



## **Research Project**

# **Risk and Return of Covered Call Strategies for Balanced Funds: Australian Evidence**

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## **Risk and Return of Covered Call Strategies for Balanced Funds: Australian Evidence**

### ***Executive Summary***

This report summarises the results of a study analysing the risk-return characteristics of a balanced portfolio with covered call strategies in the Australian market. The study covers the period July 1997 to June 2004. Specifically, the study analyses the performance of a balanced portfolio where funds are invested across various asset classes including Australian equity (40%), international equity (25%), fixed income (20%), property (10%) and cash (5%). The covered call strategy was implemented by selling slightly out-of-the-money stock call options on the Australian equity component of the portfolio represented by the stocks in the S&P/ASX 20 index. Options were selected to be 5-15% out-of-the-money with maturities of 3 months or nearest available expiry after 3 months. Option data used in the analysis was provided by the ASX and SIRCA. The portfolio was rebalanced quarterly, with the rebalance dates chosen to coincide with quarterly option expiry dates.

The results of the analysis show that covered call strategies have the effect of enhancing the average return of the portfolio, reducing the standard deviation of returns and improving the risk-adjusted returns of the balanced portfolio. The covered call strategies also have the effect of reducing the range of the returns observed for the portfolio as would be expected for such a strategy.

In addition, the results of Sortino and the Sharpe ratios indicate that the covered call strategies produce enhanced risk-adjusted returns. The Sortino ratio was used to assess the performance of the covered call strategies in terms of excess return per unit of downside risk. The Sharpe ratio was used to measure the risk-adjusted return per unit of total risk.

The performance of covered call strategies will depend on the market conditions prevailing over the holding period of the strategy. The results obtained in this study confirm the results of other similar studies on the performance of covered call strategies.

### ***About the Researchers***

Tony Hall is a Professor of Finance and Head of School at the School of Finance and Economics, University of Technology, Sydney. He is also the Director of the Quantitative Finance Research Centre, a research centre of excellence in quantitative finance focusing on the study of financial markets and asset prices.

Professor Hall's principal research interests are in applied financial econometrics, derivative securities and econometric theory. He has published extensively in leading international journals including *International Economic Review*, *Journal of Econometrics*, *Review of Economic Studies*, *Journal of Time Series Analysis*, the *Journal of Futures Markets* and *Journal of Banking and Finance*.

Nadima El-Hassan is a *Senior Lecturer at the* School of Finance and Economics, University of Technology, Sydney. Her research interests include derivative security pricing, asset allocation and portfolio theory, market and credit risk measurement. Nadima has published widely in journals such as *Computational Economics*, *Journal of Computational Finance*, *Journal of Economic Dynamics and Control* and the *Journal of Financial Engineering*.

Jan-Paul Kobarg was an MBA student at the University of Technology, Sydney. He was the Research Assistant on this project.

## 1. Introduction

This document summarises the results of a study undertaken to determine the impact of incorporating a covered-call strategy, using out-of-the-money call options, on the risk-return profile of a balanced portfolio in the context of the Australian market. The study was conducted over the period July 1, 1997 to June 24, 2004 covering a range of market conditions with bullish conditions dominating.

The research was motivated by a need for evidence on the impact of covered call strategies using stock options on the risk-return characteristics of a balanced portfolio. While a number of studies on the performance of covered calls using index options exist, no such studies on the performance of covered call strategies for balanced portfolios in the Australian context exist<sup>1</sup>. Moreover, covered call strategies are attractive to investors as they provide regular income through the premiums received and may enhance risk-adjusted returns in periods of moderate to negative performance in the stock market<sup>2</sup>.

The results of the analysis conducted in this study generally agree with previous research on the performance of covered call strategies using index options. In a recent article, Whaley (2002) analysed the performance of a buy-write strategy involving holding the S&P 500 index portfolio and taking a short position in a one-month just out-of-the-money call option on the index. The performance of such a strategy was studied over a period of 14 years from 1988 to 2001. Whaley found that the buy-write strategy outperformed the S&P 500 portfolio on a risk-adjusted basis and concluded that the average performance was driven by high implied volatility (in excess of the realised volatility) over the life of the options.

