

**An Examination of the Profitability of Technical Trading Rules in Australian
Futures Markets**

Alex Frino

Maurice Peat

Brad Wong

Discipline of Finance, University of Sydney, N.S.W., 2006, Australia

* This research was funded by the Sydney Futures Exchange under Corporations Regulation 7.5.88(2).

An examination of the profitability of technical trading rules in Australian futures markets

1. Introduction

This paper presents a comprehensive analysis of the profitability of technical trading rules within Australian financial markets. We replicate the methodology of Sullivan, Timmerman and White (1999), by assessing the profitability of 7,846 different trading rules on four futures price series – SPI futures, 10 year bond futures, 3 year bond futures and Bank Accepted Bill futures. The period of analysis covers all contract expiries from March 2001 to March 2006. As the following review reveals, there are no studies that have examined the profitability of technical trading rules in Australian derivative markets. As discussed below, there are several advantages of examining derivative markets compared to the underlying equity market.

There have been few studies that *explicitly* examine the profitability of trading rules within Australian financial markets. Lee, Chan, Faff and Kalev (2003) assess the profitability of short term contrarian strategies using weekly data for stocks in the AOI over the period 1994-2001. Their strategy involves constructing a portfolio of stocks each week, where the position in a given stock is determined by the stock's excess return in the previous week. Since their strategy is contrarian, stocks that had positive (negative) excess returns in one week are short sold (bought) in the next. While their strategy appears to yield statistically significant risk-adjusted returns, these profits vanish once reasonable transaction costs are considered. Ball (1978) tests the profitability of filter rules on 126 stocks that traded on the Melbourne Stock Exchange between 1958 and 1970. His results indicate that returns generated from

stocks to which the filter rules are applied, are similar to returns generated from a control sample to which no filter rules are applied. Thus, he concludes that filter rules are not profitable on the Melbourne Stock Exchange over this period.

Rather than focusing on trading strategies, other studies have investigated the extent and predictability of autocorrelation in Australian price series. This literature is important since it may be possible to exploit genuine autocorrelation in price series using simple trading rules. Using daily AOI data from 1979-2000, Yao, Partington and Stevenson (2005) develop a survival analysis model for predicting the length of price runs and the timing of price reversals. While their model exhibits some predictive power when applied to a two year holdout sample, it is unable to beat forecasts based on the random walk model of prices. Gaunt and Gray (2003) show that statistically significant negative autocorrelation in prices exists at lags of one month, for stocks listed on the Australian Stock Exchange (ASX) from 1973 to 1998. However, their contrarian trading strategy is only able to generate significant returns for those stocks outside the largest 200, for which problems associated with non-synchronous trading, low trading volumes and bid-ask bounce are more acute. Officer (1975), one of the first to examine seasonality and autocorrelation in Australian financial markets, finds some evidence of autocorrelation of six and nine month cycles in monthly prices of 126 companies that traded on the Melbourne Stock Exchange between 1958 and 1970. No autocorrelation was identified in bond prices.

Finally some studies have identified seasonal patterns in Australian price series. Like autocorrelation, it may be possible to exploit seasonality in prices to generate abnormal returns using basic trading rules. Yakob, Beal and Delpatchitra (2005)

estimating a GARCH (1,1) model, show that daily closing AOI prices from 2000 to 2005 exhibit day-of-the-week, month-of-the-year and a public holiday effect. Specifically, there are significantly higher returns on Friday, in August, October and December, and on the days surrounding a public holiday. Further tests show that these seasonal patterns are likely to be caused by increased market risk in the respective day or month in which the seasonality exists. This suggests that any trading rule designed to capitalise on this seasonality would not result in significant *risk-adjusted* returns. Kim (1988) examines daily closing prices for the AOI between 1980 and 1984. Lower returns are documented on Tuesdays which is attributed to a contemporaneous ‘Monday effect’ in U.S. markets. A trading rule that involves going long in the index on Tuesday and liquidating on Friday yields annual profits that are in excess of a buy and hold benchmark¹ for all years except 1983. However, when a 0.5% round trip transaction cost is considered all annual profits are eliminated, except for 1984. The average annual abnormal return, net of transaction costs, over the period considered is –17.25%. Finally, Brown, Keim, Kleidon and Marsh (1983), examining monthly share prices of 1924 companies over the period March 1958 to June 1981, find evidence of monthly seasonals from December-January and July-August after controlling for size effects.

