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Return and Risk of Buy-Write Strategies using Index Options:

Australian Evidence

February, 2004

bridging thought and practice

CONTENTS

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1. INTRODUCTION

Whaley (2002) argues that the portfolio insurance needs of fund managers creates excess demand for index put options which drives-up their price. This in turn drives up the price (and implied volatility) of index calls because of arbitrage activity related to the put-call parity relationship.[1] Consistent with this proposition, Whaley (2002) demonstrates that the implied volatility of index calls is greater than historic volatility. The implication of this finding is that index call options are over-priced by the market, and hence strategies seeking to exploit this anomaly should prove profitable. Whaley (2002) tests one such strategy based on US data. He examines the profitability of a buy-write strategy involving the purchase of the portfolio underlying the S&P 500 index and simultaneously writing a just-out of the money S&P500 index call option traded on CBOE. The study demonstrates that such a passive buy-write strategy, on average, generated positive risk-adjusted returns over the period June 1988 to December 2001, both before and after controlling for the cost of trading the option. It appears that the strategy is so popular and successful in the US that it has spawned an index which is produced by the Chicago Board Options Exchange (CBOE) which can be used by option portfolio managers to benchmark the performance of buy-write option strategies in general.

Similar to the US, research based on the Australian market also provides some evidence that the implied standard deviation of call options on index futures is greater than realised volatility [see for example Brace and Hodgson, 1991]. This suggests that index call options are over-priced. Given this, it is likely that a buy-write strategy could also prove profitable in Australia. This study replicates Whaley (2002) in an Australian environment by examining the profitability of a buy-write strategy involving the purchase of the portfolio underlying the S&P/ASX200 and simultaneously writing just out of the money S&P/ASX200 options.

The remainder of this paper is structured as follows. The next section describes the institutional detail relevant to the study reported in this paper. This is followed by section 3 which describes the data and method used to examine the profitability of buy-write strategies. Section 4 reports the results, while the final section concludes.

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[1]To understand this, note that the put call parity relationship is as follows:

$$S + p = c + E/(1+r)^{-t}$$

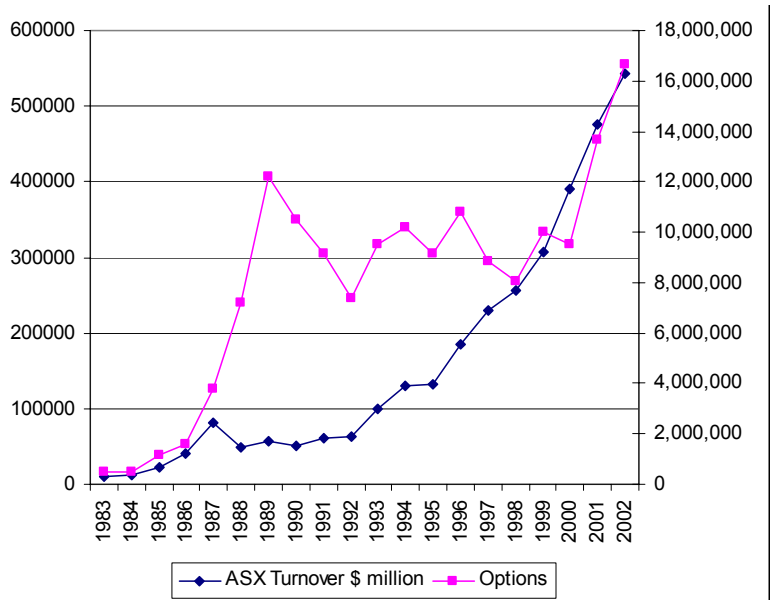
Where S is the spot price, p is the put price, c is the price of an equivalent (in terms of time to maturity and exercise price) call, E is the exercise price of the call, r is the risk free rate and t is the time to maturity of the option. Arbitrage implies that if the combination of put and Stock price is worth more than the call plus the present value of bonds, then you would sell short puts and stock and buy the call and bonds. This would put upward pressure on the price of the call.

2. INSTITUTIONAL DETAIL

The All Ordinaries Index was the main benchmark for securities trading on the Australian Stock Exchange until 31 March, 2000. The All Ordinaries Index covered approximately 300 of the largest stocks on the ASX at the time. On 31 March, 2000 a new family of indices was introduced by S&P and ASX, and the main institutional benchmarks became the S&P/ASX200 and S&P/ASX 300 indices. Options on the S&P/ASX200 were first listed on the ASX in March, 2000.[2] The expiry day of ASX call options is the third Friday of the contract month, providing this is a trading day, trading ceasing the day prior. The options are cash settled using the opening price index calculation on expiry day. In order to obtain a greater sample size, SPI options listed on the SFE were used to proxy for S&P/ASX200 options prior to the year 2000.