SIRCA(2003) replicated the Whaley (2002) study by analysing the profitability of a buy-write strategy involving buying a portfolio underlying the S&P/ASX200 and simultaneously writing just out-of-the-money S&P/ASX200 index call options over the period 1987 to 2002. The results of this study also show that the buy-write strategy produces higher average returns and lower risk than the investment on the index.

Hill and Gregory (2002) consider the performance of covered calls using S&P 500 index options over the period 1990-2002. They conclude that such a strategy can outperform the index during periods of moderate or negative equity returns.

Benesh and Compton (2000) consider the historical returns for covered calls using all options traded on the Chicago Board and Options Exchange over the period 1986-1989. The results of the study showed that the covered call strategy underperformed (in terms of returns) during periods of bullish market. However, the covered call strategy resulted in lower risk compared to the underlying stocks.

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<sup>1</sup> To the best of our knowledge

<sup>2</sup> See Hill and Gregory (2002)

***Covered Call Strategy***

A covered call strategy involves writing (selling) a call option and simultaneously holding a long position in the underlying stock.

A covered call strategy offers some downside risk protection on the stock movement because the premium received effectively lowers the holding cost of the stock. In exchange for this protection, the strategy limits the upside potential on the value of the underlying stock as the upside profit, above the exercise price, are foregone.

The strategy is executed when the view of the underlying stock (or market index) price direction is neutral to slightly bullish or slightly bearish, depending on where the strike price of the call option is written.

A covered call, unlike a sold (naked) call, is a conservative strategy that may be used to generate extra income through the premiums received under certain market conditions.

***Balanced Portfolios***

A balanced portfolio is typically constructed using various asset classes with the objective of minimising investment risk while seeking long term growth and income. The portfolio used in this study consisted of a mixture of domestic and international equity, fixed income, property and cash investments.

***ASX's Option Market***

Exchange traded stock options began trading in Australia on the ASX Options Market in 1976. Options are available on over 60 different companies as well as a number of indices. Since the inception of the market, volumes have continued to increase significantly.

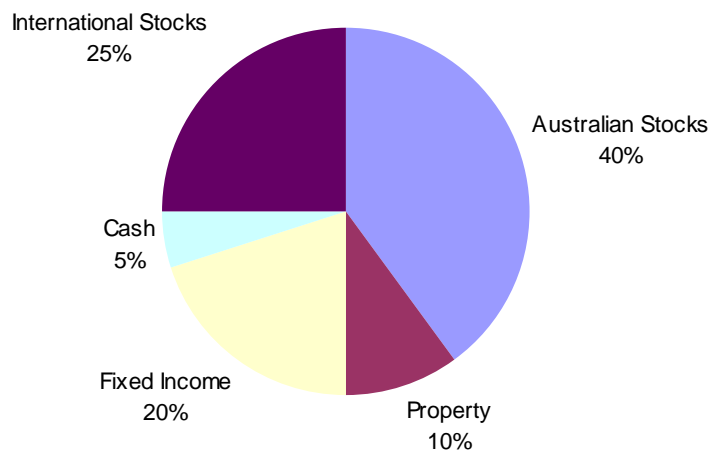
The standard number of shares covered by one option contract on the ASX's Options Market is 1,000. If exercised, equity options are settled with physical delivery of the underlying security.

## 2. Data and Methodology

### *Summary of Portfolios used in the study*

The analysis in this study was conducted using two balanced portfolios. The first balanced portfolio involved the distribution of funds across five asset classes including Australian stocks, international stocks, fixed income, property and cash as shown in Figure 1. The second portfolio used the same balanced portfolio but incorporated a covered call strategy on the Australian equity component of the portfolio.

