THE RETURNS FROM CALL AND PUT OPTION PORTFOLIO INVESTMENT STRATEGIES ON THE JSE EXCHANGE

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ABSTRACT

Investors need to be informed about the return characteristics of various option strategies in order to benefit from additional investment opportunities provided by options. The purpose of this study is to examine, from a historical perspective, the return, and associated risk, of using fully covered call option and protective put option strategies with the underlying portfolio of selected shares from the JSE Securities Exchange, South Africa (JSE).

The objective of this study is to consider two option strategies - the covered call strategy and the protective put strategy. The former strategy involves writing a call option and buying the underlying stock, while the latter involves buying a put whilst holding underlying stock.

The study compares the performance of the two strategies in a global investment strategy which combines diversification and hedging to the performance of a stock portfolio without options.

The results from this study provide investment options and strategies across various levels of risk aversion while still maintaining a diversified portfolio.

The stocks chosen were the top 40 listed shares on the JSE, measured by market capitalisation, and hypothesis testing was used to illustrate the differences in performance between portfolios.

Results from this study showed that the combination of the underlying stocks with a fully covered call option strategy leads to returns similar to those of a portfolio of underlying stocks only, but the risk, as measured by standard deviation, is lower on a portfolio with fully covered call options when compared to a portfolio of underlying stocks only.

Combining the underlying portfolio with a protective put options strategy lowers the returns compared to those of a portfolio of the underlying stocks only.

DECLARATION

I, Osborn Mzuvumile Mahanjana, declare that this research report is my own work, except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration - University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.

Osborn Mahanjana

Signed at …………………………………………………

On the …………………………….. day of ………………………… 2008

DEDICATION

I dedicate this research report to my family, Sibongile and Khanya, for their support, their love and continuous encouragement.

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CHAPTER 1: INTRODUCTION

Since options were introduced on the JSE Securities Exchange, South Africa ("JSE"), by Deutsche Bank in October 1997, the option market has experienced exponential growth. In the third quarter of 2001 the trade in options accounted for approximately 49,8% of the total volume traded on the JSE (JSE, 2002). This study will evaluate option trading strategies for a retail investor.

According to Dritsakis and Grose (2003) most of the current research focusing on options can be divided into three categories: the first involves the theoretical and empirical estimation of various option-pricing models, the second focuses on the role options play in hedging risk exposure of a portfolio, and the third attempts to price exotic option constructs. Little attention and research has been dedicated to the effect options have on a portfolio from an individual investor's perspective (Hamernik, 2005). The purpose of this study is to examine, from a historical perspective, the return and risk associated with holding various option strategies, from a representative investor standpoint.

The investor represented by this study is considered distinct from an institutional investor, since the individual has limited net worth, and faces the burden of higher transaction costs given bid-ask spreads, taxes and overall relative trade size. The results from this study provide investment options and strategies across various levels of risk aversion while still maintaining a diversified portfolio. The results will attempt to provide new insight into investment options that could be utilized in today's market.

1.1 Purpose of the study

The purpose of this study is to examine, from a historical perspective, the return, and corresponding risk, of using fully covered call option and protective put option strategies with the underlying portfolio of selected shares from the

JSE. Investors need to be informed about return characteristics of various option strategies in order to benefit from additional investment opportunities provided by options (Merton, Scholes and Gladstein, 1978).

Merton, Scholes and Gladstein (1978) assert that it is difficult to give a qualitative description of the returns pattern associated with various options strategies for a portfolio as opposed to single option stock positions. Isakov and Morard (2001) are of the view that using option strategies with a portfolio consistently improves performance, compared to a portfolio without options. This paper will provide analysis and empirical evidence of the return patterns of portfolio strategies involving options over a significant period of time.

1.2 Problem statement

The objective of the investor is to maximise returns on his/her investment/s or portfolio, while minimising the risk associated with the investment. An investor would have to choose between different types of investments namely cash, bonds, equities, commodities, currencies and derivative instruments. Therefore, due to limited resources, an investor will invest in those instruments that offer optimal returns for the risk taken.

Equity options were introduced on the JSE in 1997 and since then there has been rapid growth in the value traded on these instruments (JSE, 2002). This study wants to ascertain whether incorporating equity options into investment strategies would yield superior returns for an investor, compared to investing in stocks only.

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Two further aspects of market efficiency are highlighted as a result of this study. Firstly, the ability of a trading rule to distinguish profitable from unprofitable investments. Thus, the ability of the trading rule to explain observed prices is ascertained. The second aspect is the establishment of a trading strategy based on this rule that will ensure above-normal profits, relative to the risk taken. This could be achieved through performing an ex ante test (on past data) by replicating the existing opportunities for a trader.

1.3 Significance of the study

An increasing number of investment managers, realising the potential profits that could be made by identifying market inefficiencies, are engaging in the options market. Their aim is twofold: Establish solid hedges against positions taken on the underlying assets, and, at the same time, make profits in the options market when such opportunities arise (Korn and Trautmann, 1999).

Hedgers might wish to minimise risk close to zero, under ideal conditions, but they might also want to resort to insurance to minimise possible unfavourable future outcomes (Sheedy and Trevor, 1998). Fund managers engaging in active fund management could exploit signals of market inefficiency, even though transaction costs result in the reduction of expected profits. However, according to recent studies, option strategies are still profitable, even after transaction costs have been factored in (Isakov and Morard, 2001).

Put options are associated with term insurance, in which the term or maturity is the length of time between the purchase of the put option and its expiry date, and the value insured is the value of underlying stock (Merton, Scholes and Gladstein, 1978). An investor can insure the declining value of stock or portfolio using put options in the same way one could insure a house against fire or natural disaster. For partial losses, the amount received is equal to the number of shares involved, multiplied by the difference between the exercise price and market price of the stock at the time the put is exercised.

Moreover, depending on the relationship chosen between the exercise and market prices of the stock when the put is purchased, the put option will have features quite similar to those of an insurance policy with a deductible amount (Merton, Scholes and Gladstein, 1978). For example, if an investor owns 1000 shares of stock with a market price of R100 per share and if he/she purchases a put option on 1000 shares with an exercise price of R100 per share, then he/she is totally insured against any decline in the stock during the life of the option. However, if the investor instead purchases a put on the stock with an exercise price of R90 per share, then he/she is not insured against the first R10 per share decline, in other words the first R10 000 in losses, although he is covered against any additional losses as a result of a decline below R90 - that is, his put has a R10 000 deductible. The possibilities available in put options exceed those of traditional insurance by allowing for negative deductibility, where the put purchaser is paid the difference if the stock does not rise above a specified price (Merton, Scholes and Gladstein, 1978). Continuing with the abovementioned example, suppose an investor purchases a put on the stock with an exercise price of R110, then he/she is fully insured in the event that the stock does not appreciate by at least 10 percent.