In summary, the literature suggests that technical trading rules would not be economically viable in Australian markets. Most studies are able to show *prima facie* profits, but further inspection reveals that reported returns are eroded by transaction costs, cannot beat simple benchmarks or an artefact of increased risk bearing. Despite the overall consensus, the literature is found lacking in several areas. Firstly, the

¹ The buy and hold benchmark is measured as the return from buying at the opening price on the first day of the year that an index is bought in accordance with the day-of-the-week trading rule and selling at the closing price on the last trading day of the year.

papers reviewed consider only a small fraction of all possible trading rules. It is possible that other trading rules would prove profitable in Australian financial markets. In particular, strategies in previous studies have been designed to take advantage of autocorrelation in *prices*, but few consider the information content of *volume*. By replicating the methodology of Sullivan, Timmerman and White (1999) we are able to test the profitability of 7,846 trading rules, a much larger set than previously considered, including 2,040 volume-based trading rules.

Furthermore, the primary focus of previous studies has been on equity securities and indices. This gives rise to several concerns about the real world implementation of these trading rules, including the non-tradeability of indices and the existence of short selling constraints. Lee et al. (2003) attempt to overcome the latter problem by considering a trading strategy that involves holding the market portfolio and implementing the signals from their trading rules on this portfolio, such that sell signals translate into liquidating stocks already owned. This strategy, capital intensive and involving a high level of transactions costs, is not a completely satisfactory solution. We overcome these problems by examining futures market data. As noted by Sullivan et al. (1999), analysis of futures markets mitigates some of the problems associated with properly identifying profitable trading rules in stock markets. Firstly, it is not difficult to take a short position in a futures contract, whereas short selling may be impossible or prohibitively costly in equity markets. Secondly, it is possible to trade a futures contract on an index. Thirdly, transaction costs are lower in futures markets, decreasing the probability that observed profits will be eroded by costs. In particular, adverse selection costs are likely to be lower in futures markets since one cannot use firm-specific private information to profitably trade index futures (Frino

and Oetomo, 2005). As a result, percentage bid ask spreads are much lower in futures markets and securities typically trade at the minimum tick. The market impact costs of trades in futures markets are relatively small compared to similar costs in equity markets (Frino and Oetomo, 2005). Finally, because SFE margin accounts earn the risk free rate, the opportunity cost of transacting is lower than in equity markets.

Another contribution this paper makes to the technical trading literature is the adjustment made to volume-based trading rules for futures markets. When testing volume rules on futures products it is important to control for exogenous volume spikes surrounding the expiry of contracts. In futures markets it is typical for traders to ‘rollover’ their positions around maturity, by simultaneously closing out positions in the near contract and re-establishing those positions in the first deferred contract. This induces an increase in trading volume that is unrelated to price movements and typically contains no price related information. This paper makes a contribution to the literature by outlining a method to adjust for this, the details of which are presented in section 2.4.

2. Method

2.1 Data and sample selection

The daily closing values are examined for four price series– SPI 200 futures, 10 year bond futures, 3 year bond futures and Bank Accepted Bill futures. For each security only the nearest contract to expiry (hereafter the near contract) is examined. The

period of analysis covers all contract expiries from March 2000 to March 2006, with the exception of the SPI 200 Futures which begins with the March 2001 contract.²

2.2 Trading rules

The trading rules tested are those documented in Sullivan et al. (1999). They use 7,846 trading rules across five broad classes: filter, moving average, support and resistance, channel breakout and on-balance-volume rules.³ To assess the profitability of these rules in a manner that avoids data snooping bias we use the following methodology:

1. The best rule over four consecutive near contracts is calculated across all 7,846 rules.
2. The rule from point 1 is then applied to the next contract in time and the profit observed.
3. Moving one contract forward, the process is then repeated until all contracts have been tested.⁴

As well as testing profitability across all rules, each one of the five classes is tested to determine if there is any particular type of rule that significantly generates profits. The method outlined above represents a true *ex ante* approach to assessing the profitability of trading rules since each rule is tested only with information that was available at the time of the contract.