Turnover of ASX equities, together with the volume of options traded are depicted in Exhibit 1. The table in exhibit 1 illustrates that since the introduction of index options in 1985, turnover in ASX equities has increased from $22 billion to $542 billion. At the same time, trading in equity options including index options has increased strongly to 16.8 million contracts traded in 2002.

Exhibit 1: Turnover on ASX (equities) and Volume in ASX Options



[2] The Australian Stock Exchange listed options on the All Ordinaries Index from 8 November, 1999 to April 2000 after which they were no longer listed.

Year	ASX Turnover $ million	Contract Volume
1983	10,343	474,846
1984	12,279	516,528
1985	22,455	1,178,282
1986	39,835	1,591,297
1987	81,202	3,774,735
1988	48,860	7,226,860
1989	56,636	12,221,268
1990	51,421	10,476,625
1991	60,126	9,171,951
1992	62,248	7,354,554
1993	99,553	9,509,891
1994	129,386	10,205,004
1995	132,795	9,146,172
1996	184,806	10,778,396
1997	229,498	8,870,880
1998	256,471	8,074,514
1999	306,856	9,991,424
2000	390,592	9,507,835
2001	476,433	13,697,780
2002	542,512	16,681,248

3. DATA AND METHOD

This study examines the profitability of buy-write strategies over the period 31 December, 1987 to 31 December, 2002. The index data available for this study was downloaded from the S&P website, while the options data available for this study was extracted from the *Australian Financial Review* (SPI options data was downloaded from the SFE website).[3] Expiration dates were provided by the ASX.

For each *quarterly* expiration date,[4] the following were extracted from the data files:

1. the exercise price and closing price for the just out of the money, nearest to maturity SPI option contract up until March 2000, after which values for the S&P/ASX200 option contract are extracted
2. the settlement price of the expiring option contract (index value), and
3. the value of the All Ordinaries Accumulation Index up until June, 2000, after which values of the S&P/ASX200 Accumulation Index are extracted.

These data were cross-checked against values reported in the *Australian Financial Review* for accuracy. Bank Accepted Bill rates were also used in analysis, and these were sourced from the Reserve Bank of Australia website.

In constructing the return on the buy-write strategy, we follow Whaley (2002) very closely, merely taking into account the peculiarities of the Australian market. The return on the Buy-Write strategy was calculated by assuming that the index portfolio is purchased and a just-out-of the money index call option written each *quarter* and held to expiration. The following expression was used to calculate the *quarterly* returns on the buy-write strategy:

$$R_t = \frac{AI_t - AI_{t-1} - (C_t - C_{t-1})}{AI_{t-1} - C_{t-1}} \qquad (1)$$

where:

AI_t = *the level of the Accumulation Index on day t*

C_t = *the price of the just-out-of the money index call option on day t*[5]

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[3] Futures options on the All Ordinaries Index were first listed on the SFE on June 1985 respectively. For options traded on SFE, contract expiry quarters are March, June, September and December. All stock index options traded on SFE have expired on the last business day of the contract expiry month (since June, 2003 the last trading day for the SPI200 and SPI200 futures contracts is the 3rd Thursday of the expiration month), and the settlement price is the closing value of the stock index. Commencing with the December 2001 contract, the settlement price was an index value based on the first traded price of the component stocks of the index on the expiration day.

[4] Namely, the last business day of each expiration month.

[5] Because the options used in this study are futures margined style options, unlike the options examined in Whaley (2002), the proceeds from writing the option are not available at the time of sale. An additional set of analysis was conducted assuming that the denominator of equation (1) was simply AI_{t-1}, and the results were virtually identical to those reported in this paper.

The return on the buy write strategy is compared to the return on the Accumulation Index, as well as the return on a strategy involving the purchase of a 90 day BAB which is held to expiration.