The principal functional characteristic of a put option is for use as insurance against a decline in the underlying stock's value (Merton, Scholes and Gladstein, 1978). An investor can purchase a put option as insurance without owning the underlying asset, unlike traditional insurance where you have to own the asset before you purchase insurance. Like the traditional insurance contract, the price that the investor must pay for the put option will be higher for larger exercise prices (that is, larger maximum coverage levels) and for larger exercise prices/initial stock price ratios (smaller deductible). The price will be higher for a longer maturity (longer term) and for coverage of a more volatile (more risky) stock (Merton, Scholes and Gladstein, 1978). As with insurance, it is interesting to note that the terminology often used for the price of an option is "premium".

Let's now turn to the characteristics of a call option, which gives its owner the right to buy a specified number of shares of a given stock at a specified price per share, or before a specified date (Hull, 2006). Consider an investor who has the following investment strategy:

- First he/she buys one share of a non-dividend paying stock;
- Secondly he/she borrows money by taking out a term discount loan, for example a government bond with a face value of Rand (E) which has a maturity date (T) months in the future.

If at the end of T months the stock was selling for Rand (S) per share, then the value of his total position would be as follows: If S were less than E, he/she would exercise his/her put, deliver the stock and receive Rand (S). However, he/she would owe Rand (E) on his/her loan. In this case the net value of his/her position would be zero. If S were larger than E, he would allow the put to expire unexercised and would sell the stock, receiving Rand (S). From this, he/she would pay off the loan for Rand (E), which would leave a net positive value for the position of Rand (S – E). In abbreviated form, the net value of the position as a function of the stock could be written as Rand Max [0,S – E] (Merton, Scholes and Gladstein, 1978).

Suppose that the investor had an alternative investment strategy of purchasing a call option on one share of the stock with an exercise price of Rand (E) and expiration date (T) months in the future. If at the end of (T) months the stock was selling for Rand (S) per share and S were less than E, he would allow the call option to expire unexercised, and the value of his position would be zero. However, if S were larger than E, he would exercise the call, paying Rand (E) for the stock and sell the stock for Rand (S), and the net value of his position would be Rand (S-E). According to Merton, Scholes and Gladstein (1978) the net value of the position, as a function of the stock, would be expressed as Rand Max [0, S – E].

The payoffs of both strategies are identical for every possible stock price, and functionally equivalent (Merton, 1973). Therefore, the functional characteristics of a call option are equivalent to a long position in the stock, levered by a term loan with a face value of Rand (E) plus an insurance policy against declines in the stock price below Rand (E) per share. While the leverage component of a call option is its most commonly associated characteristic, it is the insurance characteristic that significantly distinguishes call option strategies from simple stock strategies such as buying stocks on margin.

It is well accepted that for two call options with the same maturity, the one with the higher exercise price will have more leverage. It is less frequently recognised that it will also have a larger insurance component (Merton, Scholes and Gladstein, 1978). According to Hull (2006) a call option on a volatile stock is more valuable than a call option on stock that is less volatile. For the same terms, an insurance policy against declines in a volatile stock is more valuable than one against declines in a less volatile stock (Merton, Scholes and Gladstein, 1978). It thus follows that an investor can choose one of the strategies to achieve the desired investment outcome, which is to maximise returns and minimise risk by using some of the aforementioned strategies.

The objective of this study is to consider two option strategies: the covered call strategy and the protective put strategy. The former strategy involves writing a call option and buying the underlying stock, while the latter involves buying a put whilst holding underlying stock. The study compares the performance of the two strategies in a global investment strategy which combines diversification and hedging, to the performance of a stock portfolio without options.

Covered call writing occurs when an investor owns shares in a company and writes call options on those shares (Board et al, 2000). Hull (2006) defines protective put strategy as an investment strategy that involves buying a put option on a stock as well as the stock itself. Protective put strategy is characterised by its ability to provide downside protection for the value of a risky asset portfolio, while preserving much of the upside (Clarke and Arnott, 1987).

1.4 Delimitations of the study

The research will include two option strategies: a covered call option and a protective put option, in order to modify risk-return of a portfolio. The research will compare a portfolio without these strategies to a portfolio with these strategies. The research portfolio will comprise of the top 40 listed shares on the JSE from December 1997 to December 2007.

1.5 Definition of terms

At-the-money option: When the option strike price and share price are identical.

Beta: A measurement that quantifies the correlation between the movement of a stock and the movement of the stock market as a whole.

Call: An option contract that gives the holder the right to buy and obliges the writer to sell a specified number of shares at a specified strike price, any time before the contract expiry date.

Covered write: The writer of a call option is covered if he holds an equivalent quantity of the underlying security for each option contract he sells or writes.

European option: An option that the holder can only exercise on the expiry date.

Ex-dividend date: Date on which the buyer of a stock is not entitled to an upcoming already-declared dividend, but is entitled to future dividends.

Expiry date: The date on which the option ceases to exist.

In-the-money option: When the strike price of a call option is lower, and a put option's is higher, than the share price.

Intrinsic Value Positive: The difference between the stock price and the strike price of a call option, or between the strike price of a put option and the stock price. By definition, the intrinsic value cannot be negative.

Out-of-the-money option: When the strike price of a call option is higher, and a put option's is lower, than the share price.

Premium: The price of the option.

Put: An option contract that gives the holder the right to sell, and obliges the writer to buy a specified number of shares at a specified strike price, any time before the contract expiry date.

Sharpe ratio: A measure of risk-adjusted performance of an investment asset or a trading strategy.

Strike/exercise price: The contractually specified price at which the holder of an option can buy (call option) or sell (put option) the underlying stock.

Time value: A portion of the premium that represents the remaining time until the expiry of the option contract and reflects the factors that determine the value of the option premium, which factors can change, during this period. The time value is equal to the difference between the option premium and the intrinsic value. The time value is usually positive and decreases with the passage of time.

To exercise an option: Represents the process by which the holder exercises his right to buy (in the case of a call option) or sell (in the case of a put option), according to the terms specified in the option contract.