² The SPI 200 futures first listed with a June 2000 expiry. At the time, it traded simultaneously with the SPI AOI futures contract. Liquidity did not transfer from the SPI AOI contract to the SPI 200 until January 2001, and therefore we begin the analysis with the March 2001 expiry.

³ For further explanation of these trading rules and the parameters used consult Sullivan et al. (1999).

⁴ Since each security requires at least four contracts to ascertain the best return, the number of contracts tested is equivalent to the number of contracts available less four. Therefore the returns for the interest rate products encapsulate the period March 2001 – March 2006, and the SPI 200 March 2002 to March 2006.

2.3 Price adjustment around expiry dates

The price series of futures contracts is discontinuous around expiry days since it involves the movement from one contract to the first deferred. It is typical in futures market studies to create an artificial but continuous price series by calculating first differences between consecutive days of a price series for both the near and first deferred. For a given day the appropriate change in price level is given by the difference of the near contract, with the exception of the rollover period, for which the appropriate difference is that of the near deferred. This ‘difference series’ is then used to calculate the price level for the day, which is simply the sum of the previous day’s price and the value of the difference series. The most important methodological choice in this process is the designation of the rollover date. Ma et al. (1992) outline the consequences associated with different rollover dates. They conclude that rollover on the delivery date is not recommended since it creates biases and excess volatility in the price series. In this study we rollover a price series into the first deferred contract five days before expiry. Additional tests (not reported) suggest that the choice of rollover date, within two days either side, does not significantly affect our results.

2.4 Volume adjustment around expiry dates

Since one class of rules tests the price information contained in volume it is necessary to adjust the volume series to account for exogenous increases surrounding expiry dates. We adjust for this by estimating changes in volume using the following regression:

$$Volume_{t+1} - Volume_t = \alpha + \sum_{i=0}^{20} \beta_i d_i$$

Where d_t is a dummy variable which equals one t days before contract expiry and zero otherwise. This equation provides the expected volume change for the twenty days before expiry (inclusive). Data from the previous four near contracts is used to estimate the coefficients of the above equation. The abnormal change in volume is then calculated as:

$$Abnormal\Delta vol_t = Actual\Delta vol_t - Expected\Delta vol_t$$

We assess the profitability of trading rules using the abnormal change, rather than absolute level, in volume.

2.5 Transaction costs and margin accounts

A common criticism that can be levelled at technical trading studies is a failure to account for ‘real world’ factors such as transaction costs, which can erode *prima facie* abnormal returns. Bessembinder and Chan (1998) estimate the minimum one way costs required to eliminate the profits documented by Brock, Lebaron and Lakonishok (1992). They find that the break-even cost was similar to or smaller than actual trading costs, suggesting that the inefficiencies identified by Brock et al. could not be profitably exploited. This study follows previous work of Bessembinder and Chan (1995) who conduct a similar analysis on several Asian markets. They find that transaction costs were likely to erode any trading profits on developed markets (Japan, Hong Kong and Korea)⁵ though profitable trading rules could not be ruled out for developing markets (Malaysia and Thailand). While transaction costs in futures markets are generally lower than in equity markets it is still necessary to account for

⁵ Taiwan, a developed market, was the only exception.

them. In this study we assign a cost of 2 index points per trade. This number is chosen as a representative value for spread costs (typically one tick) and market impact costs.⁶

The second ‘real world’ factor that is considered in this study is the use of margin accounts to access leverage and augment returns (or losses). As far as we know, there have been no papers that take into account the affect leverage may have on returns when trading in futures markets. We assume that the base capital used in these trading rules is the minimum initial margin requirement for each security. Returns are then based on the percentage increase (or decrease) compared to this initial amount.