Similar to Whaley (2002) we also calculate a total risk-adjusted measure of performance and a beta risk-adjusted measure of performance of the buy-write strategy.[6] Specifically, we calculate a Sharpe ratio and Jensens alpha, respectively. The Sharpe ratio is calculated as follows:

$$\text{Sharpe Ratio} = \frac{\overline{R}_p - \overline{R}_f}{\hat{\sigma}_p} \qquad (2)$$

Where the numerator is the difference in the mean buy-write return less the mean BAB return, and the denominator is the standard deviation of buy-write returns.[7]

Jensen's Alpha is calculated by regressing excess returns on the buy-write portfolio against excess returns on the Accumulation Index as follows:

$$R_{p,t}-R_{f,t} = \alpha_p + \beta_p(R_{m,t}-R_{f,t})+\varepsilon_{p,t} \qquad (3)$$

The regression co-efficient α_p captures the systematic performance in the buy-write strategy after adjusting for the beta risk (β_p) of the strategy.

[6] Refer to Whaley (2002) for a discussion of these different metrics and Frino and Gallagher(2001).
[7] While Whaley (2002) uses the standard deviation of daily returns in the calculation of the Sharpe Ratio Frino et.al. (2000) argues for the use of a high/low measure of volatility which is used in this study.

4. RESULTS

Exhibit 2 below describes the quarterly returns on the buy-write strategy, and compares it to returns on the Accumulation Index and BABs over the period December, 1987 to 31 December, 2002. The return on the buy-write portfolio has averaged 2.96 percent per quarter or approximately 11.83 percent per annum. In contrast the index portfolio returned 2.40 percent per quarter or approximately 9.59 percent per annum. Furthermore, the total risk (standard deviation) of the buy-write portfolio is smaller than the total risk of the index portfolio (5.78% and 6.15% respectively). Quite clearly, on average, the risk-return characteristics of the buy-write portfolio dominate the index portfolio. The third column, which compares the performance of the buy-write portfolio to the index portfolio on a quarterly basis confirms this. Moreover, the results also suggest that the return on the buy-write portfolio exceeded the return on the index portfolio in 87 percent of months (52 of 60 months).

Exhibit 2: Descriptive Statistics
Buy-Write Portfolio Return, Accumulation Index Return, Buy-Write Abnormal Performance (Buy-Write Return less Accumulation Index Return) and BAB Return

	Buy-Write Portfolio	All Ordinaries/ S&P/ ASX200 Accumulation Index	Buy-Write Portfolio Performance Relative to Index	BAB Return
Quarterly Returns				
Number of Quarters	60	60	60	60
Mean	2.96%	2.40%	0.56%	1.98%
Median	2.47%	1.93%	0.65%	1.52%
Standard Deviation	5.78%	6.15%	0.74%	1.00%
Skewness	-0.15	-0.03	-0.95	1.32
Kurtosis	-0.40	-0.49	2.22	0.55
Max	14.04%	13.79%	2.04%	4.53%
Min	-11.79%	-12.60%	-1.96%	1.05%
n%>0			86.67%	
Annual Returns				
	11.83%	9.59%	2.23%	7.93%

The results reported in Exhibit 2 are stronger than those reported in the US market by Whaley (2002). Whaley finds that while the index portfolio and the buy-write portfolio generate returns that are similar over the period June 1988 to December, 2001 (approximately 14 percent p.a.), the standard deviation of returns on the buy-write portfolio is smaller than the standard deviation of returns on the index portfolio. On an equivalent *quarterly* basis, the standard deviation of return on the index portfolio in the US was 7.1% as compared to that of the buy-write portfolio which stood at 4.5 percent. Similar to the US market, the results reported in Exhibit 2 also suggest that there is some negative skewness in returns (propensity for negative returns to occur greater than positive returns) but it is considerably less than that reported in Whaley (2002). Exhibit 3 provides a graphical representation of the distribution of returns. Negative skewness does not appear severe in the exhibit.

