible explanation for the difference in the findings may arise because of the different markets analysed, however this is not entirely persuasive, as the Australian, New Zealand and US markets are not that dissimilar. Another more plausible explanation may be in the methodologies used. Our research design is somewhat different from that of Hameed and Ting (2000) and Conrad et al. (1994). As discussed previously, the prevailing methodologies could easily classify a large company with many shares outstanding (relative to a smaller company with less shares) as a high volume stock when in the most relevant sense it is not. As an alternative, we offer the following explanation.

It is well documented that small stocks experience higher returns (i.e. small firm effect) when compared to larger companies. Our size-sorted results presented above strongly support this. Small firms tend to be researched, monitored and traded to a far less extent than larger firms. For example, Brennan, Jegadeesh and Swaminathan (1993) find that the number of analysts researching a firm increases with the size of the firm and, as such, so does the speed with which prices adjust to new information. As a result, one would expect that small firms might in fact suffer from neglect and subsequently lower trading volume levels, when compared with larger firms. An extension of this logic is that one could reasonably expect small firms, which provide higher contrarian profits, to have low volume levels and thus portfolios formed on the basis of trading volume would result in higher expected returns for low volume portfolios.

Interestingly, our results provide some support for this low volume/small firm hypothesis. Our portfolios formed on the basis of trading volume, indicate smaller firms are associated with lower levels of relative volume and visa versa. For example, our lowest trading volume portfolio has an average market capitalisation (size) of only \$162 million, followed by the medium trading volume portfolio with an average market capitalisation of \$977 million and finally, by the high trading volume portfolio with an average market capitalisation of \$2.1 billion. As our results and the discussion in the literature indicates, portfolios formed on the basis of firm size typically see small firm portfolios exhibiting the highest levels of short-term contrarian profits. Our small and medium trading volume portfolios are significantly smaller in average size relative to the high trading volume portfolio – it is not surprising that they exhibit significantly higher contrarian profits.

#### 4.5 A Practical Approach - Including Transaction Costs

This section presents the results of our practical approach to short-term contrarian investing. We develop an index portfolio as a means of overcoming the problems of short selling and then apply an overlay short-term contrarian strategy whilst accounting for transaction costs. Table 10 presents the results for the equal-weighted combined full and size-sorted portfolios when closing prices, bid-ask prices or VWAP prices are used as the transacting price.<sup>20</sup>

The estimated minimum level of transaction costs that could be expected for a fund manager (investment professional) operating in the Australian equities market was found to be 0.30% per one-way trade.<sup>21</sup> Any contrarian strategy that no longer records a positive profit after the inclusion of transaction costs of 0.30% or higher, is then deemed unprofitable. The results from the practical portfolio implementation strategy indicate a minimum level of transaction costs of 0.30% is sufficient to remove all of the reported significant short-term contrarian profits for all our portfolios under any pricing scheme. It is worth noting that price formed portfolios 2 and 5, bid-ask portfolio 5 and VWAP portfolio 2 required transaction costs marginally higher than the minimum 0.30% to force all profits to zero. Consequently, the profits calculated for each of these portfolios after the inclusion of 0.30% transaction costs, while positive, are not significantly different from

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<sup>20</sup> As an indication of the accuracy of the practical dollar investment model, we find that the dollar return for the full combined equal-weighted price strategy (with zero transaction costs) was only 0.03% higher than the recorded profits when using the LM and JT strategy. As a result we can safely infer that the dollar investment strategy is an accurate replication of the theoretical model presented by LM and JT.