### Balanced Portfolio Composition



**Figure 1.** *The composition of the balanced portfolio.*

The asset classes used were represented using various indices as indicated in Figure 1. The Australian equity component of the portfolio was proxied by the stocks in the S&P/ASX 20 which comprises the 20 largest stocks by market capitalisation in the Australian market.

The portfolios considered in the study were rebalanced on a quarterly basis with the exact rebalance dates chosen to coincide with the most common expiry dates of the options used. The rebalanced portfolio reflected the amount of funds available for investment on the rebalance date, as well as the composition of the S&P/ASX 20 index at that time. Hence on rebalancing, the Australian equity segment of the

balanced portfolio constituted the components and weightings of the stocks in the S&P/ASX 20 index.

Hence, the Australian equity component of the portfolio was rebalanced quarterly together with the portfolios themselves. The set of relevant stocks was determined using the weights of constituents of the S&P/ASX 20 since July 1, 1997.

The proceeds of the covered call strategy were invested in a cash account until the next rebalance date, at which time the proceeds were added to the proceeds of the balanced portfolio and reinvested among the various asset classes.

The impact of transaction costs were not considered in this study.

### ***Summary of Data Considered***

The analysis was conducted using data from July 1, 1997 to June 24, 2004. The required data was obtained from 4 sources: Datastream, IRESS, SIRCA and the ASX as detailed in Table 1.

The Australian equity component of the portfolio was represented using stocks in the S&P/ASX 20 index over the study period. The various other asset classes used in the balanced portfolios were represented by appropriate indices as indicated in Table 1.

**Table 1.** *Asset Class Representatives and Data Sources*

<b>Asset Class</b>	<b>Data Source</b>	<b>Representative</b>
Australian Stocks	IRESS	S&P/ASX 20 constituents.
International Stocks	DataStream	MSCI World Ex Australia (unhedged).
Fixed Income	IRESS DataStream	50% UBS Warburg Government Bond Index Australia (all maturities); 50% JP Morgan Global Government Bond (hedged).
Property	DataStream	Mercer Property Index.
Cash	DataStream	11am overnight cash rate.
Call Options	SIRCA Australian Stock Exchange (ASX)	Call options on S&P/ASX 20-stocks from July 1997 to June 2004.
<b>Other Data Used</b>		
Exchange Rate	DataStream	AUD/USD-exchange rate
Index Weights	SIRCA	Daily weights of S&P/ASX 20 for period July 1, 1997 and June 24, 2004



### ***Implementing the Covered Call Strategy***

The covered call strategy implemented in this study involved writing call options on every stock in the Australian equity position of the portfolio at every rebalance date.

The actual options used in this strategy were chosen from historical option data according to the following conditions.

1. **Exercise price:** in the range of 5% to 15% out-of-the-money.
2. **Expiry Date:** Wherever possible, 3-months options were used in the covered call strategies. If such an option was not available<sup>3</sup>, then an option with an expiry date no later than 5 days after the subsequent rebalance date was used. Options with maturities greater than the next rebalance date were closed out on the next rebalance date. Those that expired on the rebalance date were exercised or expired worthless.

If more than one option per stock per rebalance day satisfied these conditions, the option closest to the target parameters was selected. (If the historical price database did not contain appropriate option, the position was left unhedged at least until the next rebalance date).

The SIRCA option database was used only to select the appropriate options to set up the covered call strategy. The value of the option positions was marked-to-market on a daily basis using the ASX option settlement price<sup>4,5</sup>.

### ***Calculation of Returns***

Returns on the various classes and the portfolios considered were determined using the continuously compounded (log) daily returns using the raw data collected. The daily return of cash was calculated from the 11am cash rate, expressed in percent per annum. This rate was adjusted for use on a daily basis.

### ***Returns from Investments in Australian Equities***

Dividend payments were incorporated into the stock price data when calculating the daily log-returns for each stock:

$$r_t = \ln\left(\frac{p_t + d_t}{p_{t-1}}\right)$$

where  $p_t$  = close price of the stock on day t.  
 $d_t$  = the dividend amount paid on day t if applicable.