Treynor ratio: A measurement of the returns earned in excess of that which could have been earned on a risk free investment

Volatility: The variability of a stock as measured by the standard deviation of its return as well as a measure of the tendency of the share price to rise or fall.

Writer (Seller): The person who sells or issues an option.

1.6 Assumptions

- The outcome of the research will be of strategic importance to investors on the JSE, and this will lead to different investment strategies inclusive of the option strategies.

- The sample size and stratification approach is valid and appropriate.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

The rapid growth of option markets has generated great interest in the use of various option strategies (Isakov and Morard, 2001). Equity options are an extremely useful tool in the management of equity portfolios because they have the unique ability to modify the risk-return profile of your portfolio to meet your specific objectives (Australian Stock Exchange, 2005). Bookstaber and Clarke (1985) have shown that the introduction of options in stock portfolios can considerably alter the distribution returns. There are many different applications for equity options, all of which result in precise adjustments to the risk-return characteristics of the underlying equity portfolio (Australian Stock Exchange, 2005).

The options market today is a highly liquid, low-transaction-cost, and penetrable market. An individual investor today can easily trade small quantities of option contracts through a broker or an individual on-line brokerage account. The options market today is nothing like it was twenty to thirty years ago. Thirty years ago the options market barely existed and was primarily an institutional investment vehicle; the options market had just become standardized, allowing an individual investor to invest in index options, but at extremely high costs and without the fluidity of today's market (Williams and Hoffman, 2001).

According to Bookstaber and Clarke (1984), options can increase the flexibility of returns available from investment strategies, and some options strategies outperform the more common stock-bond strategy. The principal function of options is to provide a significant expansion of the patterns of portfolio returns available to investors. Such expansions benefit investors and add to the liquidity and efficiency of the capital markets (Bookstaber and Clarke, 1984).

The Black (1975) article corrects many popularly held misconceptions about option investments, but it does not give a quantitative description of the return patterns associated with various option strategies (Merton, Scholes and Gladstein, 1978).

Traded in conjunction with previously established positions in the stock market, options can be used to reduce downside risk or to generate incremental returns on portfolio positions. They are also a valuable means of locking in today's stock prices in anticipation of a future purchase or sale. And, as a proxy for transacting in the actual stock market, options offer the most adventurous investor a means of substantially increasing his investment leverage, without adding unlimited downside risk to his net position (Montréal Exchange, 2007).

There are three primary situations to consider when choosing an appropriate strategy on the options market: initial position on the stock market, predictions about market conditions and the availability of funds. Certain factors can have an impact on the dynamics of these elements, such as the direction, amplitude and timing of variations in the price of a security (Montréal Exchange, 2007).

Although options are not for everyone, many investors should consider them when determining their investment objectives. One should also make sure one understands the concepts underlying the trading of options, knows the risks and advantages of the chosen investment strategy, and understands how one can manage a portfolio based on changes in the market (Montréal Exchange, 2007).

In today's market, option prices instantly change in value as prices fluctuate in underlying assets, according to market makers' valuation estimates. The ease of entry and exit is as fluid as trading exchange listed stocks. Gains and losses can easily be magnified by the leverage options provide, and through the research, a solution to maximize gains and realize the potential risk of losses will be highlighted for each investor (Dritsakis and Grose, 2003*)*.

2.2. Use of equity options in portfolio management

According to the Australian Stock Exchange (2005) equity options are used with existing long stocks to do one of the following:

- Reduce risk by buying put options as protection or by writing premium income that cushions downside price movement by reducing volatility of the portfolio;
- Generate extra returns by writing options and collecting premium income while capping the upside;
- Reduce transaction costs by gaining exposure to stocks or an index using options, rather than paying full stock transactions costs; or
- Reduce market impact costs of acquiring stock by accumulating the desired level of exposure via options, and then switching from options to stock.

According to Isakov and Morard (2001) option-based strategies enhance and improve the performance of portfolios. The use of the covered call strategy with a stock portfolio consistently improves the performance of the stock portfolio (Isakov and Morard, 2001). On one hand, Bookbinder (1976), Kassouf (1977), Pounds (1978), Grube and Panton (1978) and Yates and Kopprasch (1980) observe that covered call writing still produced substantially larger returns than the traditional buy and hold strategy, even though the level of risk on a portfolio combined with options was lower compared to a portfolio without the options, as measured by the standard deviation of the returns. Conversely, the investor who sells options against stock that is owned - a covered option writing - is insuring the option purchaser against stock price declines below the option exercise price and lending money on a term basis. Covered call option portfolios exhibit lower variance of returns and a smaller interquartile range than a portfolio of the underlying stocks (Booth et al, 1985).

2.3. Fully covered option writing strategy

Merton, Scholes and Gladstein (1978) define a fully covered option writing strategy as a combination of the naked strategy with purchases of the underlying stock where the number of shares purchased is the same at the number specified in the option sold. A naked option writing strategy simply entails selling a call option short (Merton, Scholes and Gladstein, 1978).

When you sell (write) a covered call, you receive the option premium. The option premium can be seen as extra income earned from owning those shares. In effect, your shares are 'working harder' (Australian Stock Exchange, 2005). A paper by Bookstaber and Clarke (1984) suggests that this strategy is popular among portfolio managers. Writing call options offers the best of both worlds. If the stocks appreciate and are called away, the portfolio still gains the option premium and also receives dividend for the period before exercise. If the option is out of the money, the portfolio will gain if the stock appreciates just up to exercise price. If the stock declines, the loss is buffered by the option premium and therefore the loss will be less than if no option was written (Bookstaber and Clarke, 1984).

Selling covered calls provides you with extra income, but the trade-off is that the upside potential of your stock holding is capped. This is because, as long as the call option position is maintained, you have an obligation to deliver the underlying stock at the exercise price if the option is exercised by the option holder (Australian Stock Exchange, 2005). Hence, a fully covered writing strategy is functionally equivalent to both lending money on term basis and issuing an insurance policy against declines in the stock below the exercise price. Moreover, as the fully covered writing strategy is applied to options with higher exercise price-stock price ratios, the insurance-issuing characteristic becomes a larger component of the investment. That is, if the options written in a fully covered strategy have exercise prices well below the stock price, the essential characteristic of this strategy is to lend money with a small amount of insurance. If, instead, the option is written in a fully covered strategy and has exercise prices well above the stock price, the essential characteristics of the strategy are to lend more money and sell even more insurance (Merton, Scholes and Gladstein, 1978).

