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Concurrent momentum and contrarian strategies in the Australian stock market

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Abstract

We investigate the coexistence of momentum and contrarian strategies in the Australian equity market from 1992 to 2011. We show that contrarian strategies prevail in the short-term investment horizon while momentum strategies dominate in the intermediate- and long-term horizons. However, only short-term contrarian strategies significantly outperform the simple buy-and-hold strategy of investing in the market index over the same period. Further examination of these strategies show that the Australian mining sector undermines the performance of momentum while enhancing performance of contrarian strategies. Lastly, using both parametric and non-parametric approaches, we show that these strategies' returns are persistent anomalies and not completely explained by standard return-generating models.

Keywords: technical analysis, momentum and contrarian strategies, model based bootstrap.

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1. Introduction

While no consensus exists about the profitability of a particular trading strategy, it has been reported that creating a portfolio by buying securities that have had high returns over the past few months (winner securities), and selling those that have had poor returns over the same period (loser securities) yields significantly positive returns (Jegadeesh and Titman, 1993). This *momentum strategy* exploits behavioral shortcomings in investors, such as investor herding, investor over- and under-reaction, and the need for confirmation. In contrast, many investors believe that the best time to invest in a security is when shortsightedness of the market has beaten down the price. This *contrarian strategy* relies on buying such distressed stocks, and selling after the stocks recover while financing the purchase through short selling unjustifiably high valued securities that will eventually drop in price.

Our study has three objectives. Firstly, we document the concurrent profitability of momentum and contrarian strategies for three investment horizons from December 1992 to August 2011 and compare them to the simple buy-and-hold strategy of investing in the Australian market index over the same period. Secondly, we question whether size, price-to-book values and industry classification are important variables in forming loser and winner portfolios. Lastly, we investigate risk-based sources of momentum and contrarian returns using both conventional time-series regression analysis and a non-parametric model-based bootstrap approach. While regression analysis is important to identify relevant risk factors to explain momentum and contrarian returns, the bootstrap test allows us to examine if any return-generating models can produce simulated returns mimicking the characteristics of actual momentum and contrarian returns.

In their seminal work, De Bondt and Thaler (1985, 1987) show that winner stocks of the previous two to five years become losers due to long-term correction after investors overreact to adverse information. Therefore, contrarian strategies of simultaneously buying previous losers and selling previous winner stocks produce positive returns for the investment holding periods from 2 to 5 years. Subsequent studies by Jegadeesh (1990) and Lehmann (1990) and (Jegadeesh et al., 1995) reaffirm these findings for the short-term investment periods ranging from one week to one month.

In contrast to De Bondt and Thaler (1985), Jegadeesh and Titman (1993) demonstrate that investors underreact to information over an intermediate horizon leading to profitable momentum strategies when simultaneously buying previous winners and selling previous losers over holding periods that range from 3 to 12 months. Since then, studies on profitability of momentum and contrarian strategies have generated great interest among scholars, spanning through several past decades and across developing and developed markets. These studies can be broadly categorized into two strands. The first strand is the empirical testing of momentum and contrarian strategies for various asset classes. The second strand aims to explain the momentum and contrarian premiums with changes in stock fundamentals and behavioral information.

A large body of literature has documented the coexistence of momentum and contrarian strategies in the US market (Jegadeesh and Titman, 1993; Conrad and Kaul, 1998; Mun et al.,

2000; Jegadeesh and Titman, 2001; Grundy and Martin, 2001; Karolyi and Kho, 2004; Wu, 2002).[1] While momentum strategies were found profitable in the intermediate horizon ranging from 3 to 12 months (Conrad and Kaul, 1998; Wu, 2002; Karolyi and Kho, 2004; Grundy and Martin, 2001; Korajczyk and Sadka, 2004; Jegadeesh and Titman, 2001; Novy-Marx, 2012), the profitability of contrarian strategies was significant at either shorter or longer than the 3-12 month horizons (Conrad and Kaul, 1998; Mun et al., 2000). The recent study by Jegadeesh and Titman (2011), however, shows that the momentum profitability has diminished over time and did poorly in the most recent period. This is consistent with the finding in Hwang and Rubesam (2008) suggesting that momentum profits have slowly eroded in the US market since the late 1990s and its positive momentum returns during the late 1990s are driven by extraordinary performance of high-tech and telecom stocks. Once these stocks were excluded, the profitability of momentum strategies decreased significantly and was smaller than that reported by Jegadeesh and Titman (2001). In this study we investigate whether the mining sector plays a similar role in the Australian equity market, given its performance in the past two decades.

Theories to explain the momentum or contrarian anomalies, however, are not conclusive. The literature raises a question as to whether a risk- or behavioral-based explanation is the underlying reason for the superior performance of the momentum and contrarian anomalies. De Bondt and Thaler (1985); Conrad and Kaul (1998); Rouwenhorst (1998); Lee and Swaminathan (2000); Grundy and Martin (2001); Karolyi and Kho (2004) support the risk-based explanation of momentum arguing that returns of winner and loser portfolios appear to be correlated with the expected market risk premium. This suggests that momentum returns are sensitive to the way risks are estimated. Conrad and Kaul (1998) show that momentum profitability can be explained completely by the cross-sectional dispersion of unconditional mean returns. This suggests that risk-factor models, such as the three-factor Fama and French (1992) model, can explain the cross-sectional momentum return. In contrast, Grundy and Martin (2001) propose that while the factor models can explain most of the variability of momentum returns, they fail to explain their mean returns. Wu (2002) demonstrates that incorporating conditional market information into asset pricing models appears to capture both short-term momentum

[1] The evidence of price momentum and reversal around the world is also abundant. In small developed markets, Rouwenhorst (1998) finds the intermediate-term momentum strategies work best for 12 European countries with profits very close to those in the US. In contrast, both intermediate- and long-term contrarian strategies work well for the Canadian (Mun et al., 2000) and the New Zealand (Chin et al., 2002) markets. Stocks in emerging markets also exhibit intermediate-term momentum but their returns are notably smaller than those of comparable momentum portfolios reported by Jegadeesh and Titman (1993) (e.g., Rouwenhorst, 1999; van der Hart et al., 2003; Kang et al., 2002). Hameed and Kusnadi (2002) argue that return factors in emerging markets are not qualitatively similar to those in developed markets, leading to insignificant momentum profits in six Asian markets: Hong Kong, Malaysia, Singapore, South Korea, Taiwan and Thailand. While Kang et al. (2002) find profitability of short-term contrarian strategies in China, no evidence of contrarian effects was found in the 32 emerging markets in the study of van der Hart et al. (2003). Stocks in the UK market experience apparent momentum profits only over certain periods (Hon and Tonks, 2003). Interestingly, momentum returns were found insignificant in the Japanese market (Griffin et al., 2003).

and long-term reversal.

Studies favoring a behavioral-based interpretation argue that the magnitude and persistence of momentum and contrarian returns are too strong to be explained in a traditional risk-based asset pricing paradigm (De Bondt and Thaler, 1985; Lakonishok et al., 1994; Hong et al., 2000). Long et al. (1990) and Daniel et al. (1998) argue that investors are overconfident and overoptimistic when forming return expectations that are too extreme from the fundamental value. This leads to a behavioral tendency to overreact to bad news while underreacting to good news. Therefore, momentum is a symptom of underreaction and contrarian overreaction. According to this line of research, short-term return anomalies are characterised by the serial correlation of individual stock returns. If the serial correlation is caused by underreaction in the ranking period, then positive momentum return is experienced during the holding period. Conversely, when the serial correlation is caused by delayed overreaction in the ranking period, then negative contrarian return is expected in the holding period.[2]

Given the thin literature on the coexistence of momentum and contrarian strategies outside the US market, we investigate the phenomena of return reversal and continuation (De Bondt and Thaler, 1985; Jegadeesh and Titman, 1993) in the context of the Australian equity market for the short-, intermediate- and long-term investment horizons. We define a strategy as short-term if the holding and ranking periods are from 1 to 12 weeks; as intermediate-term if they are from 3 to 12 months and as long-term if they range from 2 to 5 years. Our results show that it is possible to generate profits in the Australian equity market using contrarian strategies in the short-term investment horizon as well as momentum strategies in the intermediate- and long-term horizons. The best contrarian return in the short-term arises from the 1-week holding and 1-week ranking period, earning \$55.93 in Aug 2011 for a \$1 invested in Dec 1992[3]. The best momentum strategies in the intermediate- and long-term are the 9-month holding and 6-month ranking period and 60-month holding and 48 month ranking respectively, earning \$2.70 and \$1.90 for \$1 invested over the same period. Nevertheless, only the contrarian strategies outperform the simple buy-and-hold strategy of investing in the market index over the same period.

Our results confirm the findings of Jegadeesh (1990) and Lehmann (1990) , which show that losers over the past one week to one month outperform winners over the next one week to one month, and of Jegadeesh and Titman (1993) that return continuation occurs in intermediate horizons with ranking and holding periods from 3 to 12 months. Our results suggest that return momentum persists strongly in the long-run horizons for the Australian equity market while other developed markets experience a long-run tendency toward reversal of price trends (see De Bondt and Thaler, 1985, 1987; Conrad and Kaul, 1998; Wu, 2002; Yao, 2012 for the US market ; Schiereck et al., 1999 for Germany and Chin et al., 2002 for the New Zealand market).

[2]See Barberis et al. (1998) and Lakonishok et al. (1994) for more information.

[3] The average turnover for this strategy is 90%. Consequently, the cost associated with rebalancing the portfolio on a weekly basis is significantly high.

Since the Australian economic growth is largely driven by the mining boom spurred by the demand for resources by emerging economies, with China being the most significant (Battellino, 2010, p.67), our investigation on the impact of mining stocks on the profitability of contrarian and momentum strategies provides insights on the role of the mining sector in the Australian equity market. We show that mining stocks made up, at least, a quarter to, at most, a third of total stocks in the strategies at all times. Over time, they undermine the performance of momentum strategies while enhancing the performance of contrarian strategies. Furthermore, these effects are more pronounced when the lengths of ranking and/or holding periods are extended. It is therefore suggested that investors seeking to benefit from short-term contrarian strategies in Australia should include mining stocks in their portfolios while those interested in longer-term momentum strategies are better off without them.

Finally, the concurrent existence of momentum and contrarian anomalies in the Australian equity market from Dec 1992 to Aug 2011 prompts us to evaluate if these returns are a compensation for exposure to risk factors, implying zero risk-adjusted return, or persistent anomalies unexplained by conventional asset pricing models. Our time-series analysis shows that the market factor does not explain contrarian returns, it plays a significant role in explaining momentum returns. The size (SMB) factor is found to have significant explanatory power for all three strategies, whereas the value (HML) factor plays a significant explanatory role only for the short-term contrarian strategies. In addition, using non-parametric techniques we examine if the Random Walk with drift (RW), the Capital Asset Pricing Model (CAPM) and the Fama and French three-factor (FF) models can generate simulated returns as large as the actual momentum and contrarian returns, implying zero-risk adjusted returns for these strategies. Our bootstrapped results show that none of these models completely characterise the return anomalies. We therefore suggest that momentum and contrarian returns are persistent anomalies in the Australian equity market.

This study is the latest investigation of momentum and contrarian in the Australian equity market and therefore allows us to reconcile mixed findings of previous studies within the Australian market. For example, we complement momentum existence in intermediate-term investment horizons in Hurn and Pavlov (2003), Demir et al. (2004), Brailsford and O'Brien (2008) and Bettman et al. (2009) but join Gaunt and Gray (2003) in being skeptical on the strategy performance compared to the buy-and-hold strategy of investing in the market index. We extend these studies and show that the momentum phenomenon continues to exist in long-term investment periods from 2 to 5 years. Our study is the first one to show that short-term return reversal from one week to one month is pervasive in the Australian stock market, although this trend has been long reported by Jegadeesh (1990) and Lehmann (1990) and Jegadeesh et al. (1995) for the US market. Most importantly, our study is the first to show that the distinctive characteristic of the Australian economic growth spurred by the mining boom in the last two decades explains the influential role of mining stocks in performance of momentum and contrarian strategies.

The paper proceeds as follows. Section 2 describes the data and methodology. Section 3

presents the empirical results, followed by Section 4 that investigates the sources of momentum and contrarian profits. Finally, Section 5 concludes.