<sup>21</sup> Similar studies undertaken in the US suggest that transaction costs are in the range of 0.35% to 1.05% for larger firms and 0.85% to 2.65% for smaller firms. It should be noted this includes costs associated with brokerage, tax and bid-ask spreads (see Conrad et al, 1997). For example, Berkowitz, Logue and Noser (1988), using large NYSE firms estimated costs as low as 0.23% for money managers and brokers. This figure is in our opinion below the transaction costs we would expect Australian equity managers could effectively trade equity securities when using the short-term contrarian strategy. Therefore, we conducted a small informal survey of nine Australian fund managers and financial services organisations seeking an estimate of expected transaction costs for trading in the AOI equities market over the period in question. Managers included in our sample were BNP Paribas, Invesco, Salomon Smith Barney (Transitions Management Team), JB Were Asset Management, Westpac Asset Management, Australian Unity Funds Management, Strategic Financial Management, HSBC Asset Management and UBS Asset Management. Our findings indicate an acceptable range of 0.30% as an optimistic minimum and 0.70% as the maximum expected transaction costs for a large active investment professional operating in the Australia equities market.

zero (at the 5% level). Our results demonstrate that the average level of transaction costs for the price strategy required to force contrarian profits to zero is 0.245%, which is 38% higher than required for the bid-ask strategy (0.178%) and 26% higher than required for the VWAP (0.194%) strategy.

What is interesting about these results is that the more profitable small stock portfolio strategies (for all pricing schemes) required lower levels of transaction costs to erode all profits. This is not surprising for the following reason. The more profitable 'small' portfolios would have experienced larger return reversals, which resulted in larger contrarian profits. To undertake the short-term contrarian strategy we were required to sell 'winner' stocks and buy 'loser' stocks according to the weighting scheme developed in equation (1). As a result, the more extreme the return reversals, the larger the expected profits, the greater are the assigned stock weights and thus the larger the number of stocks required to be bought or sold. Given the higher levels of stocks bought and sold for the small stock portfolio strategies, it is not surprising that these portfolios were more sensitive to transaction costs.

The results of our practical model, which allowed for the inclusion of transaction costs and short-selling, indicates economically significant short-term contrarian profits do 'not' exist under this regime. Given our results we find that short-term contrarian strategies do not yield economically significant profits in an Australian context. Accordingly, we are able to conclude that the Australian sharemarket is at least weak form efficient with respect to the short-term contrarian investment strategy.

However, before we unconditionally conclude that there is little to no benefit arising from the apparent overreaction of stocks in the Australian stockmarket, we provide the following argument as to why the short-term contrarian strategy remains a viable and potentially profitable strategy for Australian investment professionals, such as fund

managers. Fund managers and investment professionals are continually looking for ways to enhance their portfolio returns. The short-term contrarian strategy may in fact provide one such means for enhancing portfolio returns. Although the results presented above clearly indicate a short-term contrarian strategy is not economically viable as a stand-alone strategy, the strategy may in fact be used as a value-adding ‘overlay’ strategy to assist fund managers in better timing the buying or selling of stocks as part of their normal trading activities. As these stock trades would have effectively occurred in the normal course of business, the transaction costs are already factored in (i.e. they have zero incremental cost). As a result, any return benefit arising from the short-term contrarian overlay strategy could potentially enhance the fund manager’s portfolio returns. If a fund manager were able to generate significant contrarian profits in addition to the returns generated from their normal trading activities, they would have a decisive advantage over their peers who did not employ the contrarian overlay strategy. As such, research using real fund manager data could highlight the potential benefits of using the short-term contrarian strategy as an overlay strategy to an already existing investment strategy.

## **5. Conclusion**

Our primary aim has been to measure the existence and the success of the short-term contrarian investment strategy in Australia when analysing stocks from the All Ordinaries Index (AOI) over the period 1994 to 2001. In addition, we carry out a broad and comprehensive analysis to further identify the source of any observed short-term contrarian profits. We find statistically significant short-term contrarian profits exist for all the combined full and size-sorted portfolios in Australia when using both the equal and value-weighted portfolio formation methodologies. The results indicate a short-term contrarian strategy could in fact outperform the AOI benchmark and in some cases is more successful

than 25% of the Australian equity fund managers included in the Mercer performance tables.<sup>22</sup>

Employing the Jegadeesh and Titman (1995) decomposition methodology we find that most of the contrarian profits (107%) are on average attributable to an overreaction to firm specific information. The lead-lag effect, on average, detracts rather than adds to contrarian profits. When testing for firm size, we find the magnitude of the contrarian profits is strongly related to the size – small stock portfolios experienced larger return reversals, and thus profits, when compared to large stock portfolios. This is further supported by the lower profits experienced when using the value-weighted methodology, which places a larger weighting towards larger stocks.