2.3.1 Increasing the yield of an equity portfolio

Writing call options against long positions in the underlying equities is the most popular options strategy (Board, Sutcliffe and Patrinos, 2000). Selling covered calls will increase the yield on the stocks in a portfolio and this will generate extra income (Australian Stock Exchange, 2005). Pounds (1978) finds that an equally weighted portfolio, using the covered call strategy, outperformed the stock portfolio by yielding a higher return and a lower variance. Similarly Morard and Naciri (1990) ascertained that the use of covered calls improves the performance of portfolios, compared to a stock portfolio.

2.3.2 Risk-return characteristics of this strategy

The following chart shows the modification to the risk-return profile of the share holding by writing covered calls.

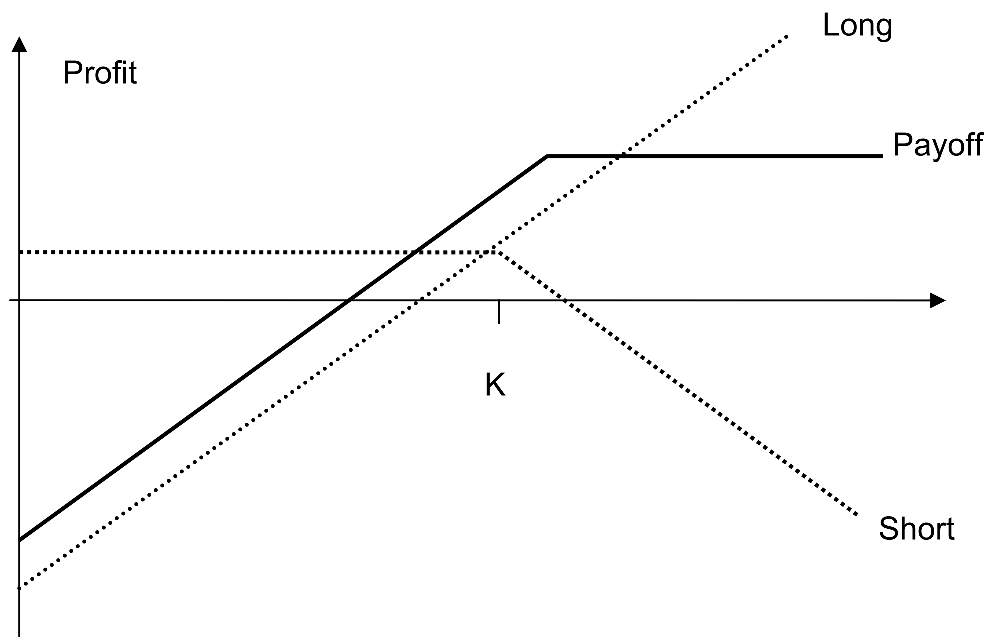

Figure 1: **Payoff – Long position in a stock combined with short position in a call**

Source: (Hull, 2006)

In comparison to the long stock position, the writing of covered calls effectively gives up exposure to the share's upside beyond the strike price. In return, the option seller receives premium income which enhances the yield of the portfolio and provides a limited cushion if the share price declines (Australian Stock Exchange, 2005).

According to Bookstaber and Clarke (1984) the use of call options appears to generate risk-return trade-off that is more favourable than that available in the market. Selling of covered call options gives the following advantage to the investor: the option premium provides a form of insurance against loss. The investor can realize a loss on stock price equal to the option premium before an actual rand loss occurs (Mueller, 1981).

Since exposure to a downward movement in the share price is retained, a favourable view on the stock is implicit in the construction of a sold covered call position. However, since one is forgoing the upside exposure above the strike price, one's view is not overly bullish for the life of the option. The covered call writer's view can usually be best described as neutral to slightly bullish, assuming that the strike price sold is just out-of-the-money (Australian Stock Exchange, 2005).

It appears that covered call options give the investor the best of both worlds: a hedge against losses if stock prices decline, and a higher return on equity if stock prices rise (Mueller, 1981). It is possible for a covered call strategy to give a higher expected return and a lower variance than the underlying stock portfolio (Bookstaber and Clarke, 1984).

2.3.3 When to use this strategy

A paper written by the Australian Stock Exchange (2005) suggests the following reasons for using this strategy:

- The most common reason for using the strategy is to generate extra income during periods when the market is expected to be flat or falling. In this case, one needs to be comfortable holding the stock as a long-term investment, but project that the share price will not rise above the strike price in the short-term. The amount received from selling covered calls represents an additional return on the underlying stock, and, therefore, a yield enhancement of your overall portfolio.

- Some cushioning against weakness in the stock is also provided by selling covered calls. If one thinks that weakness in the share price will be severe or prolonged, it is normally best to sell the stock. However, one may wish to retain the stock for reasons such as taxation management or to avoid the transaction costs involved in selling the stock and repurchasing at a later date. In these cases, a decline in the share price would be at least partially offset by the amount of option premium you receive.

Setting an exit price for your stock holding is another reason for writing calls options. The premium is received now, and the stock is sold later if the share price is above the strike price at expiry. The effective sale price is the strike price of the option plus the premium received. The objective is to divest of the stock at a pre-defined exit price.

2.3.4 Holding period

The time value of an option declines as the option approaches expiry. This reflects the shorter time remaining for the stock to exceed the strike price. By the time the option reaches expiry, the time value is zero. This process is known as ‘time decay’ (Hull, 2006).

Time decay accelerates as the option gets closer to expiry. Around half the time value of a nine-month option will be lost in the last three months, while around half the time value of a three-month option will be lost in the last month. Time decay works in favour of the seller of options because the time value of the option, for which the seller has received the premium, erodes over time. So, other things being equal, it is preferable to sell shorter dated options in order to take advantage of the accelerated rate of time decay (Australian Stock Exchange, 2005).

In general, this translates to a rule of thumb for covered call sellers that one-month options are often the most desirable, and anything longer than three months should usually be avoided. The choice of expiry month is also affected by the volatility of the underlying stock. The more volatile the stock, the riskier it is to sell longer-dated options, as there is greater potential for a damaging move in the share price (Australian Stock Exchange, 2005).