2. Data and Methodology

Using daily prices of 2,234 common stocks listed on the Australian Securities Exchange (ASX) from Dec 1992 to Aug 2011, we calculate weekly and monthly individual stock returns. To control for the weekend and end-of-the-month effects, we use closing Wednesday quotes for weekly returns and mid-month quotes to compute monthly returns. We form momentum and contrarian strategies by evaluating cumulative stock returns over the past J periods and holding the position for the next K periods. In particular, at the end of each period J, we rank stocks according to their past cumulative returns and group them into ten equally-weighted decile portfolios. In the spirit of Grundy and Martin (2001), we do not consider stocks delisted during the ranking period, as they are never invested in. Therefore, stocks must be actively traded during the ranking period to be eligible for inclusion in momentum investment. This approach should not cause look-ahead bias since the delisting information is available prior to the investment period, i.e. the holding period. For the stocks delisted during the holding period we use the last available closing price to the day of delisting to estimate the gain or loss on that position. If gain is realised, it is reinvested at the risk-free rate for the remainder of the holding period. If loss is realised, it is scaled by the weight of that position in the portfolio and subtracted from the portfolio return. This approach alleviates the look-ahead bias caused by delisted stocks in the holding period but not eliminating the problem entirely. We term the portfolio with the highest return in the ranking period as the winner and the portfolio with the lowest return as the loser.

To address the concern of illiquid and unshortable stocks in the loser portfolio, we perform two robustness checks: (1) we only consider stocks constituting the ASX300 market index[4] (2) we remove stocks with the average market value below $50 million during the ranking period as per the ASX Market Rules Guidance Note 34[5] in constructing winner and loser portfolios. We form a zero-investment momentum (contrarian) portfolio by buying (selling) the winner portfolio and selling (buying) the loser portfolio and hold the position for the next K periods[6]. The strategy is rolled over the investment horizon (i.e., overlapping J/K periods). We then examine the significance of average returns during the K periods for the winner, loser and zero-

[4] We thank the anonymous reviewer for pointing this out.

[5] According to the ASX Market Rules Guidance Note 34, ASX will consider removing a security from the list of 'Approved Short Sale Products' if: (*i*) the market capitalisation of the securities of the class on issue is less than $50 million and volume based liquidity is less than 6.25% in the preceding three months; and (*ii*) the market capitalisation of the securities of the class on issue is less than $75 million and volume based liquidity is less than 5% in the preceding three months.

[6] All strategies are applied without a delay between ranking period and the moment of portfolio formation. The reason for implementing momentum strategies with a delay, usually 1 month, is to attenuate the effects of bid-ask bounce (Rouwenhorst 1999). This effect is lessened when the least liquid and smallest stocks are excluded (van der Hart et al., 2003). Implementing aforementioned strategies with 1 week delay for short-term and 1 month delay for intermediate- and long-term momentum and contrarian strategies only mildly changes our results and does not affect our conclusion.

investment portfolios. We compare average returns of these strategies with the ASX300 index. Neither the original works by De Bondt and Thaler (1985, 1987) on contrarian strategies nor the subsequent literature on the momentum by Jegadeesh and Titman (1993) perform such a comparison. One study that explicitly examines the excess return of momentum strategies is Wu (2002).

In this study we assess the performance of momentum and contrarian strategies in the short-term, intermediate-term and long-term investment horizons. The short-term strategies are based on the holding and ranking periods ranging from 1 to 12 weeks. We consider six different horizons for both holding and ranking periods (i.e. 1, 2, 3, 6, 9 and 12 weeks). For the intermediate-term strategies, the holding and ranking periods are 3, 6, 9 and 12 months. The long-term strategies are formed when the ranking and holding periods range from 2 to 5 years. We consider 24, 36, 48 and 60 month alternatives as ranking and holding periods[7].

The Australian economy is largely driven by the growth of countries such as China and India suggesting that the mining boom may have been crucial to the Australian market in the past two decades (Battellino, 2010). We study if this factor is crucial in determining successful momentum and/or contrarian strategies by comparing the performance of these strategies for stocks of all industries and a subset of stocks exclusive of the mining sector. Figure 1 shows market values and total number of stocks available from 1992 to 2011 for portfolio formation in each ranking period J for all industries and, separately, the stocks in mining sector. A total of 414 stocks were available in Dec 1992 with the number of mining stocks reaching 105 – a quarter of total available stocks. The number of mining stocks rose to 503 in 2008 representing approximately a third of all available stocks in the market at the time. The market value of total actively trading stocks increases from $500 billion in Dec 1992 to more than threefold prior the Global Financial Crisis (GFC) before receding back to just under 1.4 trillion in Aug 2011. The market value of mining stocks also increases threefold over the 1992 to 2011 period.

(*Insert Figure 1here*)

3. Results

Table 1 summarizes the average weekly returns of the winner, loser and zero-investment portfolios for the short-term investment horizons. While average weekly returns of the winner portfolios are all significantly negative, those of loser portfolios are significantly positive for most (J, K) combinations except those with the ranking period of 12 weeks. Overall, contrarian strategies work well for short-term holding and ranking periods of 12 weeks or less, evidenced by significantly positive loser-minus-winner portfolios in every combination. While the contrarian return is statistically significant in every combination, it deteriorates monotonically with the increase of the ranking and/or holding periods. The results for the two robustness checks [8] confirm this trend but the contrarian returns are generally weakened, with most positive returns

[7] For robustness check, we also consider a semi long-term strategies which involves holding periods from 2 to 5 years and ranking periods from 3 to 12 months.

[8] Results are available upon request.

from strategies with ranking periods of less than 9 weeks and holding periods of no longer than 3 weeks. The highest contrarian return arises from the $J = 1w/K = 1w$ strategy with a return of 5.47% per week (or 284.44% per year) followed by 4.90% of the $J = 2w/K = 1w$ strategy and 4.34% for the $J = 3w/K = 1w$ strategy. Although, such astounding returns on short-term strategies may seem very lucrative, the average turnover for $J = 1w/K = 1w$ strategy is 90%[9], indicating that the cost associated with selling and purchasing 90% of the portfolio on a weekly basis may eradicate any potential gains.[10]

When mining stocks are excluded, winner portfolios are less negative while loser portfolios are less positive. In other the words, the mining sector deepens the loss of winners while strengthening the gain of the losers in post-ranking periods. As a result, returns on zero-investment contrarian portfolios without mining stocks reduce significantly in every combination when compared to portfolios with mining stocks. Nevertheless, these returns remain statistically significant. For example, when mining stocks are not considered, the return of the $J = 1w/K = 1w$ strategy drops to 4.84% per week (251.68% per year) while those of $J = 2w/K = 1w$ and $J = 3w/K = 1w$ strategies drop to 4.31% and 3.89 % respectively. We observe that this return reduction is more pronounced when the lengths of ranking and/or holding periods increase.

[Insert Table 1 here]

In Table 2 Panel A, we report average returns of the winner, loser and zero-investment portfolios for the intermediate-term investment horizons. In contrast to results in the short-term investment horizons, the returns of the loser and winner portfolios are both negative in the 3 to 12 month post-formation periods. However, the winner tends to perform better than the loser portfolio, generating positive momentum returns for 13 out of the 16 (J, K) combinations in the intermediate-term horizons. We find that only two of these strategies are statistically significant (e.g., $J = 9m/K = 6m$ with 0.48% per month or 5.76% per year and $J = 6m/K = 9m$ with 0.37% per month or 4.44% per year). When these strategies are performed on relatively more liquid stocks only, such as those in the ASX 300 or those with MV of at least 50 million[11], the momentum returns improve significantly and unanimously outperform the market index. Our results are consistent with the earlier study on the Australian market by Hurn and Pavlov (2003) reporting strong persistence of momentum effects for the intermediate-term (6 to 12 month holding period) strategies from 1973 to 1998. However, our successful intermediate-term momentum strategies show lower returns than those reported in Hurn and Pavlov (2003), where the returns range from 4.79% to 7.13% (see Hurn and Pavlov, 2003, Table 1, p.148). This trend of diminishing momentum effects in the recent period in Australia is consistent with

[9]Turnover ratio can give a good approximation of transaction costs investors need to take into account when implementing momentum and contrarian strategies. We measure the turnover ratio by taking the number of new stocks traded in the holding period divided by the total number of stocks outstanding in the previous holding investment period. The estimated turnovers for$J = 1w/K = 1w$,$J = 9m/K = 6m$ and $J = 60/K = 48$ strategies are, on average, 90%, 29%; and 11% respectively. Turnover ratios of all combinations are available upon request.

[10] We leave this issue for our further research as it falls beyond the scope of the current study.

[11]Results are available upon request.

the one found in Jegadeesh and Titman (2011) for the US market.

[Insert Table 2 here]

Although not reported in Table 2, we examine whether the performance of the intermediate-term momentum strategies improve for holding periods longer than 12 months while maintaining the initial ranking period lengths.[12] We find that the intermediate-term momentum returns reverse to negative in 13 to 36 months after the portfolio formation before picking up positive values again from month 37 to month 60. Our results are in contrast to Jegadeesh and Titman (2001) who report negative returns on the intermediate-term momentum portfolios 13-60 months post formation for the U.S. market.

In Table 2 Panel B, we summarise the results of the 16 momentum strategies when the mining stocks are excluded. Consistent with the results in Table 1, the inclusion of mining stocks, on average, deepens the losses of winner portfolios while increasing the gain/lowering the losses of loser portfolios. It can be observed from Table 2 Panel B that without mining stocks, the returns of winner portfolios are less negative while those of loser portfolios are more negative. Consequently, positive returns of winner-minus-loser portfolios are substantially strengthened in every combination in Panel B. In particular, 15 out of 16 combinations have significantly positive momentum returns as compared to only two combinations reported in Panel A. The $J = 9m/K = 6m$ strategy is still the best performer with the return of 0.99 % per month (or 11.88% per year) followed by the $J = 12m/K = 3m$ strategy with the return of 0.91% (or 10.92% per year). These momentum returns are higher than the ones reported in Hurn and Pavlov (2003) for the Australian equity market. In addition, we show that the momentum returns increase gradually as the length of the holding period increases from 3 to 9 months, but are lower for the holding period of 12 months. This pattern is consistent with the findings of Jegadeesh and Titman (1993), Rouwenhorst (1998), Lee and Swaminathan (2000) and van der Hart et al. (2003) for developed markets.

In Table 3 we show that long-term momentum strategies continue to prevail in the Australian market. Overall, 10 out of 16 J/K combinations generate significant positive returns from 0.21% to 0.59% per month (or 2.52% to 7.08% per year). The highest return arises from the the $J = 60m/K = 48m$ strategy followed closely by the $J = 60m/K = 60m$ strategy. The momentum returns increase significantly when either the holding period or the ranking period is extended. For every holding period, the strategies with the ranking period of 60 months generate highest momentum returns. Similarly, for every ranking period, the strategies with the holding period of 48 months generate the highest momentum returns. The results for strategies based on the subset of stocks without the mining sector (see Table 3 Panel B) are consistent with the pattern observed from the intermediate-term strategies. It is suggested that as the mining sector undermines the performance of momentum strategies, investors seeking to benefit from the momentum in Australia would be better off investing in the non-mining sectors. Overall, our results do not support the argument of De Bondt and Thaler (1985, 1987) and Schiereck et al. (1999) that investor's overreaction to recent past events can lead to long-term

[12]Results are available upon request.

contrarian returns. In fact, our results indicate that the long-run tendency toward reversal of trends does not exist in the Australian equity market, and therefore the contrarian strategies are not viable in Australia over long-term investment horizons of at least 2 to 5 years.

[Insert Table 3 here]

While the contrarian strategies prevail in the short-term investment horizons, the momentum strategies dominate in the intermediate- and long-term horizons. The best returns for short-term, intermediate- and long-term investment horizons arise from the $J = 1w/K = 1w$ contrarian strategy , the $J = 9m/K = 6m$ and the $J = 60m/K = 48m$ momentum strategies, respectively. Although not reported in this study[13], the results for the robustness test in which stocks with average MV below \$50 million are removed in the ranking period show that short-term contrarian returns are lower than reported in table 1 but still very significant while intermediate and long-term momentum returns improved than reported in tables 2 and3. Our results confirm the findings of Jegadeesh (1990) and Lehmann (1990) that losers over the past one week to one month outperform winners over the next one week to one month. Our findings are consistent with those in Jegadeesh and Titman (1993) that return continuations occur in intermediate horizons (3-12 months). However, we show that from 1992 to 2011 the Australian market does not have a long-run tendency toward reversal of trends which have been observed in other developed markets (for evidence in the US market see De Bondt and Thaler (1985, 1987); Conrad and Kaul (1998); Wu (2002); Yao (2012); and Schiereck et al. (1999) and Chin et al. (2002) for the German and New Zealand markets respectively). Instead, we find that return continuations persists strongly in the long-run with momentum returns accelerating when the ranking and/or holding periods are extended from 2 to 5 years.