We also undertake a sensitivity analysis to identify if contrarian profits are the result of measurement error, such as bid-ask bounce and find that the type of transaction price used only marginally affected the level of contrarian profits. In addition, we investigate whether contrarian profits are the result of time varying market risk or seasonality factors, but compelling evidence of this nature is not forthcoming. Prior empirical evidence indicates that short-term contrarian profits have also been attributable to the level of trading volume. Our results indicate that profits are not related to the level of trading volume but rather are dominated by firm size.

Prior to the inclusion of practical considerations such as short-selling and transaction costs, our findings suggest that positive and statistically significant short-term contrarian profits can be earned in the Australian stockmarket. However, when we employ a practical contrarian strategy that allows for short-selling and the inclusion of transaction costs, we find that the contrarian strategy does not, for any portfolio, record statistically significant profits.

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<sup>22</sup> The performance results for the short-term contrarian strategy and the Australian equity fund managers are before fees and taxes.

These results do not preclude some possible benefits that may arise from adopting a short-term contrarian strategy. We argue that the contrarian approach provides little value as a stand-alone strategy but may have important uses and benefits when employed as an overlay on their existing portfolio strategy. Fund managers are always seeking ways in which they can enhance portfolio returns in addition to their stock picking abilities based on fundamental analysis. For fund managers, trading effectively has a zero incremental cost. In this context, fund portfolio returns could be enhanced by using the short-term contrarian strategy to better time the sales and purchases of stocks that would have been traded in the normal course of business.

**Table 1: Short-Term Contrarian Profits for the Price Strategy**

| Size Sorted Subsamples |      | Equal-Weighted  |                 |                 | Value-Weighted  |                 |                 |
|------------------------|------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                        |      | Combined        | Winner          | Loser           | Combined        | Winner          | Loser           |
| Small                  | 1    | 0.049<br>(0.00) | 0.022<br>(0.00) | 0.027<br>(0.02) | 0.038<br>(0.00) | 0.020<br>(0.01) | 0.018<br>(0.00) |
|                        | 2    | 0.030<br>(0.00) | 0.018<br>(0.00) | 0.012<br>(0.00) | 0.029<br>(0.00) | 0.018<br>(0.00) | 0.011<br>(0.00) |
| Medium                 | 3    | 0.011<br>(0.00) | 0.006<br>(0.03) | 0.005<br>(0.16) | 0.011<br>(0.00) | 0.004<br>(0.02) | 0.008<br>(0.02) |
|                        | 4    | 0.017<br>(0.00) | 0.011<br>(0.00) | 0.006<br>(0.06) | 0.015<br>(0.00) | 0.010<br>(0.00) | 0.006<br>(0.02) |
| Large                  | 5    | 0.014<br>(0.00) | 0.007<br>(0.00) | 0.008<br>(0.01) | 0.011<br>(0.00) | 0.005<br>(0.01) | 0.006<br>(0.00) |
|                        | Full | 0.023<br>(0.00) | 0.012<br>(0.00) | 0.013<br>(0.02) | 0.012<br>(0.00) | 0.005<br>(0.00) | 0.007<br>(0.00) |

This table presents the results of the equal and value-weighted strategies using weekly closing prices. The results provided in the table are for the combined, winner and loser strategies for the full and size sorted portfolios. Results represent the average percentage weekly short-term contrarian profits over the full test period, 1994 to 2001. The numbers in parentheses represent the *p-values* from the test. The means are equal to zero when the null hypothesis is true.