<sup>3</sup> Due to the different cycle of expiry dates for the option series.

<sup>4</sup> The data set used was corrected for missing data and zero options prices. Linear interpolation was used to correct for any missing options prices. Zero option prices prior to the maturity of the option were "filled" using the available data. Linear interpolation was used where possible. The missing data and the zero option prices accounted for less than 10% of the option premiums used.

<sup>5</sup> As used by the Option Clearing House

Using the weights of the stocks in the Australian equity component of the portfolio and daily returns per stock, daily returns of investments in Australian equity were calculated. Note that these returns do not reflect the ASX 20's returns exactly since the Australian equity component of the portfolio was only rebalanced quarterly whereas the index weights of ASX 20-stocks changed almost daily.

### **Returns on Other Asset Classes**

The returns on the remaining asset classes were determined in a similar way to Australian equity, using continuous compounding (or log) returns but without the incorporation of dividend payments. The value invested in each asset class was assumed to grow at the continuously compounded rate of return over the 1-day holding period.

### **Calculation of Portfolio Returns**

The value of the balanced portfolio on a particular date was calculated as the sum of value of the investments in the various asset classes. These daily sums were used to calculate continuously compounded daily portfolio returns.

### **Income from selling Call Options**

The income from selling the call options was incorporated into the return of the balanced fund. For the balanced portfolio with covered call positions, the daily return on the portfolio was calculated using the formula:

$$r_t = \ln \left\{ \frac{V_t - (C_t - I_t)}{V_{t-1} - C_{t-1}} \right\} \quad (1)$$

where

- $V_t$  = value of portfolio at the close of day t
- $V_{t-1}$  = value of portfolio at the close of day t-1
- $C_t$  = value of the option position on Australian equity component of the portfolio at the close of day t.
- $C_{t-1}$  = value of the option position on Australian equity component of the portfolio at the close of day t-1.
- $I_t$  = Interest earned on option premiums over period [t-1, t].

Equation (1) is simply derived from using the idea that the holding period return on an investment is the rate of return which equates the value of the funds invested at the beginning of the period with the proceeds of the investment at the end of the period. The formula takes into account the change in the value of the portfolio as well as the value of the options position on a daily basis over the holding period.

That is,  $(V_{t-1} - C_{t-1})e^{r_t} = V_t - (C_t - I_t)$

Initial Outlay = value of portfolio at close of day (t-1) – value (income) from the option position at close of day (t-1).

Proceeds of Investment

= value of portfolio at close of day t *plus* accumulated interest from option premiums over the period [t-1, t] *minus* value of options at the close of day t.

### 3. Results

The results presented below include summary statistics of the quarterly returns for the balanced portfolio with and without the covered call strategy over the study period. These include the average return, the standard deviation of returns, the skewness coefficient, minimum and maximum returns on the investment.

Also presented are standard risk-adjusted performance measures – the Sortino ratio and the Sharpe ratio. Distributional properties of the portfolio returns are presented using various histograms of the empirical distributions. The year by year returns distribution on the portfolios is also presented.

Additional results including summary statistics and risk-adjusted return measures based on daily and monthly returns are provided in Appendix 1.

#### *Summary Statistics*

Descriptive statistics of the quarterly returns for the balanced portfolio with and without covered calls are provided in Table 2. These quarterly returns were determined using the rebalance dates used in the study.

Table 2 indicates that the covered call strategy provided an additional 16 basis point (0.16%) absolute increase or a 3% relative increase in the annualised average return for the 7 year period considered. The small increase in the average return is reasonable given that the study period covered extended periods of bullish market and that the sold call options were 5-15% out-of-the-money.