The investigation of trading strategies without mining stocks provide insightful information about the role of the mining sector in the Australian market. We find that unlike the U.S. momentum returns, which are driven by extraordinary performance of high-tech and telecom stocks during the late 1990s (e.g., Jegadeesh and Titman, 2001; Hwang and Rubesam, 2008), the performance of momentum and contrarian strategies in the Australian equity market is significantly influenced by the mining stocks. In particular, these stocks undermine the performance of the intermediate- and long-term momentum strategies while enhancing the performance of the short-term contrarian strategies.

3.1. Can momentum and contrarian strategies outperform the Australian market benchmark?

The persistence of short-term contrarian strategies and intermediate- and long-term momentum strategies in the Australian market from 1992 to 2011 prompt us to seek evidence of whether these strategies significantly outperform the broad market index. In Table 4, we investigate the significance of the abnormal return (AR), defined as the difference in returns between the zero-investment portfolio and the ASX300 market index. We examine the period from Dec 1992 to Aug 2011 as well as the four equal sub-periods: (*i*) Dec 1992 to Mar 1997, (*ii*) Apr 1997 to Jan 2002, (*iii*) Feb 2002 to Oct 2006 and (*iv*) Nov 2006 to Aug 2011. While periods

[13]Results are available if requested

(i) and (ii) are characterised by the Asian Financial Crisis and Dot-com Bubble respectively, period (iv) is characterised by the GFC and the European debt crisis.

We observe that all short-term contrarian strategies significantly outperform the market in all four sub-periods as well as the full period. The highest AR in each period is consistently generated by the $J = 1w/K = 1w$ contrarian strategy. Among the four sub-periods, the contrarian strategies perform best in period (iv) in every strategy and least in period (i) in 26 out of 36 strategies. For longer holding periods, as the ranking period increases the least successful strategies appear to shift from period (i) to period (iii). Our result is consistent with the suggestion made by Jegadeesh and Titman (2011) proposing that the market behaviour after the GFC is, to some extent, similar to the strong market recovery in 1933 which follows a market crash in the Great Depression. During this recovery period, the contrarian strategies have the largest gains. In contrast with the findings of De Bondt and Thaler (1987) and Chopra et al. (1992) who suggest that the contrarian portfolio has a considerably higher up-market than down-market beta, we observe more diverse beta values for short-term contrarian strategies and more concentrated (around one) betas for longer term momentum strategies (see Figure 6). Overall, our results indicate that when the market experiences a sharp reversal after the crisis, contrarian strategies will generate significant gains.

[Insert Table 4 here]

In Table 5 Panel A we present the ARs of the intermediate-term momentum strategies. Comparing performances of these strategies across the four sub-periods, we observe that only 7 strategies generate positive ARs and all of them are in period (iv). On the other hand, the least successful strategies appear in period (i). For longer holding periods, as the ranking period increases the least successful strategies appear to shift from period (i) to period (ii). These returns, however, are not statistically significant. Likewise, none of the momentum strategies earns statistically significant positive ARs in the full period from Dec 1992 to Aug 2011. We conclude that, although there is strong evidence that the momentum strategies are profitable in Australia for the intermediate investment horizons, they do not outperform the buy-and-hold strategy of investing in the market index during the same period.

As the Australian market is one of the few markets in the world in which momentum strategies prevail in the long-term, we further test if these strategies outperform the market and report the results in Panel B of Table 5.[14] There are only three strategies generating positive ARs with the highest of 0.10% per month (1.20% per year), offered both by the $J = 60m/K = 36m$ and the $J = 60m/K = 48m$ strategies. Similar to the patterns observed in the intermediate-term horizons, none of these strategies is able to beat the simple buy-and-hold strategy of investing in the market index in the period from Dec 1992 to Aug 2011. Nevertheless, we observe that the performance of the momentum strategies relative to the market index is improved, as evidenced by the monotonic increase in ARs once the ranking or holding period is extended.

In Figure 2 zero-investment portfolio cumulative returns are compared to the market index. We

[14] Due to the potential bias caused by small sample size, we omit the sub-periods from investigation.

observe that the short-term contrarian strategy results in significant positive returns over the 20 years, beating the market 50 times. Consistent with results in Table 4, the short term contrarian strategy, when implemented in Dec 1992 and rolled over to Aug 2011, consistently outperforms the market index. The average return on this strategy is 33.4 times the market average return (equivalently, a \$1 invested in the short-term contrarian portfolio will return \$55.93 after 20 years while the same investment in the market index will return \$2.64). The overall evidence indicates that the short-term contrarian strategies are significantly more profitable than the simple buy-and-hold strategy of investing in the market index over time. On the other hand, the intermediate-term and long-term momentum strategies work well in generating significant positive returns but they do not outperform the market index. We also find that both short-term contrarian and intermediate-term strategies tend to perform best in period (iv) and least in period (i).

[Insert Figure 2 here]

3.2. Industry Effects

The study of Moskowitz and Grinblatt (1999) suggests that industry is a primary driving factor of momentum while Grundy and Martin (2001) argue that the industry effect is not the primary cause of the momentum phenomenon. Our results in Tables 1 to 3 suggest that the mining sector plays an important role in determining the success of trading strategies in the Australian market. Therefore, we further extend this analysis to investigate the impacts of Australian industries, namely Oil and Gas, Basic Materials, Industrials, Consumer Goods, Health Care, Consumer Services, Telecommunications, Utilities, Financials and Technology, to our trading strategies. In particular, we examine time-series industry compositions of the three most successful contrarian and momentum strategies from 1992 to 2011.

[Insert Figure 3 here]

Figure 3 displays the industry compositions of winner and loser portfolios of $J = 1w/K = 1w$, $J = 9m/K = 6m$ and $J = 60m/48m$ strategies. As the industry compositions of winner and loser portfolios of the $J = 1w/K = 1w$ strategy are relatively similar over time, we argue that the industry effect has little impact on the stock composition of this strategy. We do observe that the largest portion of both the winner and loser portfolios consists of stocks in Basic Materials. We reach the same conclusion with other short-term profitable contrarian strategies in Table 1. Furthermore, we notice that these compositions show insignificant changes following major market wide events, such as the 1997 Asian Financial Crisis, the 2001 Dot-com Bubble, the 2007-2008 Global Financial Crisis and the 2010-2011 European Debt Crisis.

In contrast, the industry composition of the $J = 9m/K = 6m$ strategy tells a different story. Despite comprising around one-third of total stocks in the market, the percentage of Basic Materials in the winner portfolio shrinks to its minimum during the 1998-1999 and 2009-2010 periods, which coincide with the post Asian and Global Financial Crises. Between these two periods, Basic Materials expand rapidly to nearly 75% of total winner stocks at the end of 2008. Comprising approximately 15% of traded securities in the markets, Financials perform best in the intermediate-term investment horizons in 1996 and the 1998-1999 periods, which

coincide with the period preceding the Asian Financial Crisis and the recovery process post the Crisis. The portion of the Financials in the loser portfolio expanded significantly following the Global Financial Crisis. As expected, the percentage of technology stocks in the loser portfolio is highest during the 2001-2003 period, corresponding to the burst of the Dot-com Bubble.

While Basic Materials dominates other industries in the winner portfolio in the short-term $J = 1w/K = 1w$ and intermediate-term $J = 9m/K = 6m$ strategies, they make up the largest portion of the loser stocks in the long-term $J = 60m/48m$, especially during the 2001-2006 period. Since 2007, their share in the winner portfolio accumulates rapidly to almost half of the portfolio in 2011, replacing Consumer Goods and Health Care. Throughout the period, Financials consistently dominate in the winner portfolio while Technology stocks tend to persist strongly in the loser portfolio of these strategies.

3.3. Size Effects

[Insert Figure 4 here]

We examine the impacts of size on the most profitable momentum and contrarian strategies in Figure 4. The presence of large capitalization stocks in winner portfolios (left panels in Figure 4) is more pronounced compared to that in the loser portfolios (right panels) especially for larger J. In Figure 4 Panel C, the largest stocks dominate in the winner portfolio while the smallest stocks characterise the loser portfolio in the long-term $J = 60m/48m$ strategy. This pattern upholds in the intermediate $J = 9m/K = 6m$ strategy. Our findings do not support the conclusion made by Rouwenhorst (1999) for emerging markets where it was shown that small stocks outperform large stocks. However, the pattern is less pronounced in the short term $J = 1w/K = 1w$ strategy. Overall, our results show that smallest and largest stocks are prevailing in the loser and winner portfolios respectively in strategies of all investment horizons, with a more pronounced effect in the longer term. This implies that the strategies are sensitive to size. Overall, our results suggest that while size is an important factor in explaining the success of momentum strategies in intermediate- and long-term horizons, its effect is lessened in short-term contrarian strategies.

3.4. Value Effects

[Insert Figure 5 here]

Similar to the analysis of size impact, we investigate whether price-to-book values (PTBVs) differ between winner and loser portfolios. Figure 5 box-plots the distribution of PTBVs for each of the three selected strategies, contrasting the distribution of PTBVs between winner and loser portfolios. The composition of the portfolio depends solely on the formation period (ranking period J) and the distribution of its PTBVs is presented using box plot for each point in time with weekly (for short-term) and monthly (for intermediate- and long-term) rolling windows. On each box, the central mark is the median, the bold edges are the 25th and 75th percentiles, the whiskers extend to the most extreme data points not considered outliers, and outliers are plotted individually (in red). Horizontal dashed lines mark plotting limits. Points outside these limits are compressed but retained the relative order.

Overall, we observe no particular pattern discerning loser from winner portfolios when exam-

ining the PTBV distributions of these portfolios over time. Winner portfolios seem to have lower variance in the PTBV constituents, while the PTBVs of loser portfolio constituents seem to have a much wider spread. This is true for the short term and long term strategies but is the opposite for the intermediate term strategy.

4. Sources of momentum and contrarian profits

Our results in Section 3 indicate that momentum and contrarian strategies can be profitable at different investment horizons. We question if these profits are in fact a compensation for exposure to risk factors, implying zero risk-adjusted return, or persistent anomaly unexplained by standard return-generating models. We use the RW, the CAPM and the FF models to test if the momentum and contrarian returns of the three most profitable strategies, the short-term contrarian ($J = 1w/K = 1w$), intermediate-term momentum ($J = 9m/K = 6m$) and long-term momentum ($J = 60m/K = 48m$), can be explained within these models. We employ a non-parametric approach to check the robustness of our regression results. We follow Efron and Tibshirani (1993), Karolyi and Kho (2004) and Muga and Santamaria (2007) in applying a model-based bootstrap simulation procedure to test if the return-generating models are able to explain the returns of our successful strategies. If these models can generate simulated returns as large as the actual returns from these strategies then excess returns from these strategies are simply explained by the risk factors in these models.

4.1. Explaining momentum/contrarian return using asset pricing models

[Insert Table 6 here]

Table *6* shows that the RW model can neither explain contrarian or momentum returns nor the winner or loser returns in all three strategies. When the market factor is included in the model, it does not explain the short-term contrarian returns (LW) but does explain the winner and loser portfolio returns. On the other hand, the market factor plays a significant role in explaining momentum returns (WL) as well as the returns on the winner and loser portfolios in the intermediate- and long-term horizons. However, the significance of the momentum or contrarian alphas (intercepts) in every regression suggests that the inclusion of the market factor alone cannot fully characterise the momentum or contrarian returns.

Based on our conclusion from Sections 3.3 and 3.4 and following Fama and French (1992), we include the SMB and HML factors to test if it helps explain patterns of momentum and contrarian returns. Firstly, we observe that the significance of the market factor, in the presence of the size and value factors, is consistent with the results obtained from the RW model for all strategies. Secondly, while the size factor is found significant for all three strategies, the value factor plays a significant explanatory role for the short-term contrarian strategy only. This is consistent with the observation in 3.4 that PTBV has limited influences on the constitution of winner and loser portfolios over time. Lastly, although the Fama-French factors are statistically significant in explaining patterns of contrarian returns, the significance of the regression alphas generated from the FF model seems to suggest that the model does not fully characterise the time-series contrarian returns. Likewise, the significance of the intercepts for the intermediate- and long-term momentum suggests similar conclusions. Our results with non-mining stocks

confirm the results obtained for all stocks. We further test the appropriateness of these models to explain patterns of the returns in the bootstrap simulation in Table 7.