**Table 2: Sensitivities to Contemporaneous and Lagged Returns**

|        | Size sorted subsamples | $\bar{b}_0$   | $\bar{b}_1$   | $\hat{d}$     |
|--------|------------------------|---------------|---------------|---------------|
| Small  | 1                      | 0.7138        | 0.3175        | -0.0049       |
|        | 2                      | 0.6220        | 0.2382        | -0.0002       |
| Medium | 3                      | 0.7248        | 0.2266        | 0.0400        |
|        | 4                      | 0.8643        | 0.1673        | -0.0216       |
| Large  | 5                      | 0.9754        | 0.0904        | 0.0604        |
|        | <i>Average</i>         | <i>0.7800</i> | <i>0.2080</i> | <i>0.0147</i> |
|        | all                    | 0.8665        | 0.1906        | 0.0170        |

This table presents the average estimates of the sensitivities of stock returns to current and lagged value-weighted index (AOI) returns based on the following time series regression:

$$r_{i,t} = \mathbf{a}_i + b_{0,i}r_{m,t}^* + b_{1,i}r_{m,t-1}^* + e_{i,t},$$

where:  $r_{i,t}$  and  $r_{m,t}^*$  are the returns on stock  $i$  and the AOI respectively. For  $\hat{d} \equiv \frac{1}{N} \sum_{i=1}^N ((b_{0,i} - \bar{b}_0)(b_{1,i} - \bar{b}_1))$  refer

to equation (9). The estimates are presented for the combined full and size-sorted portfolios. The sample period is 1994 to 2001.

**Table 3: Decomposition of Contrarian Profits**

|        | Size sorted subsamples | $-\hat{d}s_M^2$<br>$\times 10^3$ | $-\Omega$<br>$\times 10^3$ | $-S_a^2$<br>$\times 10^3$ |
|--------|------------------------|----------------------------------|----------------------------|---------------------------|
| small  | 1                      | 0.0098<br>[0.012]                | 0.0643<br>[0.131]          | -0.0783<br>[-0.160]       |
|        | 2                      | 0.0003<br>[0.001]                | 0.3146<br>[1.044]          | -0.0634<br>[-0.210]       |
| medium | 3                      | -0.0796<br>[-0.725]              | 0.1664<br>[1.516]          | -0.0593<br>[-0.541]       |
|        | 4                      | 0.0431<br>[0.247]                | 0.2399<br>[1.373]          | -0.0497<br>[-0.284]       |
| large  | 5                      | -0.1203<br>[-0.839]              | 0.1627<br>[1.135]          | -0.0202<br>[-0.141]       |
|        | <b>Average</b>         | <b>-0.0293</b>                   | <b>0.1896</b>              | <b>-0.0542</b>            |
|        | all                    | -0.0339<br>[-0.145]              | 0.2488<br>[1.066]          | -0.0305<br>[-0.131]       |

This table presents the estimates of the various sources of contrarian profits. The three terms  $-\hat{d}s_M^2$ ,  $-\Omega$ , and  $-S_a^2$  are the estimates of contrarian profits due to the lead-lag structure, overreaction to the firm specific component of returns and the cross-sectional dispersion of expected returns, respectively, as per equations (7), (8) and (9). The results are presented for the full sample as well as the five size-sorted portfolios. The sample period is from 1994 to 2001. The numbers within the square brackets are the ratios of each of these components relative to the contrarian profits ( $p$ ) reported in Table 1.