**Table 2.**  
*Summary Statistics July 1997- June 2004 based on quarterly returns.*

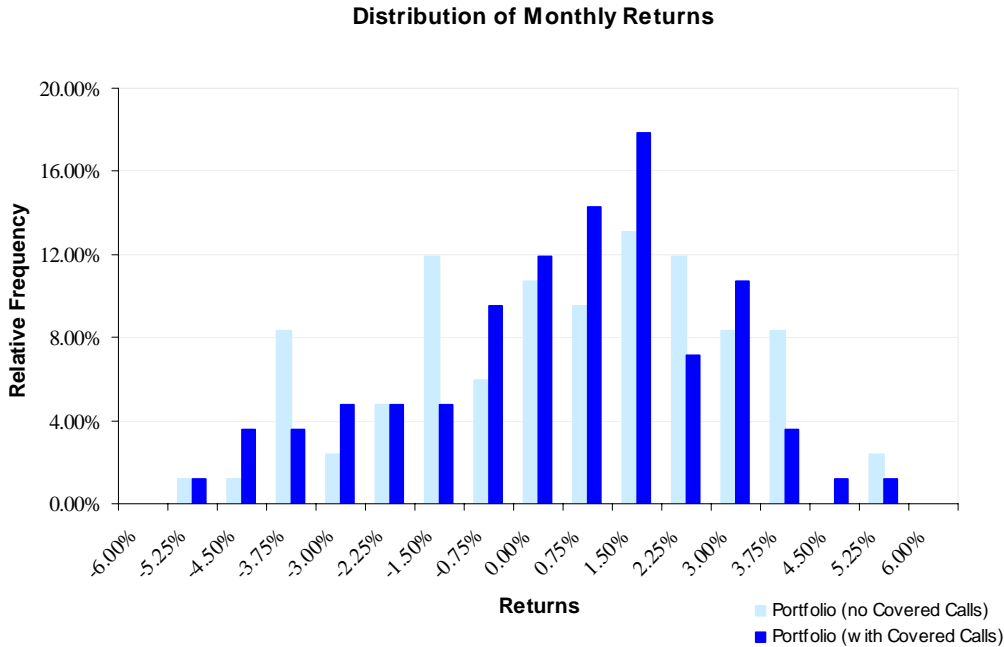
	Balanced Portfolio - no Covered Calls	Balanced Portfolio with Covered Calls
<i>Annual Statistics</i>		
Mean Return (annualised)	5.93%	6.09%
Standard Deviation (annualised)	9.64%	8.93%
Probability of Negative Return (annualised)	26.91%	24.84%
<i>Quarterly Statistics</i>		
Number of Quarters	28	28
Mean Return	1.48%	1.52%
Standard Deviation	4.82%	4.46%
Maximum Return	8.54%	7.63%
Minimum Return	-10.10%	-9.83%
Skewness	-0.78	-0.90

The covered call strategy provided a reduction in the risk of the balanced portfolio as measured by annualised standard deviation as would be expected by such a strategy. The standard deviation dropped from 9.64% to 8.93%, resulting in a 7.4% relative reduction in risk as a result of the covered call strategy.

The balanced portfolio with the covered call strategy also produced a lower range for the quarterly returns. Specifically, a sacrifice of the upside potential is evident in the lower maximum return for the portfolio with covered calls of 7.63% from 8.54%. Similarly, the strategy provided some downside protection as is evident in the slightly higher quarterly minimum return associated with the balanced portfolio with covered calls of -9.83% from -10.10%. The reduction in the range of returns is largely due to the capping of the upside potential of the investment and the partial insurance on the downside.

The return distribution of the portfolio with covered calls exhibits more negative skewness than the balanced portfolio without covered calls. The coefficient of skewness for the quarterly returns of the portfolio with covered calls is -0.90 compared with a skewness coefficient of -0.78 in the absence of covered calls as indicated in Table 2. This is also evident in histogram of the empirical distribution of returns for the two portfolios shown in Figure 2.

The existence of negative skewness should be taken into account when measuring the risk-adjusted performance of the portfolios as the existence of skewness renders the standard deviation inadequate as a measure of risk. To account for skewness, the semi-standard deviation is used as a measure of downside risk and used in the calculation of risk-adjusted performance measures presented in Table 3.