4.2. Bootstrap tests

Traditional asset pricing models assume that the disturbance term in the model is normal, an assumption that may not necessarily hold in our sample. If the assumption does not hold, standard errors of the t-tests may result in inaccurate statistical inference. To address this issue we use a bootstrap method to generate standard errors from the empirical distribution of the fitted residuals. This bootstrap method allows us to generate simulated returns from a specified model. Therefore, one way to test if a model can fully characterise an asset return is to test if the model can generate simulated returns mimicking the characteristics of the asset's actual return. We implement the bootstrap procedure outlined in Efron and Tibshirani (1993) to assess the performance of the RW, CAPM and FF models in generating simulated returns as large as the actual momentum and contrarian returns.

[Insert Table 7 here]

Table 7 shows the results of the standard and block bootstrap tests for the three best performing strategies based on the sample of all available stocks and when the mining sector is excluded. Simulated return (*Sim.return*) is the average return of the 5,000 simulated excess returns under the null hypothesis that a return-generating model completely explains excess momentum and contrarian returns. Simulated p-value is the percentage of simulated excess returns that are more (less) than the actual excess return from the strategy. The simulated returns from the standard and block-bootstrap tests show that none of these three models can generate the excess return as large as the actual excess return in any strategies considered. This is further confirmed by the simulated p-values which show that the range of the simulated returns generated from these models under the null hypothesis does not cover the actual return of the strategies, except for the winner portfolio of the $J = 9m/K = 6m$ momentum strategy under the standard bootstrap on the RW model. Its simulated p-values of 0.1414 implies that there is 14.14% chance the RW model will generate a simulated return as large as the actual return. However, the block-bootrap simulated p-values shows that this chance is in fact 0%. Further comparison between the performance of these models on non-mining stocks confirms our conclusion that none of these models are able to characterise the momentum or contrarian returns efficiently.

5. Conclusion

Returns from momentum and contrarian strategies have been one of the most persistent anomalies challenging the efficient market hypothesis.[15] These phenomena have been consistently reported in the US market as well as markets around the world. In this paper, we show that Australian investors in the period from Dec 1992 to Aug 2011 can benefit from implementing concurrent momentum and contrarian strategies by forming portfolios with various

[15]While the momentum is undoubtedly a market anomaly, the long-term contrarian effect is often viewed as a consequence of a firm's business cycle. The short-term contrarian effect can then be viewed as an anomaly stemming from investors' expectational errors.

ranking and holding periods. The contrarian strategies work well in the short-term investment horizons: we find that the $J = 1w/K = 1w$ strategy outperforms the simple buy-and-hold strategy of investing in the market index as much as 33.4 times. The momentum strategies dominate in both the intermediate- and long-term horizons, contradicting long-run tendency toward reversal of price trends observed in other developed markets. Although these momentum strategies work well in generating significant positive returns, they do not outperform the buy-and-hold strategy. Further investigation into the strategy composition shows that mining stocks undermine the performance of the intermediate- and long-term momentum strategies while enhancing the performance of the short-term contrarian strategies. Understanding this characteristic of the momentum and contrarian phenomena in the Australian market allows investors to maximise their strategy returns by choosing to exclude or retain mining stocks when forming momentum or contrarian portfolios.

Our investigation of fundamental factors that may constitute momentum and contrarian portfolios shows industry and market value may play an important role in forming loser and winner portfolios. We find that PTBVs have no distinct characteristics in either of the two portfolios across all investment horizons. Our regression analysis on sources of momentum and contrarian returns show that standard asset pricing models such as the RW, the CAPM and the FF models are limited in explaining the return anomalies. While there is some evidence suggesting the significance of the CAPM to explain momentum returns and of the FF model to explain contrarian returns, the bootstrap and block-bootstrap results show that none of these models successfully generate simulated returns mimicking the characteristics of the actual returns obtained from these strategies. This leads us to conclude that momentum and contrarian returns being the long standing anomalies in markets around the world, continue to persist strongly in the Australian market and defy fundamental explanations.

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Figure 1: Market Value and the total number of stocks available when forming trading strategies. A total of 2,234 common stocks were listed on the Australian Securities Exchange (ASX) at any time from December 1992 to August 2011. Stocks delisted during the ranking period are not considered whereas stocks delisted during the holding period are included in calculating the portfolio returns with the risk-free rate replacing the data from the moment of delisting to the end of the holding period. The number of stocks in the figure is obtained using ranking period $J = 1$ month. The market value is expressed in millions of AUD.

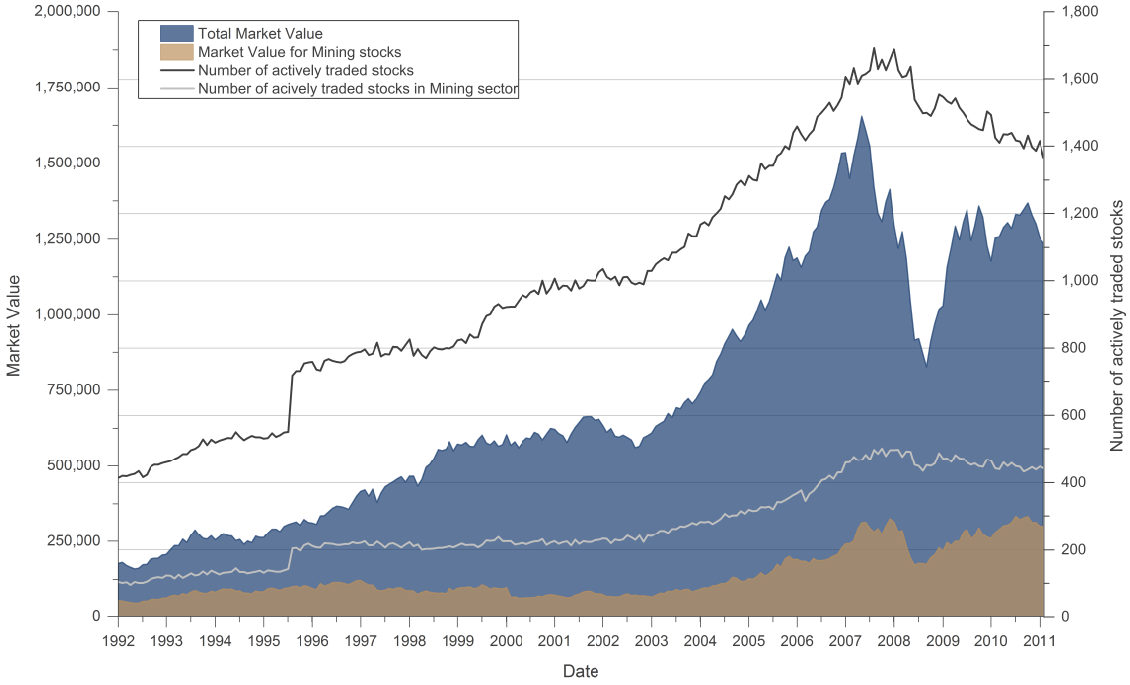


Figure 2: CUMULATIVE RETURNS OF MOMENTUM AND CONTRARIAN STRATEGIES. Figures below present cumulative returns for the $J = 1w/K = 1w$ contrarian (top panel), $J = 9m/K = 6m$ momentum (center panel) and $J = 60m/K = 48m$ momentum (bottom panel) strategies. Market cumulative returns (dashed lines) are provided as a benchmark in each of the three panels below.

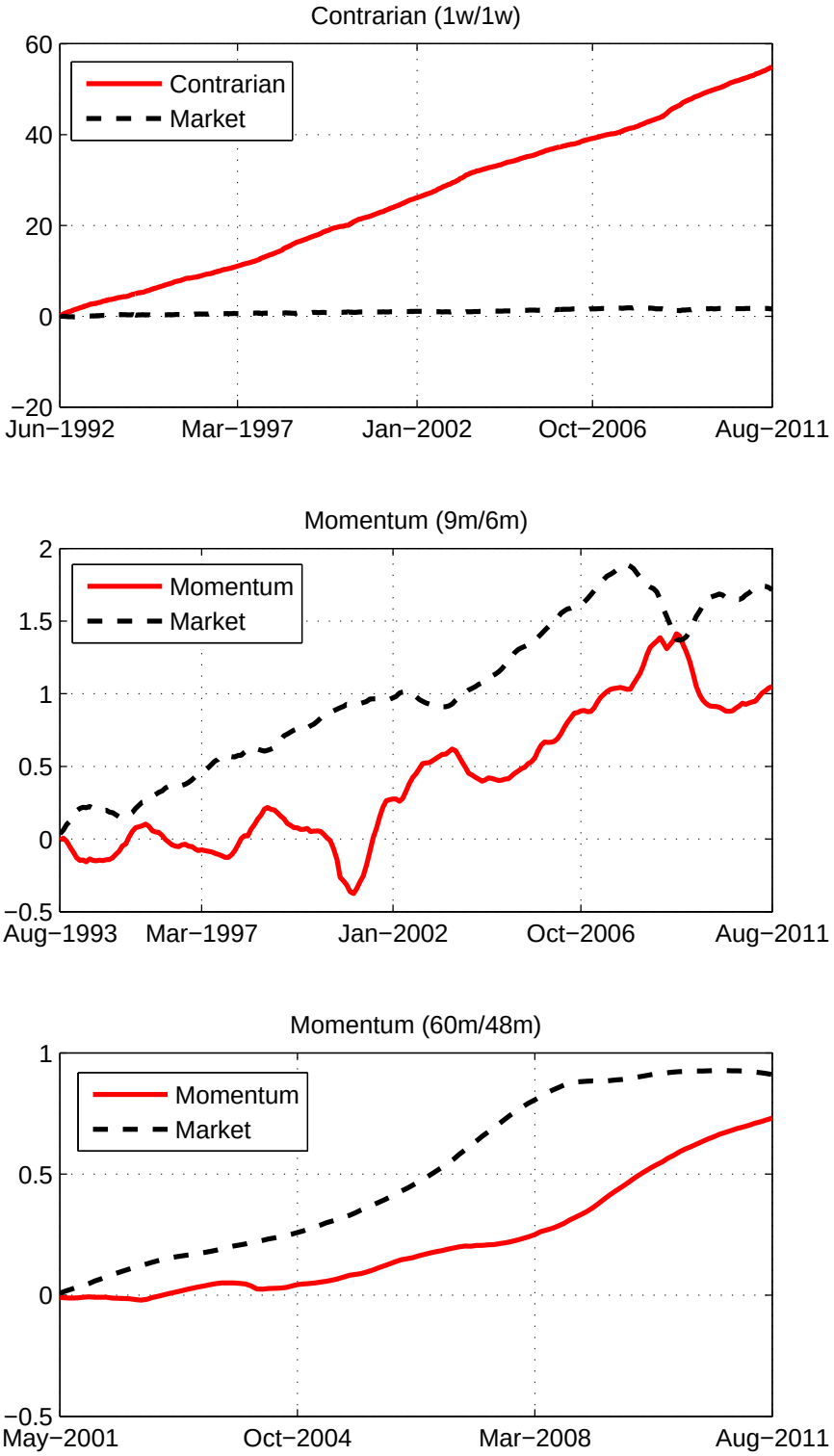


Table 1: Short-term Contrarian Strategies in the Australian market from 1992 to 2011. This table reports weekly returns of winner, loser and zero-investment contrarian portfolios. t-statistics are reported in parenthesis. The results for the sample including all stocks are reported in Panel A; results for the sample of firms that excludes the mining sector are reported in Panel B.