The rationale for covered calls is that, if the call option finishes out-of-the-money, the investor keeps the call premium, thus increasing the payoffs from the long position in shares. However, if the call option finishes in-the-money, the investor's gain from a fully covered call is limited to the strike price (K) plus the value of the call premium at expiry (C'), less the initial price of the share (S) (Board, Sutcliffe and Patrinos, 2000)

2.3.5 Strike prices

All other things being equal, the lower the strike price, the higher the call option premium received (Australian Stock Exchange, 2005). However, this also means that upside exposure is capped at a lower level. Therefore, a balance must be reached between risk and return, that is, between minimizing the upside potential forgone and maximizing the premium income received.

The balance reached will obviously depend on one's view of the likely share price movement during the life of the option. For example, if one thinks that the share price could appreciate by up to 7 percent before the expiry date of the option, one would choose a strike price that is around 7 percent out-of-the-money. This would allow one to capture the premium income without surrendering any upside potential (Australian Stock Exchange, 2005).

2.3.6 Selling in-the-money covered calls

In-the-money call options command the highest premiums, but are also the most likely to be exercised. For this reason, if one wants to keep one's stock, they are not the best choice (Merton, Scholes and Gladstein, 1978).

2.3.7 Selling at-the-money covered calls

The sale of an at-the-money call covered by a holding in the underlying shares produces a risk-return profile almost identical to that of a sold at-the-money put. The risk-return characteristics of this position are not conservative. On the downside, one has equity risk exposure, and on the upside one has limited profitability that is capped at a certain level (Australian Stock Exchange, 2005).

Typically, a conservative investor would want the exact opposite, that is, unlimited upside profitability with limited downside risk, capped at a certain level. In fact, the conservative investor achieves this by holding stocks and buying puts for protection (Merton, Scholes and Gladstein, 1978). If one sells at-the-money calls against one's stock holding one must, of necessity, firmly believe that the share price is not going to fall by more than the premium received. If it does, losses will mount as the market falls further (Australian Stock Exchange, 2005).

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The main advantage of selling an at-the-money call is that the at-the-money option has the most time value, and therefore will produce the greatest profit to the option writer if the share price remains steady (Australian Stock Exchange, 2005).

2.3.8 Selling out-of-the-money covered calls

This is the area that is usually of most interest to covered call writers. Typically, investors sell out-of-the-money call options in an attempt to enhance the yield of a portfolio, with the reasonable expectation that the calls will not be exercised (Merton, Scholes and Gladstein, 1978).

It is also advantageous choosing out-of-the-money strikes if one thinks that the stock may be due for an upward move. The further out-of-the-money one writes one's calls, the greater the participation in the share price gains. The trade-off is that the premium income will be lower (Merton, Scholes and Gladstein, 1978).

Another advantage of choosing out-of-the-money strike prices is that, as long as the share price remains below the option strike, less position management is required. When lower strike prices are chosen, management of the position can be an issue if the share price moves up unexpectedly. The option may be exercised prior to expiry (Australian Stock Exchange, 2005).

According to the Australian stock exchange (2005) the possibility of the call being exercised becomes more likely as expiry approaches, if the share price rises above the strike price. At this point, there are three alternatives:

- Wait until the call is exercised, and deliver the stock at the exercise price;
- Buy back the call option on market (possibly at a loss) in order to remove the risk of exercise and therefore retain the stock; or
- Roll the position. This means buying back the call and then selling another call option with a higher strike price and/or later expiry date.

2.3.9 Potential risk

If the share price rises above the strike price, the worst case scenario is that the stock is called away. Since the sold calls are 'covered' through ownership of the stock, there is no physical upside risk in selling calls. The only upside risk is the opportunity cost of having stock called away in circumstances where you might prefer to keep it (Merton, Scholes and Gladstein, 1978).

There is, however, risk on the downside, where an unexpected drop in the share price can result in large losses. The call premiums received provide only a limited cushioning effect in the face of a large drop in the share price. Note, however, that in the event of a fall in the share price one will always be better off having written calls rather than simply having held the shares alone (Australian Stock Exchange, 2005).

These benefits are, however, not obtained without some cost: the investor's potential for profit is limited. Once the option is sold, the maximum obtainable profit is set, provided the investor holds both the stock and written option until expiration (Mueller, 1981).

2.3.10 Main benefits of the options strategy

Merton, Scholes and Gladstein (1978) assert that the main benefits of a covered call strategy are:

- This option strategy generates income in flat and falling markets that will enhances the yield of a stock holding and of a portfolio.
- It provides limited cushioning in the case of a market fall.
- If the option is exercised, the sale of shares is achieved at a higher price than the share price at the time of writing the option.

2.3.11 Conclusion

Using simulation, Bookstaber and Clarke (1983, 1984, 1985) found that the use of covered calls produces portfolios that are superior in risk-return terms to the unhedged portfolios, according to the capital market line, the security market line (and beta), the Sharpe ratio and the Treynor index. This dominance is caused primarily by the substantial reduction in the variance of returns from the covered call strategy, with little change in returns.

A fully covered writing strategy can be used by an investor to modify significantly the pattern of returns associated with underlying patterns of returns associated with this strategy which is not reproducible by any simple strategy of combining stocks and fixed income securities, which is the traditional method of changing the return composition of a portfolio. This is because of the insurance component of the options (Merton, Scholes and Gladstein, 1978). Hence the existence of options significantly expands the investment opportunity set for investors.

Merton, Scholes and Gladstein (1978) suggest that fully covered strategies are less risky than holding the underlying stocks, and an investor should expect lower returns on average as compared to holding the underlying stocks alone. Bookstaber and Clarke (1984) contradict this statement, as they believe it possible for a covered call strategy to give a higher expected return and a lower variance than the underlying stock portfolio. Nonetheless, both agree that a covered call option strategy offers higher returns than fixed income securities.

A writer of a covered call option is bullish on stock, as he/she hopes that the stock will not decline, because the larger the decline the greater the losses. On the other hand, if the stock rises, the investor is indifferent to the extent of the rise. Hence, the fully covered call strategy is ideal for an investor who is bullish and believes that the market is going to be less active than generally anticipated.

<u>Research Question:</u> A portfolio that consists of a combination of fully covered call options with underlying stocks offers better returns than holding a portfolio of underlying stocks alone.

2.4. Protection for stocks

When one has a holding in a stock and is concerned about a possible fall in the share price in the near future, one can protect the capital value of one’s stock holding through the purchase of put options (Hull, 2006). No matter how much the market price of the underlying stock decreases during the life of the options, one is guaranteed the right to sell stock at the strike price of the put option (Australian Stock Exchange, 2005). According to Garcia and Gould (1987) portfolio insurance is a strategy that preserves existing capital while at the same time allowing for maximum upside participation. All the above definitions suggest that portfolio insurance protects a portfolio from declining in value during down markets.