**Figure 2** Empirical Distribution of the Standardised Monthly Returns.

### Performance Measures

The performance of the two portfolios (balanced portfolio with and without covered calls) was assessed on a risk-adjusted basis using the Sharpe and the Sortino ratios with the formulae provided in Table 3.

The Sharpe ratio measures the portfolio's return in excess of the risk-free rate on a total risk adjusted basis.

The Sortino ratio is a measure of the portfolio's excess return per unit of downside risk. The Sortino ratio is an appropriate measure of risk-adjusted performance in this study given the negative skewness of the portfolios.

**Table 3** Summary of Portfolio Performance Measures

<b>Sharpe Ratio</b>	Excess portfolio return per unit of total risk	$\frac{\bar{R}_p - \bar{R}_f}{\sigma_p}$
<b>Sortino Ratio</b>	Excess portfolio return per unit of downside deviation	$SR = \frac{\bar{R}_p - \bar{R}_f}{\sigma_p^{DS}}$

$\bar{R}_p$  and  $\bar{R}_f$  denote the mean return of the portfolio and the risk-free rate respectively over the evaluation period.  
 $\sigma_p$  and  $\sigma_p^{DS}$  denote the standard deviation and the semi-standard deviation of returns respectively over the evaluation period.

Table 4 summarises the results of the portfolio performance measures applied to the returns of the portfolios. The results show that the use of the covered strategy enhances the average return per unit of risk.

As indicated by the values of the Sortino ratio, the balanced portfolio with the covered call strategy outperforms the balanced portfolio with no covered calls on a risk-adjusted basis. The relative improvement in the risk adjusted return is 23% per unit of downside risk. The Sharpe measure also confirms the improved return on the portfolio due to the covered call strategy.

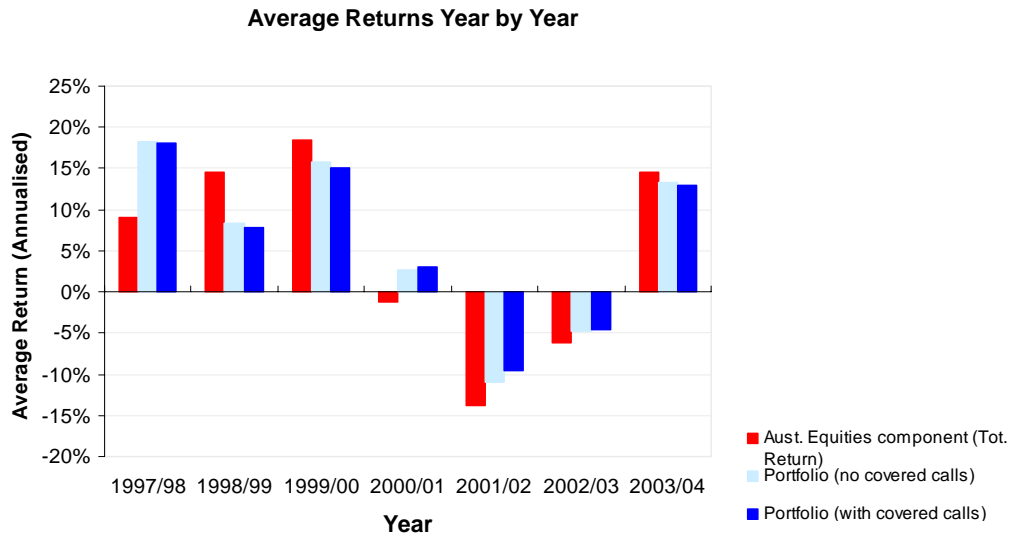
The values presented in Appendix 1 based on the daily and monthly returns also confirm these results.