Rank Period (J weeks)		**Holding Period (K weeks)**											
		Panel A: All stocks						Panel B: Without mining stocks					
	Portfolio	K=1	K=2	K=3	K=6	K=9	K=12	K=1	K=2	K=3	K=6	K=9	K=12
J=1	Winner	-0.0248	-0.0162	-0.0121	-0.0074	-0.0056	-0.0046	-0.0223	-0.0144	-0.0111	-0.0070	-0.0056	-0.0046
		(-21.95)**	(-19.86)**	(-16.86)**	(-12.98)**	(-11.27)**	(-10.41)**	(-21.14)**	(-19.19)**	(-16.88)**	(-13.35)**	(-12.26)**	(-11.26)**
J=1	Loser	0.0300	0.0165	0.0105	0.0042	0.0020	0.0008	0.0261	0.0141	0.0089	0.0031	0.0010	-0.0001
		(28.81)**	(19.69)**	(14.59)**	(7.36)**	(3.86)**	(1.76)	(25.61)**	(17.44)**	(12.99)**	(5.76)**	(2.14)*	(-0.27)
J=1	Loser-Winner	0.0547	0.0327	0.0226	0.0116	0.0075	0.0054	0.0484	0.0285	0.0200	0.0101	0.0066	0.0045
		(56.62)**	(50.61)**	(45.44)**	(35.73)**	(29.08)**	(25.31)**	(48.97)**	(42.89)**	(39.77)**	(30.07)**	(24.81)**	(20.06)**
J=2	Winner	-0.0218	-0.0144	-0.0107	-0.0068	-0.0051	-0.0042	-0.0197	-0.0132	-0.0100	-0.0065	-0.0051	-0.0042
		(-20.54)**	(-18.21)**	(-15.40)**	(-12.12)**	(-10.50)**	(-9.79)**	-19.98	(-18.24)**	(-15.66)**	(-12.67)**	(-11.38)**	(-10.64)**
J=2	Loser	0.0272	0.0152	0.0098	0.0041	0.0019	0.0007	0.0235	0.0129	0.0081	0.0028	0.0009	-0.0002
		(24.44)**	(17.74)**	(13.19)**	(6.91)**	(3.62)**	(1.60)	(21.35)**	(15.51)**	(11.27)**	(5.02)**	(1.84)	(-0.57)
J=2	Loser-Winner	0.0490	0.0296	0.0205	0.0108	0.0070	0.0050	0.0432	0.0261	0.0181	0.0093	0.0060	0.0040
		(46.77)**	(42.90)**	(36.89)**	(29.18)**	(23.92)**	(20.90)**	(40.50)**	(37.30)**	(32.25)**	(24.83)**	(20.31)**	(16.16)**
J=3	Winner	-0.0188	-0.0125	-0.0095	-0.0061	-0.0047	-0.0038	-0.0176	-0.0119	-0.0092	-0.0061	-0.0048	-0.0039
		(-17.87)**	(-16.19)**	(-13.81)**	(-11.07)**	(-9.77)**	(-8.97)**	(-17.94)**	(-16.71)**	(-14.86)**	(-12.17)**	(-10.97)**	(-9.97)**
J=3	Loser	0.0246	0.0140	0.0092	0.0037	0.0016	0.0005	0.0213	0.0119	0.0075	0.0025	0.0006	-0.0005
		(21.98)**	(16.09)**	(12.26)**	(6.31)**	(3.02)**	(1.00)	(19.22)**	(14.19)**	(10.36)**	(4.49)**	(1.17)	(-1.24)
J=3	Loser-Winner	0.0434	0.0265	0.0187	0.0098	0.0063	0.0043	0.0389	0.0238	0.0167	0.0086	0.0054	0.0034
		(42.19)**	(38.00)**	(33.44)**	(25.79)**	(21.25)**	(17.35)**	(36.33)**	(33.70)**	(29.75)**	(22.39)**	(18.02)**	(13.14)**
J=6	Winner	-0.0141	-0.0096	-0.0075	-0.0049	-0.0037	-0.0030	-0.0132	-0.0092	-0.0073	-0.0050	-0.0038	-0.0030
		(-13.50)**	(-12.54)**	(-11.01)**	(-9.07)**	(-7.83)**	(-7.18)**	(-13.68)**	(-13.17)**	(-11.84)**	(-9.95)**	(-8.68)**	(-7.76)**
J=6	Loser	0.0194	0.0113	0.0075	0.0030	0.0011	0.0001	0.0159	0.0089	0.0057	0.0019	0.0000	-0.0010
		(17.20)**	(12.84)**	(9.94)**	(5.01)**	(2.07)*	(0.17)	(14.31)**	(10.49)**	(7.74)**	(3.25)**	(-0.02)	(-2.23)*
J=6	Loser-Winner	0.0334	0.0209	0.0150	0.0079	0.0048	0.0031	0.0291	0.0181	0.0130	0.0068	0.0038	0.0021
		(32.91)**	(30.26)**	(27.27)**	(20.20)**	(15.32)**	(11.97)**	(27.90)**	(25.81)**	(23.07)**	(17.17)**	(11.86)**	(7.64)**
J=9	Winner	-0.0115	-0.0079	-0.0061	-0.0039	-0.0029	-0.0025	-0.0113	-0.0080	-0.0063	-0.0040	-0.0029	-0.0024
		(-10.86)**	(-10.25)**	(-8.88)**	(-6.99)**	(-6.06)**	(-5.76)**	(-11.67)**	(-11.39)**	(-9.97)**	(-7.79)**	(-6.64)**	(-6.10)**
J=9	Loser	0.0163	0.0095	0.0063	0.0022	0.0005	-0.0004	0.0137	0.0076	0.0048	0.0011	-0.0005	-0.0014
		(14.43)**	(10.83)**	(8.28)**	(3.72)**	(0.92)	(-0.78)	(12.36)**	(8.97)**	(6.46)**	(1.92)	(-1.08)	(-3.10)**
J=9	Loser-Winner	0.0277	0.0174	0.0124	0.0061	0.0034	0.0021	0.0250	0.0156	0.0110	0.0051	0.0024	0.0010
		(26.57)**	(24.65)**	(21.74)**	(14.54)**	(10.20)**	(7.51)**	(24.23)**	(22.20)**	(19.39)**	(12.07)**	(7.15)**	(3.57)**
J=12	Winner	-0.0094	-0.0064	-0.0048	-0.0031	-0.0024	-0.0021	-0.0091	-0.0063	-0.0048	-0.0030	-0.0022	-0.0019
		(-9.04)**	(-8.34)**	(-6.96)**	(-5.53)**	(-5.02)**	(-4.94)**	(-9.49)**	(-8.99)**	(-7.66)**	(-5.87)**	(-5.15)**	(-4.89)**
J=12	Loser	0.0140	0.0083	0.0055	0.0017	0.0002	-0.0005	0.0114	0.0063	0.0038	0.0005	-0.0009	-0.0016
		(12.65)**	(9.48)**	(7.27)**	(2.79)**	(0.34)	(-1.09)	(10.50)**	(7.41)**	(5.11)**	(0.84)	(-1.76)	(-3.52)**
J=12	Loser-Winner	0.0235	0.0147	0.0103	0.0048	0.0026	0.0016	0.0205	0.0126	0.0086	0.0035	0.0014	0.0003
		(22.94)**	(20.88)**	(17.66)**	(11.12)**	(7.53)**	(5.51)**	(20.32)**	(18.09)**	(14.87)**	(7.97)**	(3.91)**	(1.02)

* and ** denote 5% and 1% significance levels respectively.

Table 2: Intermediate-term Momentum Strategies in the Australian market from 1992 to 2011. This table reports monthly returns of winner, loser and zero-investment momentum portfolios. t-statistics are reported in parenthesis. The results for the sample including all stocks are reported in Panel A; results for the sample of firms that excludes the mining sector are reported in Panel B.

Rank Period (J months)		**Holding Period (K months)**							
		Panel A: All stocks				Panel B: Without mining stocks			
	Portfolio	K=3	K=6	K=9	K=12	K=3	K=6	K=9	K=12
J=3	Winner	-0.0083	-0.0066	-0.0058	-0.0062	-0.0076	-0.0057	-0.0052	-0.0055
		(-2.16)*	(-2.29)*	(-2.38)*	(-2.96)**	(-2.14)*	(-2.20)*	(-2.33)*	(-2.82)**
J=3	Loser	-0.0029	-0.0069	-0.0078	-0.0087	-0.0079	-0.0114	-0.0112	-0.0115
		(-0.66)	(-1.95)*	(-2.61)**	(-3.35)**	(-1.94)	(-3.44)**	(-3.95)**	(-4.61)**
J=3	Winner-Loser	-0.0054	0.0002	0.002	0.0025	0.0003	0.0057	0.0060	0.0060
		(-1.98)*	(0.11)	(1.17)	(1.63)	(0.12)	(2.83)**	(3.46)**	(3.90)**
J=6	Winner	-0.006	-0.0058	-0.0061	-0.0077	-0.0047	-0.0045	-0.0047	-0.0063
		(-1.60)	(-2.08)*	(-2.60)**	(-3.70)**	(-1.38)	(-1.79)	(-2.17)*	(-3.26)**
J=6	Loser	-0.0053	-0.009	-0.0099	-0.0101	-0.0109	-0.0131	-0.0130	-0.0128
		(-1.19)	(-2.55)**	(-3.30)**	(-3.87)**	(-2.55)**	(-3.89)**	(-4.48)**	(-5.04)**
J=6	Winner-Loser	-0.0007	0.0031	0.0037	0.0023	0.0061	0.0086	0.0083	0.0065
		(-0.25)	(1.50)	(2.07)*	(1.49)	(2.11)*	(4.10)**	(4.47)**	(4.05)**
J=9	Winner	-0.0052	-0.0061	-0.0076	-0.0095	-0.0035	-0.0043	-0.0060	-0.0079
		(-1.40)	(-2.22)*	(-3.15)**	(-4.36)**	(-1.09)	(-1.77)	(-2.77)**	(-3.95)**
J=9	Loser	-0.0081	-0.011	-0.0108	-0.0105	-0.0122	-0.0142	-0.0137	-0.0132
		(-1.82)	(-3.17)**	(-3.72)**	(-4.22)**	(-2.88)**	(-4.27)**	(-4.85)**	(-5.40)**
J=9	Winner-Loser	0.0029	0.0048	0.0033	0.0011	0.0087	0.0099	0.0077	0.0053
		(1.03)	(2.35)*	(1.85)	(0.73)	(3.12)**	(4.71)**	(4.30)**	(3.57)**
J=12	Winner	-0.0062	-0.0083	-0.0098	-0.0114	-0.0040	-0.0061	-0.0076	-0.0093
		(-1.70)	(-3.06)**	(-4.09)**	(-5.21)**	(-1.20)	(-2.47)**	(-3.47)**	(-4.60)**
J=12	Loser	-0.0097	-0.0112	-0.0107	-0.0103	-0.0131	-0.0144	-0.0134	-0.0124
		(-2.26)*	(-3.30)**	(-3.83)**	(-4.36)**	(-3.19)**	(-4.40)**	(-4.92)**	(-5.36)**
J=12	Winner-Loser	0.0035	0.0028	0.0009	-0.0011	0.0091	0.0083	0.0058	0.0031
		(1.30)	(1.41)	(0.54)	(-0.72)	(3.29)**	(3.90)**	(3.30)**	(2.09)*

* and ** denote 5% and 1% significance levels respectively.

Table 3: Long-term Momentum Strategies in the Australian market from 1992 to 2011. This table reports monthly returns of winner, loser and zero-investment momentum portfolios. t-statistics are reported in parenthesis. The results for the sample including all stocks are reported in Panel A; results for the sample of firms that excludes the mining sector are reported in Panel B.

Rank Period (J months)		**Holding Period (K months)**							
		Panel A: All stocks				Panel B: Without mining stocks			
	Portfolio	K=24	K=36	K=48	K=60	K=24	K=36	K=48	K=60
J=24	Winner	-0.0107	-0.0102	-0.0090	-0.0079	-0.0096	-0.0089	-0.0076	-0.0061
		(-6.70)**	(-8.99)**	(-10.53)**	(-10.56)**	(-6.34)**	(-7.99)**	(-9.01)**	(-8.61)**
J=24	Loser	-0.0082	-0.0105	-0.0103	-0.0091	-0.0092	-0.0111	-0.0109	-0.0099
		(-6.04)**	(-14.30)**	(-16.72)**	(-16.55)**	(-6.61)**	(-13.52)**	(-15.55)**	(-16.22)**
J=24	Winner-Loser	-0.0025	0.0004	0.0013	0.0013	-0.0004	0.0022	0.0033	0.0038
		(-2.58)**	(0.42)	(1.71)	(1.69)	(-0.36)	(2.49)**	(4.41)**	(5.39)**
J=36	Winner	-0.0092	-0.0086	-0.0071	-0.0065	-0.0076	-0.0071	-0.0056	-0.0050
		(-6.22)**	(-8.27)**	(-9.45)**	(-9.84)**	(-5.58)**	(-7.09)**	(-7.91)**	(-8.91)**
J=36	Loser	-0.0088	-0.0108	-0.0100	-0.0091	-0.0091	-0.0113	-0.0109	-0.0102
		(-6.24)**	(-13.17)**	(-14.83)**	(-15.52)**	(-6.31)**	(-12.63)**	(-14.73)**	(-16.46)**
J=36	Winner-Loser	-0.0004	0.0021	0.0029	0.0026	0.0016	0.0042	0.0053	0.0052
		(-0.45)	(3.01)**	(4.49)**	(3.99)**	(1.82)	(6.87)**	(10.54)**	(10.42)**
J=48	Winner	-0.0081	-0.0073	-0.0062	-0.0053	-0.0064	-0.0058	-0.0049	-0.0042
		(-5.61)**	(-7.19)**	(-8.44)**	(-8.17)**	(-5.01)	(-6.08)**	(-7.50)**	(-7.66)**
J=48	Loser	-0.0095	-0.0110	-0.0106	-0.0094	-0.0100	-0.0119	-0.0119	-0.0108
		(-6.46)**	(-12.11)**	(-14.76)**	(-14.74)**	(-6.58)**	(-12.24)**	(-15.62)**	(-17.14)**
J=48	Winner-Loser	0.0014	0.0036	0.0044	0.0040	0.0037	0.0061	0.0070	0.0067
		(1.75)	(5.49)**	(7.41)**	(6.54)**	(4.54)**	(11.33)**	(15.39)**	(13.90)**
J=60	Winner	-0.0057	-0.0056	-0.0045	-0.0031	-0.0045	-0.0047	-0.0037	-0.0025
		(-4.10)**	(-5.69)**	(-6.26)**	(-5.33)**	(-3.53)**	(-4.98)**	(-5.46)**	(-4.51)**
J=60	Loser	-0.0088	-0.0111	-0.0104	-0.0088	-0.0100	-0.0124	-0.0120	-0.0105
		(-5.83)**	(-11.29)**	(-13.70)**	(-13.74)**	(-6.34)**	(-12.16)**	(-15.26)**	(-17.52)**
J=60	Winner-Loser	0.0032	0.0054	0.0059	0.0057	0.0055	0.0078	0.0083	0.0081
		(3.84)**	(9.00)**	(11.58)**	(11.81)**	(6.37)**	(13.36)**	(17.78)**	(18.69)**

* and ** denote 5% and 1% significance levels respectively.