3. Results

The profits from each class of rules and across all rules are presented in Table 1. It is apparent that technical trading rules are not profitable at all for any of the interest rate products. Only one case, the channel breakout rules for the 10 year bond futures is able to beat the benchmark of the underlying security. In fact, the large negative returns associated with those rules suggest that it would have been better to adopt a contrarian strategy with the interest rate products. It is possible that these returns are a by product of mean reversion in interest rates.

Interestingly, for the SPI 200 it appears that when all rules are utilised profits in excess of a buy and hold benchmark are 3.26% over the four and a quarter years. Indeed filter rules and on-balance-volume rules produce significant abnormal profits. This suggests a level of inefficiency in SPI 200 prices that is economically exploitable

⁶ Frino, Kruk and Lepone (2006) show that slippage of two index points is typical for trade packages of approximately 75 contracts.

even after transaction costs. To assess the robustness of this result we calculate returns across different sub periods of the sample. Table II, Panel A, provides average annual returns of this sensitivity analysis. The results are generally similar to the original results: Filter rules and on-balance-volume rules always outperform the market, whereas moving average rules always underperform. Interestingly, if the study had ended with the March 2005 contract we may have concluded that technical analysis did not lead to above market returns. This fact highlights the need to examine various subsets to determine the sensitivity of results to the choice of period under analysis.

The second robustness test we employ is to examine the influence of risk. It is apparent from Table II that the returns from technical analysis vary significantly over time compared to the returns from the underlying security. This fact, and the use of leverage inherent in margin accounts, suggests that the observed returns from technical trading are no more than an artefact of increased risk bearing. Neely (2003) cautions against making conclusions about technical trading without assessing risk, since models of asset pricing (such as the CAPM) predict higher returns from increased risk bearing. If technical trading in futures markets involves different risks compared to holding the underlying security then a comparison of returns is not appropriate. In order to account for risk, we therefore calculate Sharpe ratios for each category of rules and for the benchmark, which are presented in Table II, Panel B.

The results from the Sharpe ratio analysis are similar to those reported in Table I for the SPI. The moving average and support and resistance rules do not outperform the buy and hold benchmark, whereas the strategy employing only the filter rules, only the volume rules and across all rules outperform the benchmark.

Conclusion

This study examines the profitability of 7,846 trading rules on four prominent futures price series. The innovation of this research is that it is the first study to examine technical analysis on Australian derivative markets. The results indicate that technical trading is not profitable for interest rate futures. However the large negative returns suggest a contrarian trading strategy may be beneficial. We attribute the negative returns to our methodology – the use of past history to predict the best rule – and the fact that interest rates tend to be mean reverting.

The study suggests the technical analysis is able to generate returns greater than a buy and hold benchmark when trading SPI 200 index futures. The returns are in excess of 3 percent per annum over our study, when all trading rules are adopted. When only filter rules and volume rules are considered abnormal profits are much larger. This suggests that the SPI 200 price series is not weak form efficient and that economically significant profits are available even after accounting for transaction costs and risk.