This strategy can be useful when one has a long-term bullish view on a stock, but is concerned about a short-term fall in the price. Without using put options to obtain temporary protection, there are only two choices: either watch the value of the shares fall, or sell them (Australian Stock Exchange, 2005).

The protective put buying strategies all have the common property that the investor holds a specific number of shares of the stock and buys put options on the same number of shares of the same stock (Merton et al, 1982). The maximum gross loss per share on a protective put-buying position is the difference between the initial stock price and the exercise price, less any dividends received on the stock. The maximum net loss per share is computed by adding to the gross loss the cost of the put per share (Merton et al, 1982).

Garcia and Gould (1987), in line with an earlier assertion by Merton et al (1982), view the protective-put strategy as bullish on the underlying stock with no ceiling on gains, but there is a floor on losses. Buy and hold equity strategies allow investors to achieve returns proportional to terminal value of a reference portfolio, while buy and hold option strategies permit non-proportional returns to be achieved (Leland, 1980). The buyer of this strategy, like any buyer of insurance, hopes that he will not have to collect on the policy and exercise his put. He hopes that the stock will rise because the greater the rise, the larger his gains (Merton et al, 1982).

The returns of any protective put strategy will be lower than on the underlying stock if the stock and the put are correctly priced (Clarke and Arnott, 1987). According to Merton et al (1982) the shift in return distribution is due to a narrower return range of observed returns and smaller variances for the protective put strategy. The volatility of the returns will be lowest for the in-the-money strategy and highest for out-of-the-money strategy (Merton et al, 1982). Overall, the in-the-money strategy returns will be the least sensitive to movements in the underlying stock's price and the out-of-the-money strategy will be the most sensitive. Therefore, protective put strategies are always less volatile than the underlying stocks (Gould and Garcia, 1987).

2.4.1 The main benefits of the protective put option strategy

The main benefit of the protective put option strategy identified by the Australian Stock Exchange (2005) relates to the fact that put options enable the investor to protect the value of his or her shareholding during the life of the option. The profit potential is not limited, since the investor still benefits from the increase in value of his/her shares, if the share price rises.

2.4.2 The main risks of the protective put option strategy

The risks associated with protective put option strategy as alluded to by the Australian Stock Exchange (2005) are:

- Protective puts offer high cost protection and it is usually not cost-effective to have protection for long periods. Therefore, this strategy is generally appropriate for shorter periods, where one anticipates that the share price may decline.
- Time decay erodes the value of the bought option.

2.4.3 Risk return of protective put strategy

The following chart shows the payoff for combining long position in a put with a long position in a stock.

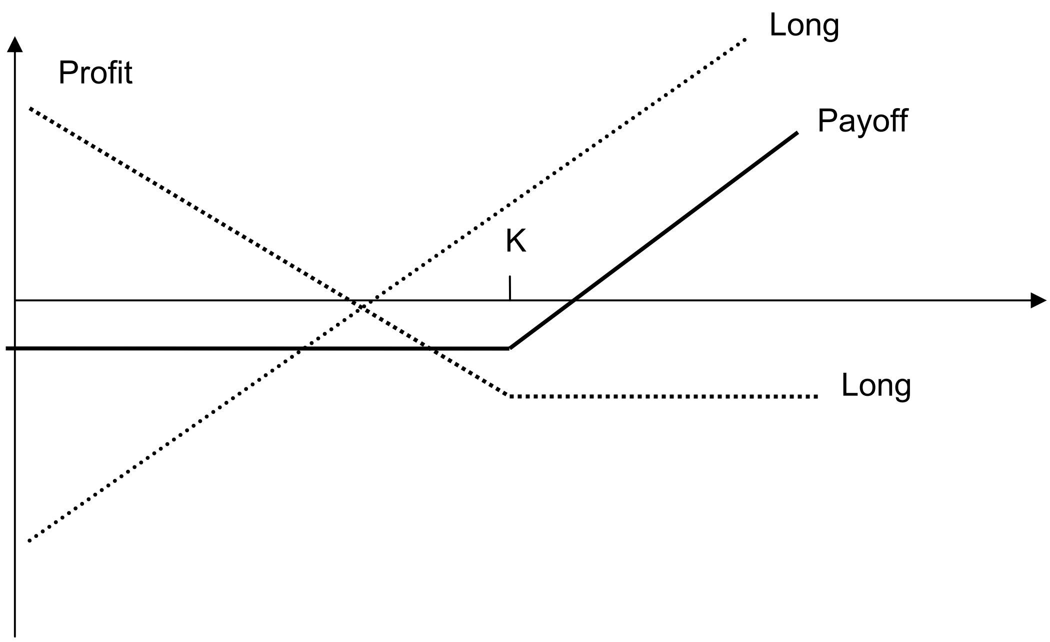

Figure 2: Payoff – Long position in a put combined with long position in a stock

Source: (Hull, 2006)

2.4.4 Conclusion

Research Question: A portfolio that consists of the combination of a protective put strategy with underlying stocks offers better returns than holding a portfolio of underlying stocks alone.

2.5. Conclusion of Literature Review

The hypotheses formulated through the literature review have been stated at the end of each relevant section and are listed below for clarity.

The objective of this study is to evaluate the use of option strategies on the JSE, and what impact they have on returns of a portfolio. The portfolio chosen is the top 40 shares on the JSE by market capitalisation. Two option strategies will be applied to this portfolio, namely a fully covered call option strategy and a protective put strategy.

2.5.1 Hypothesis 1:

H_0 : The null hypothesis states that there is no difference in portfolio returns when a portfolio that consists of the fully covered call option strategy in combination with underlying stocks is compared to a portfolio of just underlying stocks.

H_A : The alternative hypothesis states that a portfolio that consists of the combination of a fully covered call option with underlying stocks offers different returns than holding a portfolio of only underlying stocks.

2.5.2 Hypothesis 2:

H_0 : The null hypothesis states that there is no difference in portfolio returns when a portfolio that consists of the protective put option strategy in combination with underlying stocks is compared to a portfolio of just underlying stocks.