Table 4: Abnormal returns of short-term contrarian strategies. This table reports monthly abnormal returns of the short-term contrarian portfolios for the full period as well as the four subperiods when companies from all industries are available. t-statistics are reported in parenthesis. Abnormal returns are defined as the difference in returns between the zero-investment portfolios and the market index.

Strategy	Periods					Strategy	Periods				
Weekly (J,K)	Dec1992 - Mar 1997	Apr1997 - Jan 2002	Feb2002 – Oct 2006	Nov 2006 – Oct 2011	Dec1992 -Aug 2011	Weekly (J,K)	Dec1992 - Mar 1997	Apr1997 - Jan 2002	Feb2002 – Oct 2006	Nov 2006 – Oct 2011	Dec1992 -Aug 2011
(1,1)	0.0416	0.0577	0.0505	0.0628	0.0531	(6,1)	0.0262	0.0352	0.0286	0.0378	0.0318
	(20.16)**	(24.89)**	(26.88)**	(23.41)**	(46.16)**		(11.70)**	(12.87)**	(15.58)**	(14.83)**	(27.12)**
(1,2)	0.0249	0.0331	0.0297	0.0366	0.0311	(6,2)	0.0158	0.0213	0.0174	0.0232	0.0192
	(17.90)**	(21.27)**	(23.78)**	(19.64)**	(40.18)**		(11.44)**	(11.17)**	(13.77)**	(13.11)**	(24.27)**
(1,3)	0.0160	0.0225	0.0197	0.0257	0.0209	(6,3)	0.0110	0.0150	0.0114	0.0172	0.0133
	(15.27)**	(17.31)**	(20.16)**	(17.77)**	(34.43)**		(10.42)**	(9.39)**	(11.26)**	(11.94)**	(20.72)**
(1,6)	0.0079	0.0101	0.0088	0.0135	0.0100	(6,6)	0.0056	0.0074	0.0043	0.0087	0.0062
	(10.65)**	(11.17)**	(13.33)**	(13.38)**	(23.86)**		(6.88)**	(6.33)**	(6.37)**	(9.13)**	(13.71)**
(1,9)	0.0042	0.0060	0.0049	0.0088	0.0059	(6,9)	0.0024	0.0042	0.0014	0.0049	0.0030
	(7.06)**	(7.96)**	(9.77)**	(11.22)**	(17.64)**		(3.69)**	(4.39)**	(2.58)**	(7.10)**	(8.45)**
(1,12)	0.0021	0.0038	0.0030	0.0064	0.0037	(6,12)	0.0009	0.0026	-0.0002	0.0031	0.0014
	(4.01)**	(6.19)**	(6.95)**	(9.35)**	(13.13)**		1.68	(3.11)**	-0.52	(5.28)**	(4.49)**
(2,1)	0.0379	0.0502	0.0461	0.0556	0.0474	(9,1)	0.0223	0.0298	0.0228	0.0316	0.0260
	(17.68)**	(19.06)**	(23.91)**	(20.09)**	(39.35)**		(10.11)**	(10.21)**	(12.42)**	(12.52)**	(21.99)**
(2,2)	0.0219	0.0293	0.0275	0.0332	0.0280	(9,2)	0.0132	0.0185	0.0134	0.0195	0.0157
	(15.68)**	(16.44)**	(21.59)**	(17.22)**	(34.47)**		(9.19)**	(9.44)**	(10.71)**	(11.13)**	(19.65)**
(2,3)	0.0141	0.0197	0.0184	0.0235	0.0189	(9,3)	0.0093	0.0125	0.0087	0.0139	0.0107
	(12.57)**	(12.76)**	(18.34)**	(15.50)**	(28.62)**		(8.40)**	(7.53)**	(8.61)**	(9.70)**	(16.34)**
(2,6)	0.0071	0.0093	0.0084	0.0123	0.0092	(9,6)	0.0043	0.0057	0.0024	0.0064	0.0044
	(9.25)**	(8.64)**	(11.69)**	(12.16)**	(20.45)**		(5.12)**	(4.49)**	(3.40)**	(6.70)**	(9.28)**
(2,9)	0.0037	0.0057	0.0044	0.0079	0.0053	(9,9)	0.0014	0.0031	0.0000	0.0031	0.0016
	(6.03)**	(6.31)**	(8.42)**	(10.57)**	(15.09)**		(2.25)*	(2.97)**	(-0.06)	(4.35)**	(4.36)**
(2,12)	0.0019	0.0035	0.0025	0.0057	0.0032	(9,12)	0.0002	0.0013	-0.0012	0.0019	0.0003
	(3.65)**	(4.80)**	(5.60)**	(9.02)**	(11.18)**		(0.41)	(1.52)	(-2.51)**	(3.20)**	(1.01)
(3,1)	0.0336	0.0446	0.0400	0.0491	0.0417	(12,1)	0.0175	0.0245	0.0201	0.0266	0.0217
	(15.89)**	(16.78)**	(20.49)**	(18.76)**	(35.42)**		(8.10)**	(8.28)**	(10.65)**	(10.45)**	(18.43)**
(3,2)	0.0196	0.0264	0.0238	0.0300	0.0249	(12,2)	0.0112	0.0148	0.0115	0.0161	0.0130
	(14.65)**	(14.30)**	(18.20)**	(16.07)**	(30.94)**		(8.07)**	(7.18)**	(9.07)**	(9.20)**	(16.23)**
(3,3)	0.0131	0.0182	0.0161	0.0211	0.0170	(12,3)	0.0076	0.0103	0.0070	0.0111	0.0086
	(13.40)**	(11.53)**	(15.41)**	(14.14)**	(26.22)**		(7.12)**	(5.75)**	(6.75)**	(7.70)**	(12.93)**
(3,6)	0.0065	0.0085	0.0070	0.0112	0.0082	(12,6)	0.0031	0.0043	0.0014	0.0047	0.0030
	(8.82)**	(7.40)**	(9.91)**	(11.21)**	(18.00)**		(4.12)**	(3.21)**	(1.95)*	(4.77)**	(6.30)**
(3,9)	0.0031	0.0052	0.0036	0.0069	0.0046	(12,9)	0.0011	0.0018	-0.0007	0.0023	0.0008
	(5.27)**	(5.56)**	(6.92)**	(9.44)**	(12.98)**		(1.88)	(1.66)	(-1.19)	(3.19)**	(2.11)*
(3,12)	0.0013	0.0029	0.0017	0.0048	0.0026	(12,12)	0.0003	0.0001	-0.0017	0.0015	-0.0002
	(2.56)**	(3.81)**	(3.67)**	(7.73)**	(8.63)**		(0.67)	(0.09)	(-3.48)**	(2.42)*	(-0.77)

* and ** denote 5% and 1% significance levels respectively.

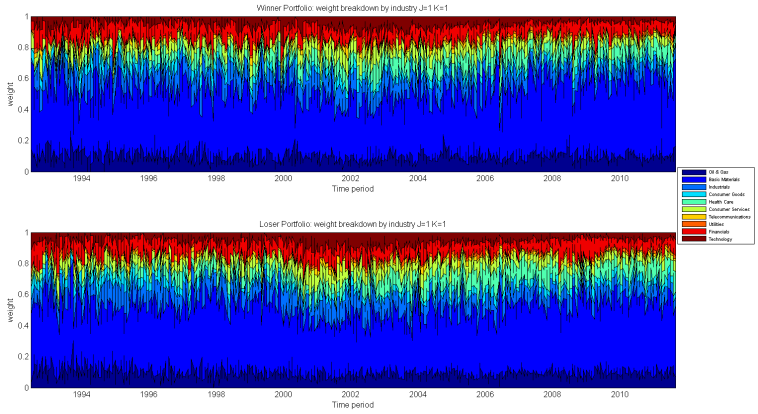
Table 5: Abnormal returns of intermediate- and long-term momentum strategies. This table reports monthly abnormal returns of the intermediate- and long-term portfolios for the full period as well as the four subperiods when companies from all industries are available. t-Statistics are reported in parenthesis. Abnormal returns are defined as the difference in returns between the zero-investment portfolios and the market index.

Panel A: Intermediate-term strategies						Panel B: Long-term strategies	
			Periods				Period
Strategy	Dec1992	Apr1997	Feb2002	Nov 2006	Dec1992	Strategy	Dec1992
Monthly (J,K)	- Mar 1997	- Jan 2002	– Oct 2006	– Oct 2011	-Aug 2011	Monthly (J,K)	-Aug 2011
(3,3)	-0.0265	-0.0116	-0.0095	-0.0038	-0.0136	(24,24)	-0.0082
	(-4.40)**	(-1.21)	(-2.59)**	(-0.49)	(-4.01)**		(-7.04)**
(3,6)	-0.0210	-0.0028	-0.0052	-0.0001	-0.0081	(24,36)	-0.0054
	(-4.47)**	(-0.38)	(-1.75)	(-0.01)	(-3.13)**		(-5.58)**
(3,9)	-0.0170	-0.0042	-0.0068	0.0004	-0.0064	(24,48)	-0.0047
	(-4.54)**	(-0.68)	(-2.81)**	(0.06)	(-2.96)**		(-5.42)**
(3,12)	-0.0164	-0.0079	-0.0079	0.0033	-0.0058	(24,60)	-0.0046
	(-4.80)**	(-1.36)	(-3.91)**	(0.57)	(-3.01)**		(-5.69)**
(6,3)	-0.0210	-0.0054	-0.0075	-0.0022	-0.0089	(36,24)	-0.0061
	(-2.92)**	(-0.53)	(-1.75)	(-0.24)	(-2.45)*		(-5.77)**
(6,6)	-0.0159	0.0000	-0.0076	-0.0005	-0.0051	(36,36)	-0.0031
	(-3.16)**	(0.01)	(-2.33)*	(-0.06)	(-1.87)		(-3.99)**
(6,9)	-0.0149	-0.0033	-0.0091	0.0021	-0.0044	(36,48)	-0.0025
	(-3.76)**	(-0.49)	(-3.62)**	(0.27)	(-1.93)		(-3.45)**
(6,12)	-0.0159	-0.0112	-0.0123	0.0026	-0.0056	(36,60)	-0.0030
	(-4.60)**	(-1.87)	(-6.63)**	(0.41)	(-2.82)**		(-4.42)**
(9,3)	-0.0132	-0.0060	-0.0085	-0.0020	-0.0049	(48,24)	-0.0037
	(-2.19)*	(-0.64)	(-1.77)	(-0.18)	(-1.39)		(-3.20)**
(9,6)	-0.0122	-0.0029	-0.0081	0.0022	-0.0031	(48,36)	-0.0010
	(-2.79)**	(-0.38)	(-2.24)*	(0.24)	(-1.13)		(-1.09)
(9,9)	-0.0130	-0.0103	-0.0120	0.0015	-0.0045	(48,36)	-0.0006
	(-3.79)**	(-1.54)	(-4.59)**	(0.20)	(-2.03)*		(-0.78)
(9,12)	-0.0142	-0.0207	-0.0141	0.0007	-0.0066	(48,60)	-0.0014
	(-4.74)**	(-4.03)**	(-7.15)**	(0.11)	(-3.52)**		(-1.93)
(12,3)	-0.0132	-0.0058	-0.0077	0.0007	-0.0041	(60,24)	-0.0017
	(-2.22)*	(-0.59)	(-1.50)	(0.07)	(-1.19)		(-1.30)
(12,6)	-0.0142	-0.0107	-0.0115	0.0014	-0.0047	(60,36)	0.0010
	(-3.59)**	(-1.36)	(-3.09)**	(0.16)	(-1.78)		(0.98)
(12,9)	-0.0138	-0.0205	-0.0136	-0.0013	-0.0066	(60,48)	0.0010
	(-4.53)**	(-3.23)**	(-5.51)**	(-0.17)	(-3.03)**		(1.17)
(12,12)	-0.0139	-0.0305	-0.0142	-0.0029	-0.0085	(60,60)	0.0002
	(-5.38)**	(-6.57)**	(-8.05)**	(-0.47)	(-4.72)**		(0.25)