**Table 4: Short-Term Contrarian Profits for the Bid-Ask Strategy**

| Size Sorted Subsamples |      | Equal-Weighted  |                 |                 | Value-Weighted  |                 |                 |
|------------------------|------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                        |      | Combined        | Winner          | Loser           | Combined        | Winner          | Loser           |
| Small                  | 1    | 0.040<br>(0.00) | 0.017<br>(0.00) | 0.022<br>(0.00) | 0.033<br>(0.00) | 0.017<br>(0.03) | 0.016<br>(0.00) |
|                        | 2    | 0.026<br>(0.00) | 0.014<br>(0.00) | 0.012<br>(0.01) | 0.026<br>(0.00) | 0.015<br>(0.00) | 0.011<br>(0.01) |
| Medium                 | 3    | 0.007<br>(0.03) | 0.003<br>(0.31) | 0.004<br>(0.02) | 0.007<br>(0.05) | 0.001<br>(0.84) | 0.006<br>(0.03) |
|                        | 4    | 0.015<br>(0.00) | 0.008<br>(0.00) | 0.007<br>(0.05) | 0.012<br>(0.00) | 0.007<br>(0.00) | 0.005<br>(0.04) |
| Large                  | 5    | 0.010<br>(0.00) | 0.004<br>(0.03) | 0.006<br>(0.02) | 0.008<br>(0.00) | 0.003<br>(0.10) | 0.004<br>(0.00) |
|                        | Full | 0.019<br>(0.00) | 0.009<br>(0.00) | 0.010<br>(0.00) | 0.009<br>(0.00) | 0.003<br>(0.00) | 0.006<br>(0.00) |

This table presents the results of the equal and value-weighted strategies using weekly bid-ask prices. The results provided in the table are for the combined, winner and loser strategies for the full and size sorted portfolios. Results represent the average percentage weekly short-term contrarian profits over the full test period, 1994 to 2001. The numbers in parentheses represent the  $p$ -values from the test. The means are equal to zero when the null hypothesis is true.

**Table 5: Short-Term Contrarian Profits for the VWAP Strategy**

| Size Sorted Subsamples |      | Equal-Weighted  |                 |                 | Value-Weighted  |                  |                 |
|------------------------|------|-----------------|-----------------|-----------------|-----------------|------------------|-----------------|
|                        |      | Combined        | Winner          | Loser           | Combined        | Winner           | Loser           |
| Small                  | 1    | 0.035<br>(0.00) | 0.014<br>(0.01) | 0.021<br>(0.00) | 0.026<br>(0.00) | 0.012<br>(0.12)  | 0.014<br>(0.00) |
|                        | 2    | 0.022<br>(0.00) | 0.012<br>(0.00) | 0.010<br>(0.01) | 0.020<br>(0.00) | 0.010<br>(0.01)  | 0.009<br>(0.01) |
| Medium                 | 3    | 0.005<br>(0.00) | 0.001<br>(0.72) | 0.004<br>(0.25) | 0.005<br>(0.15) | -0.001<br>(0.69) | 0.007<br>(0.04) |
|                        | 4    | 0.014<br>(0.00) | 0.008<br>(0.00) | 0.006<br>(0.08) | 0.012<br>(0.00) | 0.007<br>(0.00)  | 0.005<br>(0.04) |
| Large                  | 5    | 0.014<br>(0.00) | 0.006<br>(0.01) | 0.007<br>(0.00) | 0.015<br>(0.00) | 0.005<br>(0.00)  | 0.010<br>(0.00) |
|                        | Full | 0.017<br>(0.00) | 0.008<br>(0.00) | 0.009<br>(0.00) | 0.013<br>(0.00) | 0.004<br>(0.01)  | 0.008<br>(0.00) |

This table presents the results of the equal and value-weighted strategies using weekly VWAP prices. The results provided in the table are for the combined, winner and loser strategies for the full and size sorted portfolios. Results represent the average percentage weekly short-term contrarian profits over the full test period, 1994 to 2001. The numbers in parentheses represent the *p-values* from the test. The means are equal to zero when the null hypothesis is true.