H_A : The alternative hypothesis states that a portfolio that consists of the combination of a protective put option strategy with underlying stocks offers different returns than holding a portfolio of only underlying stocks.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Research methodology

This section describes the methodology that was followed to answer the research questions posed in the literature review section. The methodology that was used is a quantitative research methodology. The section starts with a description of the chosen method and its implications for the research. It further draws attention to the limitations of the chosen methodology. The research design and sample are discussed next. It proceeds with a discussion of the process followed. The section is concluded with a discussion of validity and reliability as it applies to this study.

3.2 Option pricing and option premiums

Option prices are necessary to generate a time series of returns for the option strategies. For this research, the Black-Scholes and Merton option formula is used to simulate the option strategies instead of using market option prices, for a number of reasons. Firstly, to generate a representative pattern of returns requires a long period, covering a variety of market environments, given the fact that prior to 1997 there was no standardised option market on the JSE. Secondly, to simulate a specific strategy requires price data for options with the same exercise price – stock price ratio, as well as the same expiration date for a large number of stocks.

The option pricing formula used in this study was derived from a seminal paper by Fischer Black and Myron Scholes (Merton, Scholes and Gladstein, 1978). The inputs for the model are current stock price per share (S_0), the exercise price (K), the length of time until expiration of the option (T), risk free rate (r), dividends paid by stock and the variance rate for the logarithmic returns on the underlying stock (σ^2). No inputs, except the variance rate, require estimation. However, the variance rate, unlike the expected return on the stock, can be reasonably well estimated by using the recent past time series of the stock returns (Latane and Rendleman, 1976). The impact of implied volatility versus historical volatility was a concern in the setup of the research. Since the implied volatility can only be inferred through exploration of actual option prices, and the period examined includes the time from before the options were standardized, historical volatility proved to be a more viable, realistic, and attainable value for use in the Black-Scholes formula (Dritsakis and Grose, 2003). The Black-Scholes option pricing formula is outlined below:

$$c = S_0 N(d_1) - Ke^{-rT}N(d_2) \tag{1}$$

where:

N(x) = cumulative normal distribution function

$$d_1 = \frac{\ln(S_0/K) + (r + \sigma^2/2)T}{\sigma\sqrt{T}} \tag{2}$$

$$d_2 = d_1 - \sigma\sqrt{T}. \tag{3}$$

All the simulations involve three-month holding periods, and all positions are maintained until expiration. Hence, the option-pricing model is needed only to estimate the premium at the time the position is established. Moreover, by requiring that all positions be held until expiration, the researcher rules out the possibility of early exercise of the option. In practice, it is often optimal to exercise an option prior to the stock going out of dividend (Merton, Scholes and Gladstein, 1978). Hence, it might appear that the no early exercise constraint might favour option writing as opposed to option buying. These are European style options and, therefore, no early exercise is possible.

To estimate the variance rate for the stock as of each date, the researcher used the sample variance of the previous three months of daily logarithmic price changes. To adjust the formula for cash dividends, the present value of the actual dividends paid during the life of the option was calculated, using risk free rate to discount, and this result was subtracted from the current stock price. In effect, this assumes that the dividends paid in any three-month period escrowed at the beginning of the period. The dividend adjustment, unlike the variance-rate estimate, uses future information not actually available at the time the position is established. The bias of this procedure is trivial in its impact on the option premiums and strategy returns (Merton, Scholes and Gladstein, 1978).

3.3 Put option pricing

The formula used for call option pricing is known as Black-Scholes and is adjusted for dividends. For put option pricing, the parity-model formula outlined below, was used:

$$P_e = C - S + Ee^{-rt} + \sum^{m} d_i e^{-rti} \tag{4}$$

where

P_e = price of a European put with exercise price E and time until expiration T;

C = price of a European call option with the same exercise price and time until expiration;

S = price of the underlying stock

R = (continuously compounded) market rate of interest

d_i = cash dividend per share on the stock payable at time t_i ($0 \leq t_i \leq T$; $_i$ = 1,2, ….,m)

For a put option, there is a stock price at such a level that, for a given put option, it is worth more if it is exercised early (Merton et al, 1982). Hence, the fundamentals of the assumption of the parity model is violated and the put option price formula given above will be systemically biased towards a price below the correct put option price.

Although its derivation is beyond the scope of this study, a put pricing model that takes into account the possibility of early exercise has been derived along the methodological lines of the Black-Scholes model. The model simultaneously provides the put price and the schedule of stock prices, S(T), where it is optimal to exercise the put.

Like the Black-Scholes call pricing model, the derived put pricing model uses the following inputs:

- the current stock price per share, S;
- the length of time until expiration of the option, T;
- the exercise price, E;
- the risk-free rate; fixed income securities, r:
- the variance rate for the logarithmic returns on the underlying stock, σ^2; and
- the cash dividend payouts on the stock during the life of the option, d_i.

All the inputs, except the variance rate and dividends, require no estimation. Moreover, given the relatively short duration of the options, the dividend policy, and, to a lesser extent the variance rate, can be reasonably well estimated. In this study, the researcher will use the sample variance of the previous three months of daily logarithmic price changes to estimate the variance rate for each stock during each of the 40 three-monthly holding periods. The dividends to be used are the actual dividends paid on the stock during the life of the option. While the dividend estimate, unlike the variance rate estimate, uses future information not actually available at the time the position is established, the bias of this procedure is trivial in its impact on the option premiums and the strategy returns (Merton et al, 1982).

3.4 Returns computation

The returns of the hedged and unhedged positions are computed on the same time intervals using the following notation:

r_{t+1}	portfolio return from time *t* to t+1
p_t, p_{t+1}	stock price at time *t* and *t+1*
w_t	price of call or put option at time *t*
x	exercise price of the option
d	dividend paid between time *t* and *t+1*

The unhedged position return is computed as:

$$r_{t+1} = (p_{t+1} + d - p_t) / p_t \tag{5}$$

The hedged position return is expressed in different ways for both call and put, depending on whether the option is exercised or not by the buyer, and whether or not there is a dividend before maturity. The hedged return is computed in two different ways, depending on the level of the underlying price at maturity date.

If the stock price is above the strike price at maturity for a covered call strategy, the option is assumed to have been exercised by the buyer and the hedged return is:

$$r_{t+1} = (x + d + w_t - p_t) / (p_t - w_t) \qquad (6)$$

For a protective put option strategy, if the stock price is above the strike price at maturity, the option is assumed not to have been exercised by the buyer and the hedged return is:

$$r_{t+1} = (p_{t+1} + d - w_t - p_t) / (p_t + w_t) \qquad (7)$$

If the stock price is below the strike at maturity for a covered call option strategy, there is no exercise and the hedged return is:

$$r_{t+1} = (p_{t+1} + d + w_t - p_t) / (p_t - w_t) \qquad (8)$$

If the stock price is below the strike at maturity for a protective put option strategy, then the option is assumed to have been exercised and the hedged return is:

$$r_{t+1} = (x + d - w_t - p_t) / (p_t + w_t) \qquad (9)$$

3.5 Population and sample

3.5.1 Population

The population studied included all shares listed on the JSE between January 2005 and December 2007.