**Table 4.**  
*Portfolio Performance Measures (based on quarterly returns)*

	Balanced Portfolio - no Covered Calls	Balanced Portfolio with Covered Calls
<i>Returns (Annualised)</i>		
Mean	5.93%	6.09%
Semi-Variance	0.0056	0.0049
Semi-Standard Deviation	7.477%	7.003%
<b>Sortino Ratio</b>	<b>0.0975</b>	<b>0.1256</b>
<b>Sharpe Ratio</b>	<b>0.0756</b>	<b>0.0985</b>
<i>Risk-Free Rate( Annual)</i>	5.21%	

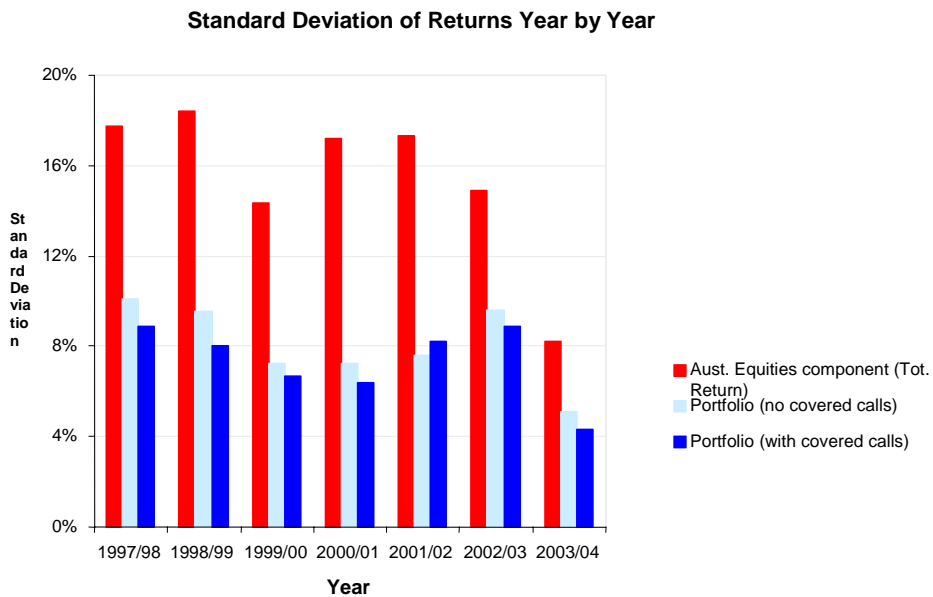
### ***Summary of Year by Year Returns***

The average returns and the standard deviation of the returns on a year by year basis are presented in Figure 3. The results show that the balanced portfolio with covered calls outperformed the portfolio with no covered calls in the years 2000-2003 when the Australian equity market exhibited negative returns. The higher average returns on the balanced portfolio with covered calls during this period can be attributed to the downside protection offered by the covered call strategy during periods of declining markets. During such market conditions, the exercise of the sold call options by the option holder is unlikely and the option seller benefits from the premium received. Over the rest of the study period, the balanced portfolio with covered call options underperformed. This can be attributed to the bullish Australian equity market over those years as indicated in Figure 3.



**Figure 3.** Year by year mean returns of the portfolios.

The covered call strategies used also resulted in a reduction in the standard deviation of the returns on a year-by-year basis as indicated in Figure 4. The balanced portfolio by its nature has significantly less risk than Australian stocks. The inclusion of covered calls reduced the standard deviation of returns for the balanced portfolio even further. This can be attributed to the property that covered call strategies reduce the range of observed returns as is evident in Table 2 by the maximum and minimum return values.



**Figure 4.** Standard deviation of year by year returns of the portfolios.



#### 4. Conclusion

This report summarised the result of a study of the risk and return characteristics of covered call strategies on a balanced portfolio in the Australian market. The balanced portfolio used in the analysis consisted of several asset classes including Australian equity, international equity, fixed income and cash. The covered call strategy was implemented by selling slightly out-of-the-money options on stocks in the Australian equity component of the portfolio.

The results of the analysis show that for the period of the study, the covered call strategy resulted in an improved average return, lower standard deviation, more negative skewness and enhanced risk adjusted returns for the balanced portfolio. The results of the study agree with similar studies on covered calls involving index options.