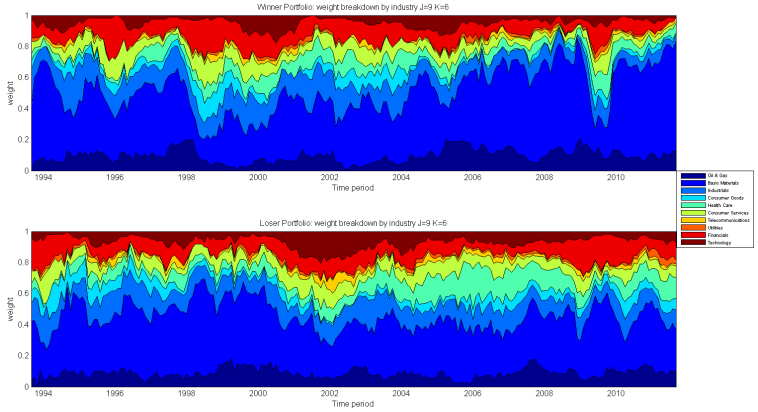
* and ** denote 5% and 1% significance levels respectively.

Figure 3: Industry composition of portfolios in successful trading strategies. We present the industry breakdown of winner (top panels) and loser (bottom panels) portfolios formed over J periods for each rolling time window from December 1992 to August 2011. From top to bottom we consider Technology, Financials, Utilities, Telecommunications, Consumer Services, Health Care, Consumer Goods, Consumer Goods, Basic Materials, and Oil and Gas.

(a) Trading strategy with $J = 1$ week.



(b) Trading strategy with $J = 9$ months.



(c) Trading strategy with $J = 60$ months.

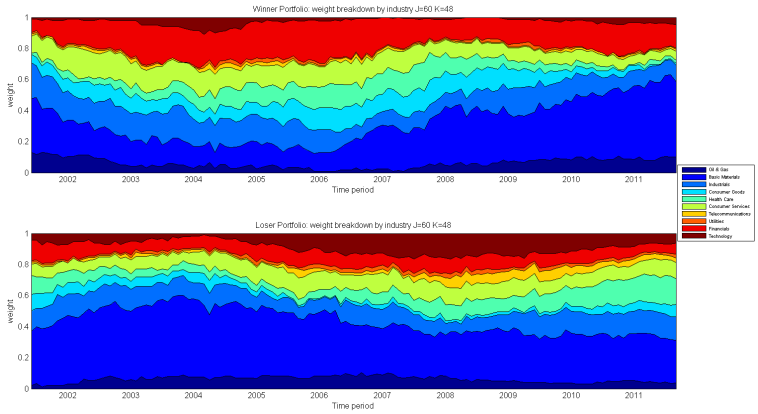


Table 6: Risk factor analysis. The table reports regression coefficients and t-statistics (in parenthesis) of the estimated parameters for the random walk with drift, CAPM and Fama-French three factor model for the winner, loser and zero-investment portfolios from 1992 to 2011. W denotes winner, L - loser, LW - contrarian (loser-winner) and WL - momentum (winner-loser) portfolios. Panel A presents regression results for the short-term $J = 1w/K = 1w$ contrarian strategy based on all available stocks and when the mining sector is excluded . Similarly, Panels B and C show the results for the intermediate- and long-term strategies respectively. * and ** refer to 5% and 1% significance levels.

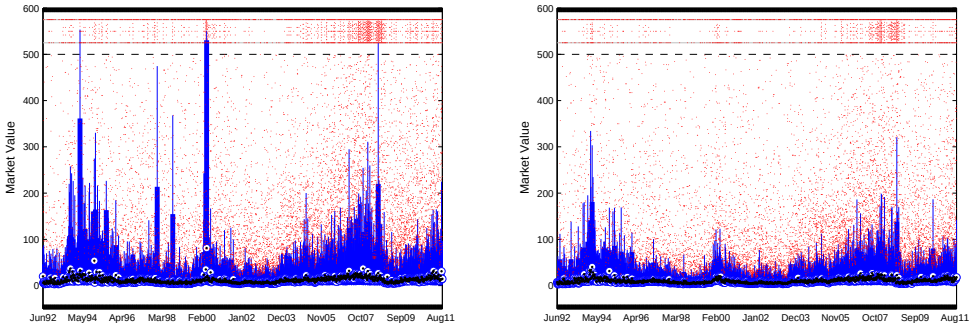
		Random Walk	CAPM		Fama-French			
		Intercept	Intercept	MARKET	Intercept	MARKET	SMB	HML
Panel A: $J = 1w/K = 1w$ contrarian strategy								
All stocks	LW	0.0547	0.0547	0.0205	0.0535	0.0144	-0.1845	0.1735
		(56.62)**	(56.38)**	(0.43)	(50.58)**	(0.29)	(-3.84)**	(3.30)**
	W	-0.0248	-0.0262	0.8801	-0.0239	0.9952	0.9434	-0.4324
		(-21.95)**	(-26.65)**	(18.10)**	(-30.08)**	(26.73)**	(26.11)**	(-10.94)**
	L	0.0300	0.0285	0.9005	0.0296	1.0097	0.7590	-0.2590
		(28.81)**	(32.70)**	(20.91)**	(38.20)**	(27.83)**	(21.56)**	(-6.72)**
Ex.Mining	LW	0.0484	0.0483	0.0402	0.0121	0.0501	-0.0987	0.1637
		(48.97)**	(48.73)**	(0.82)	(43.26)**	(0.98)	(-2.00)*	(3.02)**
	W	-0.0223	-0.0236	0.8161	-0.0217	0.9102	0.7754	-0.3587
		(-21.14)**	(-25.67)**	(17.97)**	(-26.69)**	(23.93)**	(21.01)**	(-8.88)**
	L	0.0261	0.0247	0.8563	0.0254	0.9603	0.6766	-0.1950
		(25.61)**	(28.57)**	(20.02)**	(31.19)**	(25.17)**	(18.28)**	(-4.81)**
Panel B: $J = 9m/K = 6m$ momentum strategy								
All stocks	WL	-0.0110	0.0092	-0.5562	0.0118	-0.516	-0.0747	-0.0741
		(-3.17)**	(4.33)**	(-5.07)**	(4.50)**	(-4.70)**	(-2.30)**	(-1.74)
	W	0.0048	-0.0122	1.0547	-0.0159	1.442	0.1505	-0.0540
		(2.35)*	(-16.09)**	(12.92)**	(-5.99)**	(12.94)**	(4.56)**	(-1.25)
	L	-0.0110	-0.0275	2.0908	-0.0278	1.958	0.2252	0.0118
		(-3.17)**	(-10.60)**	(15.69)**	(-9.25)**	(15.59)**	(6.06)**	(0.25)
Ex.Mining	WL	-0.0099	-0.0149	0.6339	0.0177	-0.5953	-0.0778	-0.0806
		(-4.71)**	(-6.97)**	(5.78)**	(6.71)**	(-5.40)**	(-2.41)**	(-1.88)
	W	-0.0043	-0.0200	1.3743	-0.0122	1.28	0.1500	-0.0700
		(-1.77)	(-7.72)**	(13.61)**	(-3.22)**	(13.37)**	(5.33)**	(-1.95)*
	L	0.0261	-0.0301	2.0082	-0.0299	1.8887	0.2019	0.0082
		(25.61)**	(-12.09)**	(15.72)**	(-10.29)**	(15.52)**	(5.60)**	(0.17)
Panel C: $J = 60m/K = 48m$ momentum strategy								
All stocks	WL	-0.0059	0.0082	-0.3149	0.0094	-0.3157	0.0219	-0.0250
		(-11.58)**	(10.38)**	(-3.70)**	(8.44)**	(-3.75)**	(2.17)*	(-1.54)
	W	-0.0122	-0.0183	1.5346	-0.0159	1.442	0.1505	-0.0540
		(-16.09)**	(-8.16)**	(13.34)**	(-5.99)**	(12.94)**	(4.56)**	(-1.25)
	L	-0.0142	-0.0204	1.3696	-0.0200	1.3678	0.0042	-0.0085
		(-4.27)**	(-45.19)**	(28.18)**	(-31.05)**	(27.93)**	(0.72)	(-0.90)
Ex.Mining	WL	0.0083	0.0110	-0.3691	0.0120	-0.3688	0.0209	-0.0214
		(17.78)**	(15.76)**	(-4.91)**	(6.71)**	(-4.97)**	(2.35)*	(-1.49)
	W	-0.0037	-0.0100	1.0821	-0.0109	1.0849	0.0217	-0.0164
		(-5.46)**	(-18.16)**	(15.66)**	(-12.25)**	(15.98)**	(2.67)**	(-1.25)
	L	-0.0120	-0.0227	1.4512	-0.0229	1.4537	0.0008	0.0050
		(-15.26)**	(-54.39)**	(32.34)**	(-38.44)**	(32.08)**	(0.15)	(0.58)

Table 7: Bootstrap Results. The standard and block bootstrap tests are performed with replacement for the three best performing strategies based on the sample of all available stocks and when the mining sector is excluded. Simulated return (Sim.return) is the average return of the 5,000 simulated excess returns under the null hypothesis that a return-generating model explains excess momentum and contrarian return. We consider the random walk with drift, CAPM and Fama-French three factor model for the winner, loser and zero-investment portfolios from 1992 to 2011. Simulated p-value is the percentage of simulated excess returns that are greater than the actual excess return from the strategy. W denotes winner, L - loser, LW - contrarian (loser-winner) and WL - momentum (winner-loser) portfolios. Panel A presents regression results for the short-term $J = 1w/K = 1w$ contrarian strategy. Similarly, Panels B and C show the results for the intermediate- and long-term strategies respectively.