Exhibit 3: Distribution of Accumulation Index and Buy-Write Strategy Returns

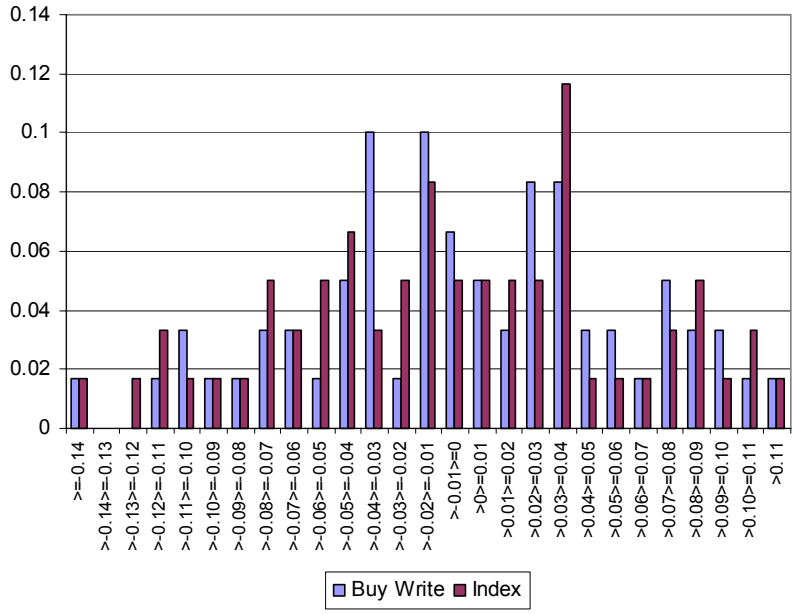

Exhibit 4 provides a clear representation of the wealth-effects of investing in the index portfolio relative to the buy-write strategy. The Exhibit illustrates the effect of investing $1 in the index portfolio and $1 in the buy-write portfolio in December 1987 through to December, 2002. Exhibit 4 clearly provides a visual representation of the extent to which the buy-write strategy outperformed the index portfolio through time.

Exhibit 4: Performance Index – Accumulation Index Versus Buy-Write Strategy

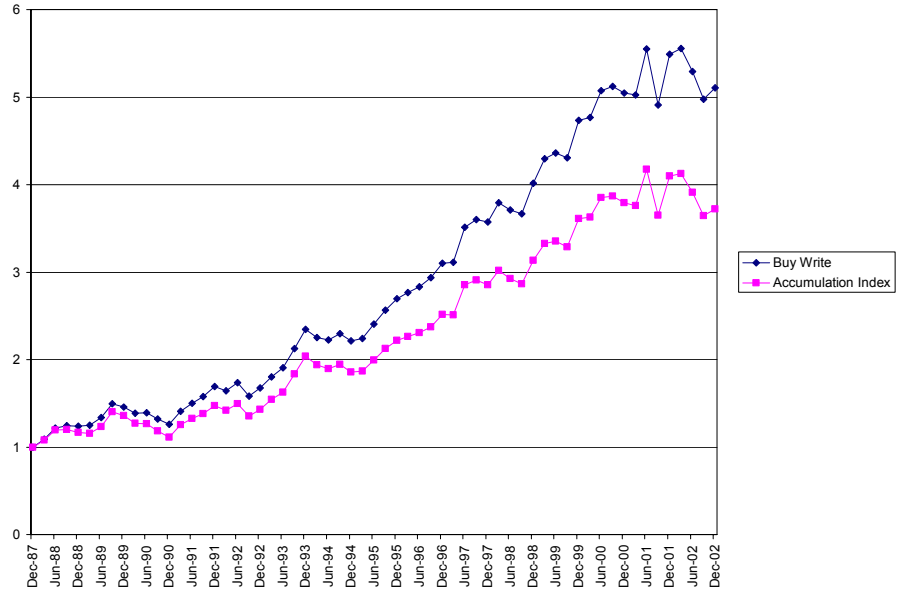

Exhibit 5 confirms that the risk adjusted performance of the buy-write strategy is positive and significant. For example, the estimated alpha is 0.006 or 0.58 percent per quarter. Interestingly, this is equivalent to slightly less than 0.2% per month, which is the risk-adjusted performance reported by Whaley (2002) for the US market. Similarly, the comparison of Sharpe Ratios for the Accumulation Index and Buy-write portfolio confirms that the risk-adjusted performance of the buy-write strategy outperforms the risk-adjusted performance of the index portfolio.

Exhibit 5: Risk-Adjusted Performance

	Accumulation Index Performance	Accumulation Index Portfolio Risk	Buy-Write Portfolio Performance	Buy-Write Portfolio Risk
Sharpe Ratio	0.067	0.061	0.168	.058
Jensen Alpha				
coefficients			0.006	0.93
t statistic			7.3	72.7

SUMMARY

This paper examines the performance of a buy-write strategy involving the purchase of the index portfolio and writing one just-out-of the money index call option for the Australian market. The results confirm that the buy-write strategy generates a higher return than the index portfolio, and the standard deviation of returns on the buy-write portfolio is less than the standard deviation of returns on the index portfolio. On both a total risk and beta-risk adjusted basis, the buy-write strategy outperforms the index portfolio. Consistent with Whaley (2002) for the US market, we conclude that a buy write strategy appears to be profitable in the Australian market.

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