#### 5. References

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Benesh, G.A and Compton, W., *Historical Return Distributions for Calls, Puts and Covered Calls*, *Journal of Financial and Strategic Decisions*, Spring 2000, pp.16-33.

Hill, J. and Gregory, K., *Covered Call Strategies on S&P 500 Index Funds: Potential Alpha and Properties of Risk-Adjusted Returns*, 2003, Goldman Sachs Research.

**APPENDIX 1.**
**Table A1.** *Summary Statistics July 1997- June 2004 based on daily returns.*

	<b>Balanced Portfolio - no Covered Calls</b>	<b>Balanced Portfolio with Covered Calls</b>
<i>Annual Statistics</i>		
Mean (annualised)	5.93%	6.09%
Standard deviation (annualised)	8.71%	7.86%
Probability of negative Return (annualised)	24.81%	21.95%
<i>Monthly Statistics</i>		
Number of Months	1822	1822
Mean	0.0228%	0.0233%
Standard deviation	0.54%	0.49%
Maximum Return	2.91%	2.80%
Minimum Return	-4.64%	-4.54%
Skewness	-0.32	-0.46

**Table A2.** *Summary Statistics July 1997- June 200 based on monthly returns.*

	<b>Balanced Portfolio - no Covered Calls</b>	<b>Balanced Portfolio with Covered Calls</b>
<i>Annual Statistics</i>		
Mean (annualised)	5.93%	6.09%
Standard deviation (annualised)	8.41%	7.80%
Probability of negative Return (annualised)	24.06%	21.72%
<i>Monthly Statistics</i>		
Number of Months	84	84
Mean	0.494%	0.508%
Standard deviation	2.43%	2.25%
Maximum Return	5.36%	5.43%
Minimum Return	-5.20%	-4.84%
Skewness	-0.31	-0.43

**Table A3.** *Portfolio Performance Measures (based on daily returns)*

	<b>Balanced Portfolio - no Covered Calls</b>	<b>Balanced Portfolio with Covered Calls</b>
<b>Returns (Annualised)</b>		
Mean	5.93%	6.09%
Semi-Variance	0.0039	0.0032
Semi-Standard Deviation	6.25%	5.69%
<b>Sortino Ratio</b>	<b>0.1156</b>	<b>0.1547</b>
<b>Sharpe Ratio</b>	<b>0.0829</b>	<b>0.1120</b>
<i>Risk-Free Rate( Annual)</i>	5.21%	

**Table A4.** *Annualised Portfolio Performance Measures (based on monthly returns)*

	<b>Balanced Portfolio - no Covered Calls</b>	<b>Balanced Portfolio with Covered Calls</b>
<b>Returns (Annualised)</b>		
Mean	5.93%	6.09%
Semi-Variance	0.0037	0.0036
Semi-Standard Deviation	6.067%	6.021%
<b>Sortino Ratio</b>	<b>0.1187</b>	<b>0.1477</b>
<b>Sharpe Ratio</b>	<b>0.0856</b>	<b>0.1141</b>
<i>Risk-Free Rate( Annual)</i>	5.21%	

## APPENDIX 2.

Sample of expiry dates for options used in the study.

Rebalance Date	AMP	ANZ	BHP	BIL	CBA	CML	NAB	RIO
	<b>Option Expiry Dates</b>							
23/09/1999	23/12/99	23/12/99	23/12/99	23/12/99	27/01/00	24/02/00	23/12/99	23/12/99
23/12/1999	30/03/00	27/04/00	30/03/00	30/03/00	27/04/00	25/05/00	27/04/00	30/03/00
30/03/2000	29/06/00	29/06/00	29/06/00	29/06/00	29/06/00	24/08/00	29/06/00	29/06/00

Expiry dates of options written on 23/9/1999. The next rebalance date is 23/12/1999. Hence, options written on 23/9/1999 must expire on or after 23/12/1999.