**Table 6: Comparison of Large Stock and Small Stock Portfolio Returns**

| Transaction Price | Size Sorted Sub Samples |   | <i>Equal Weighted</i> |                 | <i>Value Weighted</i> |                 |
|-------------------|-------------------------|---|-----------------------|-----------------|-----------------------|-----------------|
|                   |                         |   | Average return        | Median Return   | Average return        | Median Return   |
| Price             | Small                   | 1 | 0.049                 | 0.036           | 0.038                 | 0.038           |
|                   | Large                   | 5 | 0.014<br>(0.00)       | 0.011<br>(0.00) | 0.011<br>(0.00)       | 0.008<br>(0.00) |
| Bid-Ask           | Small                   | 1 | 0.040                 | 0.029           | 0.033                 | 0.021           |
|                   | Large                   | 5 | 0.010<br>(0.00)       | 0.008<br>(0.00) | 0.008<br>(0.01)       | 0.007<br>(0.00) |
| VWAP              | Small                   | 1 | 0.035                 | 0.026           | 0.026                 | 0.018           |
|                   | Large                   | 5 | 0.014<br>(0.00)       | 0.008<br>(0.00) | 0.015<br>(0.20)       | 0.008<br>(0.10) |

This table presents the results of the ANOVA and Wilcoxon Rank Tests between the small stock and large stock portfolios. Tests of differences between the mean returns and median returns were performed using the ANOVA and Wilcoxon Rank Tests, respectively. Tests were undertaken for both the equal and value-weighted portfolios. In addition, tests were undertaken for all the pricing methodologies including price, bid-ask and VWAP. The sample period is from 1994 to 2001. Returns represent the average percentage weekly short-term contrarian profits over the full test period. The numbers in parentheses represent the *p-values* from the test. The means are equal when the null hypothesis is true.

**Table 7: Risk Adjusted Tests of Short-Term Contrarian Profits**

$$R_{A,t} = \mathbf{a}_A + \mathbf{b}_A(r_{m,t} - r_{f,t}) + \mathbf{e}_{A,t}$$

$$R_{A,t} = \mathbf{a}_A + \mathbf{b}_A(r_{m,t}^* - r_{f,t}) + \mathbf{e}_{A,t}$$

| Size Sorted Subsamples | Equal Weighted Strategy |                    |                  |        | Value Weighted Strategy |                    |                  |        |     |
|------------------------|-------------------------|--------------------|------------------|--------|-------------------------|--------------------|------------------|--------|-----|
|                        | $\hat{\mathbf{a}}$      | $\hat{\mathbf{b}}$ | $\overline{R^2}$ | NOBS   | $\hat{\mathbf{a}}$      | $\hat{\mathbf{b}}$ | $\overline{R^2}$ | NOBS   |     |
| Small                  | 1                       | 0.048<br>(0.00)    | -0.012<br>(0.00) | 0.0228 | 417                     | 0.039<br>(0.00)    | -0.009<br>(0.05) | 0.0091 | 417 |
|                        | 2                       | 0.029<br>(0.00)    | -0.011<br>(0.00) | 0.0515 | 417                     | 0.030<br>(0.00)    | -0.007<br>(0.01) | 0.0151 | 417 |
| Medium                 | 3                       | 0.010<br>(0.00)    | -0.006<br>(0.00) | 0.0262 | 417                     | 0.012<br>(0.00)    | -0.007<br>(0.00) | 0.0292 | 417 |
|                        | 4                       | 0.017<br>(0.00)    | -0.003<br>(0.13) | 0.0055 | 417                     | 0.016<br>(0.00)    | -0.002<br>(0.06) | 0.0089 | 417 |
| Large                  | 5                       | 0.014<br>(0.00)    | -0.008<br>(0.00) | 0.0645 | 417                     | 0.011<br>(0.00)    | -0.002<br>(0.04) | 0.0101 | 417 |
|                        | Full                    | 0.023<br>(0.00)    | -0.008<br>(0.00) | 0.0684 | 417                     | 0.012<br>(0.00)    | -0.002<br>(0.01) | 0.0186 | 417 |