References

- Ball, R., 1978, 'Filter rules: Interpretation of market efficiency, experimental problems and Australian evidence', *Accounting and Finance*, 1-17
- Bessembinder, H. and K. Chan, 1998, 'Market efficiency and the returns to technical analysis', *Financial Management*, 27, 5-17.
- Bessembinder, H. and K. Chan, 1995, 'The profitability of technical trading rules in the Asian stock markets,' *Pacific-Basin Finance Journal*, 257-284.
- Brock, W., J. Lakonishok and B. LeBaron, 1992, 'Simple technical trading rules and the stochastic properties of stock returns', *Journal of Finance*, 47, 1731-1764
- Brown. P., D. B. Keim, A. W. Kleidon and T. A. Marsh, 1983, 'Stock return seasonalities and the tax-loss selling hypothesis. Analysis of the arguments and Australian evidence', *Journal of Financial Economics*, 12, 105-127.
- Frino, A., J. Kruk and A. Lepone, 2006, 'Transactions in futures markets: Informed or uninformed?', *Working Paper*, University of Sydney.
- Frino, A. and T. Oetomo, 2005, 'Slippage in futures markets: Evidence from the Sydney Futures Exchange', *Journal of Futures Markets*, 25, 1129-1146.
- Gaunt, C. and P. Gray, 2003, 'Short term autocorrelation in Australian equities', *Australian Journal of Management*, 28, 97-117

Kim, S-W., 1988, 'Capitalizing on the weekend effect', *Journal of Portfolio Management*, 14, 59-63

Lee, D. D., H. Chan, R. Faff and P. S. Kalev, 2003, 'Short term contrarian investing – is it profitable? ... Yes and no', *Journal of Multinational Financial Management*, 13, 385-404

Ma, C. K., J. M. Mercer and M. A. Walker, 1992, 'Rolling over futures contracts: A note', *Journal of Futures Markets*, 43, 203-217

Neelly, C. J., 2003, 'Risk-adjusted, ex ante, optimal technical trading rules in equity markets', *International Review of Economics and Finance*, 12, 69-87

Officer, R. R., 1975, 'Seasonality in Australian capital markets', *Journal of Financial Economics*, 2, 29-51

Sullivan, R., A. Timmerman and H. White, 1999, 'Data snooping, technical trading rule performance and the bootstrap', *Journal of Finance*, 54, 1647-1691

Yakob, N. A., D. Beal and S. Delpatchitra, 2005, 'Seasonality in the Asia Pacific stock markets', *Journal of Asset Management*, 6, 298-318

Yao, J., G. Partington and M. Stevenson, 2005, 'Run length and predictability of stock price reversals', *Accounting and Finance*, 45, 653-671

Table I
Average Annual Returns of Technical Trading Strategies (March 2001 / March 2002 - March 2006 contracts)

	AF	MA	SR	CB	OBV	All Rules	Buy and Hold: Underlying security
SPI 200 Futures	35.32%	4.29%	-5.14%	10.52%	36.13%	15.45%	12.19%
BABS	-4.65%	-37.95%	-17.17%	-12.39%	-15.99%	-60.72%	5.16%
3 Year Bond Futures	0.67%	-109.72%	-79.70%	-70.84%	-37.98%	-170.38%	5.15%
10 Year Bond Futures	3.60%	-6.85%	-35.51%	13.59%	-29.27%	-9.85%	5.54%

Discrete returns based on initial margin requirements

Initial Margin Requirements

SPI 200 Futures - \$4500

BABS - \$750

3 Year Bond Futures - \$950

10 Year Bond Futures - \$2,800

Above results involving futures contracts include 5% interest gained on margin accounts.

SPI results based on March 2002 – March 2006 contracts, except for OBV which is based on March 2003 - March 2006 contracts

Table II
Robustness Tests for SPI

	AF	MA	SR	CB	OBV	Best Rule	Buy and Hold: ASX 200
Panel A							
March 02 – March 06	35.32%	4.29%	-5.14%	10.52%	36.13%	15.45%	12.19%
March 02 – March 05	43.76%	2.57%	34.34%	-3.98%	18.07%	2.47%	4.61%
March 02 – March 04	50.30%	-39.85%	19.41%	1.36%	71.57%	29.62%	-0.08%
March 02 – March 03	91.49%	-126.46%	-2.38%	69.26%	142.59%	113.54%	-10.54%
Panel B							
Sharpe Ratio, March 02 – March 06	0.59	0.25	-0.22	0.36	0.57	0.39	0.26

All OBV samples are from H3, rather than H2.