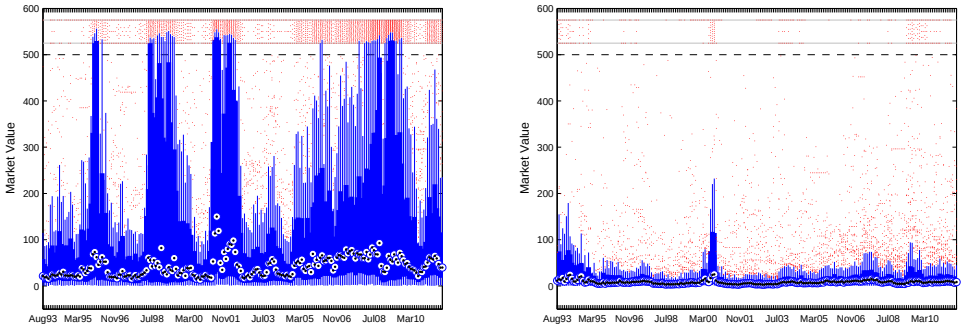
			Random Walk				CAPM				Fama-French			
			Standard		Block		Standard		Block		Standard		Block	
		Mean	Sim.return	p-value	Sim.return	p-value	Sim.return	p-value	Sim.return	p-value	Sim.return	p-value	Sim.return	p-value
Panel A: $J = 1w/K = 1w$ contrarian strategy														
	LW	0.0547	-0.0501	0.000	-0.0501	0.000	0.0000	0.000	0.0000	0.000	0.0011	0.000	0.0010	0.000
All Stocks	W	-0.0248	0.0374	0.000	0.0373	0.000	0.0015	0.000	0.0015	0.000	0.0015	0.000	0.0015	0.000
	L	0.0300	-0.0128	0.000	-0.0128	0.000	0.0015	0.000	0.0015	0.000	0.0003	0.000	0.0003	0.000
	LW	0.0484	0.0049	0.000	0.0050	0.000	0.0000	0.000	0.0000	0.000	0.0012	0.000	0.0011	0.000
Ex.Mining	W	-0.0223	0.0131	0.000	0.0132	0.000	0.0014	0.000	0.0014	0.000	-0.0005	0.000	-0.0005	0.000
	L	0.0261	0.0181	0.000	0.0181	0.000	0.0014	0.000	0.0014	0.000	0.0006	0.000	0.0006	0.000
Panel B: $J = 9m/K = 6m$ momentum strategy														
	WL	0.0048	-0.1017	0.000	-0.1019	0.000	-0.0045	0.016	-0.0044	0.000	-0.0072	0.000	-0.0071	0.000
All Stocks	W	-0.0061	0.0096	0.1414	0.0097	0.000	0.0123	0.000	0.0122	0.000	0.0101	0.000	0.0100	0.000
	L	-0.0110	-0.1020	0.000	-0.1019	0.000	0.0168	0.000	0.0166	0.000	0.0172	0.000	0.0172	0.000
	WL	0.0099	0.0180	0.000	0.0181	0.000	-0.0051	0.000	-0.0051	0.000	-0.0080	0.000	-0.0081	0.000
Ex.Mining	W	-0.0043	-0.0718	0.000	-0.0719	0.000	0.0110	0.000	0.0109	0.000	0.0080	0.000	0.0080	0.000
	L	-0.0142	-0.0899	0.000	-0.0899	0.000	0.0161	0.000	0.0160	0.000	0.0161	0.000	0.0161	0.000
Panel C: $J = 60m/K = 48m$ momentum strategy														
	WL	0.0059	-0.0009	0.000	-0.0008	0.000	-0.0024	0.000	-0.0024	0.000	-0.0037	0.000	-0.0037	0.000
All Stocks	W	-0.0045	0.0155	0.000	0.0155	0.000	0.0079	0.000	0.0079	0.000	0.0065	0.000	0.0065	0.000
	L	-0.0104	-0.0008	0.000	-0.0008	0.000	0.0103	0.000	0.0103	0.000	0.0102	0.000	0.0102	0.000
	WL	0.0083	0.0142	0.000	0.0142	0.000	-0.0028	0.000	-0.0028	0.000	-0.0040	0.000	-0.0040	0.000
Ex.Mining	W	-0.0037	0.0102	0.000	0.0102	0.000	0.0080	0.000	0.0081	0.000	0.0075	0.000	0.0075	0.000
	L	-0.0120	-0.0040	0.000	-0.0040	0.000	0.0108	0.000	0.0108	0.000	0.0115	0.000	0.0115	0.000

Figure 4: Market value distribution of winner and loser portfolios. In series of box plots we show the distributions of market values of individual stocks forming winner (panels on the left) and loser (panels on the right) portfolios for each of the three successful strategies. The composition of the portfolio depends solely on the formation period (ranking period J) and the distribution of its market values is presented using box plot for each point in time with weekly (for short-term) and monthly (for intermediate- and long-term) rolling windows. On each box, the central mark is the median, the bold edges are the 25th and 75th percentiles, the whiskers extend to the most extreme data points not considered outliers, and outliers are plotted individually (in red). A horizontal dashed line marks a plotting limit. Points outside the limit are compressed but retained the relative order. The presence of large capitalization stocks in winner portfolios (left panels) is more pronounced compared to that in the loser portfolios (right panels) especially for larger J.

(a) Trading strategy with $J = 1$ week.



(b) Trading strategy with $J = 9$ months.



(c) Trading strategy with $J = 60$ months.

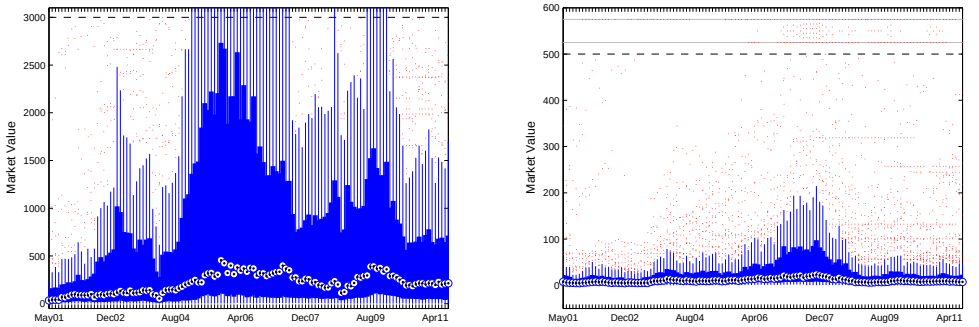
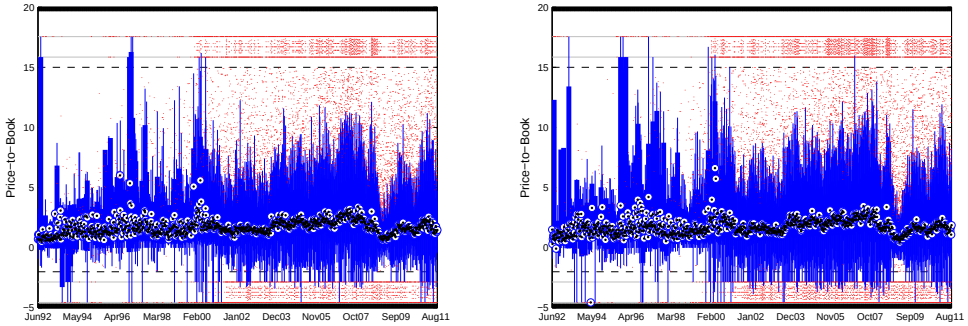
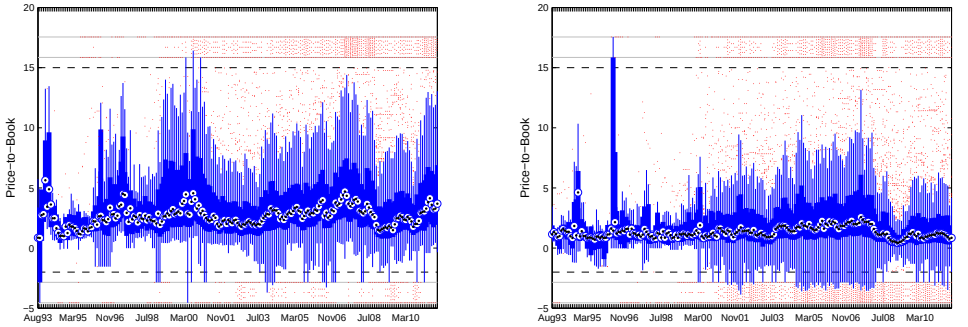


Figure 5: Price-to-Book value distribution of winner and loser portfolios. In series of box plots we show the distributions of price-to-book values of individual stocks forming winner (panels on the left) and loser (panels on the right) portfolios for each of the three successful strategies. The composition of the portfolio depends solely on the formation period (ranking period J) and the distribution of its price-to-book values is presented using box plot for each point in time with weekly (for short-term) and monthly (for intermediate- and long-term) rolling windows. On each box, the central mark is the median, the bold edges are the 25th and 75th percentiles, the whiskers extend to the most extreme data points not considered outliers, and outliers are plotted individually (in red). Horizontal dashed lines mark plotting limits. Points outside these limits are compressed but retained the relative order.

(a) Trading strategy with $J = 1$ week.



(b) Trading strategy with $J = 9$ months.



(c) Trading strategy with $J = 60$ months.

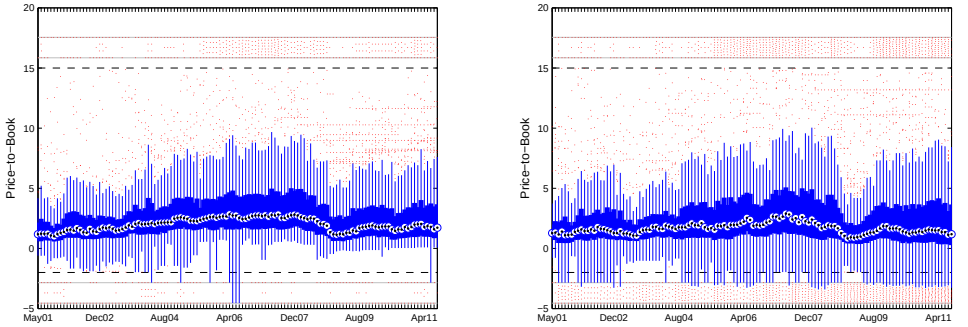
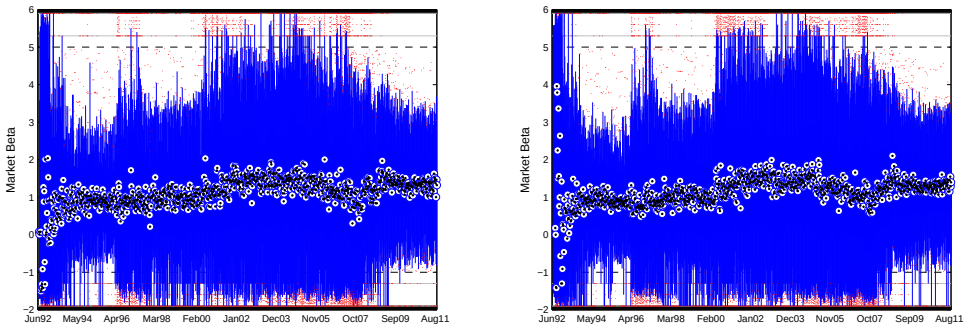
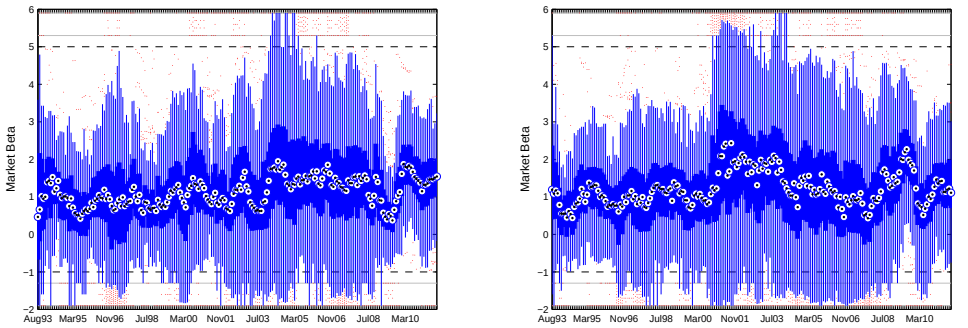


Figure 6: Market beta distribution of winner and loser portfolios. In series of box plots we show the distributions of market beta values of individual stocks forming winner (panels on the left) and loser (panels on the right) portfolios for each of the three successful strategies. The composition of the portfolio depends solely on the formation period (ranking period J) and the distribution of its price-to-book values is presented using box plot for each point in time with weekly (for short-term) and monthly (for intermediate- and long-term) rolling windows. On each box, the central mark is the median, the bold edges are the 25th and 75th percentiles, the whiskers extend to the most extreme data points not considered outliers, and outliers are plotted individually (in red). Horizontal dashed lines mark plotting limits. Points outside these limits are compressed but retained the relative order.

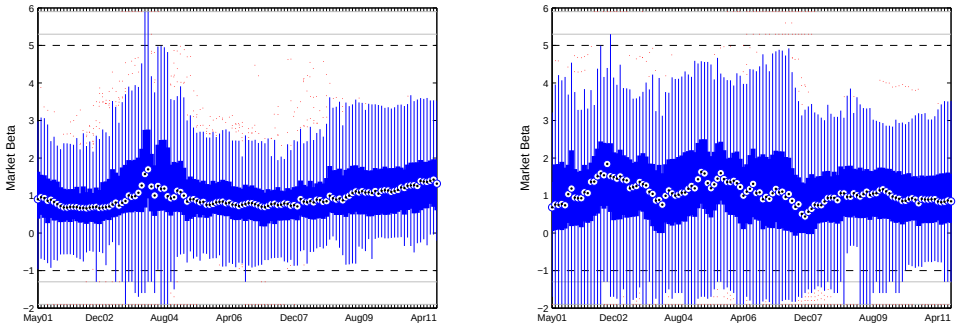
(a) Trading strategy with $J = 1$ week.



(b) Trading strategy with $J = 9$ months.



(c) Trading strategy with $J = 60$ months.



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