Where:  $r_{A,t}$  = weekly return on portfolio A in period  $t$ .  $r_{m,t} - r_{f,t}$  = the market risk premium minus the return on the AOI equal-weighted index minus the risk-free rate.  $r_{m,t}^* - r_{f,t}$  = the market risk premium minus the return on the AOI value-weighted index minus the risk-free rate (one month bank bill de-annualised to provide a weekly return).  $\mathbf{a}_A$  = the abnormal return for the zero net investment strategy of buying loser stocks and selling winner stocks, represented in percentage terms.  $\mathbf{b}_A$  = the slope coefficient which provides an estimate of the systematic risk for portfolio A over the test period.  $p$ -values are reported in parentheses. NOBS = number of observations.

**Table 8: Short-Term Contrarian Profits after Adjusting for Seasonality Effects**

|                                | Average Weekly Returns |                  |                  |                  |                  |                  | NOBS |
|--------------------------------|------------------------|------------------|------------------|------------------|------------------|------------------|------|
|                                | Full                   | 1                | 2                | 3                | 4                | 5                |      |
| Panel A                        |                        |                  |                  |                  |                  |                  |      |
| All Months                     | 0.023                  | 0.049            | 0.030            | 0.011            | 0.017            | 0.014            | 417  |
| Panel B                        |                        |                  |                  |                  |                  |                  |      |
| All months Excl (Jan and July) | 0.023<br>[0.975]       | 0.046<br>[0.760] | 0.031<br>[0.914] | 0.011<br>[0.962] | 0.019<br>[0.774] | 0.014<br>[0.989] | 351  |

Panel A represents the average percentage profits for the equal-weighted price strategy when all months are included in the sample test period. Panel B represents the average percentage profits when observations in the months of January and July are removed. NOBS = the number of observations for each portfolio before and after adjusting for seasonality. Profits are reported over the full sample period (1994 to 2001). Numbers in square brackets represent the  $p$ -values from the t tests. The means are equal when the null hypothesis is true.

**Table 9: Short-Term Contrarian Profits for Volume Sorted Portfolios**

| Panel A        | Low Volume      | Medium Volume   | High Volume     |
|----------------|-----------------|-----------------|-----------------|
| Average Profit | 0.026<br>(0.00) | 0.028<br>(0.00) | 0.015<br>(0.00) |

  

| Panel B       | Matrix     |               |
|---------------|------------|---------------|
|               | Low Volume | Medium Volume |
| Medium Volume | 0.717      |               |
| High Volume   | 0.017      | 0.012         |

Panel A represents the average profits for the combined equal-weighted price portfolios formed on the basis of trading volume over the full test period (1994 to 2001). Profits are reported in percentage terms. The numbers in parentheses represent the *p-values* from the test. The means are equal to zero when the null hypothesis is true. Panel B represents the *p-values* from the ANOVA tests when accepting the null that the means are equal between the various volume sizes.

**Table 10: Break Even Transaction Costs**

| Transaction Price Used | Size Sorted Subsamples | Percentage transaction costs required to make contrarian profits zero |         |       |
|------------------------|------------------------|---|---------|-------|
|                        |                        | Price   | Bid-Ask | VWAP  |
| Small                  | 1                      | 0.242   | 0.105   | 0.136 |
|                        | 2                      | 0.316   | 0.258   | 0.304 |
| Medium                 | 3                      | 0.086   | 0.019   | 0.066 |
|                        | 4                      | 0.265   | 0.226   | 0.233 |
| Large                  | 5                      | 0.300   | 0.301   | 0.250 |
|                        | Full                   | 0.262   | 0.159   | 0.176 |
| Average Costs          |                        | 0.245   | 0.178   | 0.194 |

This table presents the percentage amount of transaction costs that would be required to force all contrarian profits to equal zero. Tests we undertaken for the equal-weighted strategy for all the combined full and size-sorted portfolios when closing prices, bid-ask prices and VWAP prices were used as the transacting price. The test period was from 1994 to 2001.

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