3.5.2 Sample and sampling method

Sampling is the process of selecting units (e.g., people, organizations) from a population of interest so that by studying the sample results may be fairly generalized back to the population from which they were chosen (Trochim, 2006).

The sample to be studied in this research is the JSE's top 40 companies by market capitalisation. See Table 1 below for details of the sample. The sample represents about 80 percent of the volume traded on the JSE (JSE, 2007). This group has a large but trackable number of stocks with representation in most of the major sectors of the South African economy. The stocks in this sample span a wide range of risk levels and dividend yields. Therefore, portfolios based on these stocks would be expected to be well diversified because the companies represented are large, and have attracted considerable investor interest. These stocks are relatively liquid, which increases the feasibility of actually executing the option strategies.

The period chosen for this research is a 10-year interval from December 1997 to December 2007. This period provides a variety of market environments including up and down markets, as well as volatile and quiet markets. All the strategies examined have quarterly holding periods between portfolio revisions and therefore a total of 40 basic observation sub-periods, as shown in this research. To be consistent with the holding periods chosen, all returns and associated statistics reported throughout the research are quarterly.

Table 1: Top 40 listed shares on the JSE as at April 2007

Code	Share	Year of Listing
AGL	Anglo American Plc	1978
AMS	Anglo American Platinum	1978
ANG	Anglogold Ashanti Ltd	1979
ARI	African Rainbow Minerals	1988
ASA	Absa Group Ltd	1986
BAW	Barloworld Ltd	1978
BIL	BHP Billiton Plc	1997
BVT	Bidvest Ltd Ord	1978
ECO	Edgards Cons Stores Ltd	1978
EXX	Exxaro Resources Ltd	2001
FSR	Firstrand Ltd	1986
GFI	GoldFields Ltd	1998
HAR	Harmony G M Co Ltd	1979

IMP	Impala Platinum HLGS Ltd	1978
INL	Investec Ltd	1986
INP	Investec Plc	2002
IPL	Imperial Holdings Ltd	1989
KIO	Kumba Resources Ltd	2001
LBT	Liberty International Plc	1999
LGL	Liberty Group Ltd	1978
LON	Lonmin Plc	1969
MLA (ACL)	Mittal Steel SA Ltd	1989
MTN	MTN Group Ltd	1995
NED	Nedcor Ltd	1978
NPN	Naspers Ltd	1994
NTC	Network Healthcare Holdings	1983
OML	Old Mutual Plc	1999
PIK	Pick n Pay Stores Ltd	1978

PPC	Pretoria Portland Cement	1978
RCH	Richemont Securities DR	1988
REM	Remgro Ltd	1998
RMH	RMB Holdings Ltd	1992
SAB	SABMiller Plc	1978
SAP	Sappi Ltd	1978
SBK	Standard Bank Group Ltd	1978
SHF	Steinhoff International Holdings	1998
SLM	Sanlam Ltd	1998
SOL	Sasol Ltd	1979
TBS	Tiger Brands Ltd Ord	1978
TKG	Telkom SA Ltd	2003
WHL	Woolworths Holdings Ltd	1997

Source: Satrix 40 Fact Sheet - March 2007

3.6 Procedure for data collection

Quantitative researchers identify one or few variables that they intend to study, and then collect data specifically related to those variables (Leedy and Ormond, 2001). The data collected was the closing prices of the top 40 listed shares on the JSE from August 1997 to December 2007, as available from INET-BRIDGE.

3.7 Data analysis and interpretation

Quantitative research using statistical methods typically begins with the collection of data based on a theory or hypothesis, followed by the application of descriptive or inferential statistical methods. Causal relationships are studied by manipulating factors thought to influence the phenomena of interest while controlling other variables relevant to the experimental outcomes (Wikipedia, 2007).

The Results section of papers, including quantitative data analysis, often contains descriptive statistics and inferential statistics. Descriptive statistics include measures of central tendency (averages - mean, median and mode) and measures of variability about the average (range and standard deviation). These give the reader a 'picture' of the data collected and used in the research project. Inferential statistics are the outcomes of statistical tests, helping deductions to be made from the data collected, to test hypotheses set, and relate findings to the sample or population (Trochim, 2006).

Trochim (2006) asserts that in most social research the data analysis involves three major steps, conducted more or less in the following order:

- Cleaning and organizing the data for analysis (Data Preparation)
- Describing the data (Descriptive Statistics)
- Testing hypotheses and models (Inferential Statistics)

Each of these steps will now be further discussed.

3.7.1 Data preparation

This involves checking or logging the data in, checking the data for accuracy, entering the data into the computer, transforming the data, and developing and documenting - a database structure that integrates the various measures (Trochim, 2006). For this research, daily closing prices were used in calculating the returns and no transformation of the sample data took place. Some shares within the sample of the top 40 listed shares on JSE were part of the top 40 listed for the full period on which the study was conducted. The period ran from 1997 to 2007 and only shares that met this criterion of full duration were used in this study. Only 28 shares met the criterion of full duration.

3.7.2 Descriptive statistics

Descriptive statistics are used to describe the basic features of the data in a study. They provide simple summaries about the sample and the measures. Together with simple graphics analysis, these statistics form the basis of virtually every quantitative analysis of data. With descriptive statistics one is simply describing what is, what the data shows (Trochim, 2006). The mean and the standard deviation of the sample's returns were calculated and shown on a table. The graph analysis of the performance of both hedged and unhedged portfolios was done to check any obvious performance difference between the two portfolios. The mean and standard deviation of both the hedged and unhedged portfolios was tabulated.

3.7.3 Inferential statistics

According to Trochim (2006) inferential statistics investigate questions, models and hypotheses. In many cases, the conclusions from inferential statistics extend beyond the immediate data alone. For instance, inferential statistics are used to try to infer from the sample data what the population thinks, or inferential statistics are used to make judgments regarding the probability that an observed difference between groups is a dependable one, or that it might have happened by chance in a particular study. Thus, inferential statistics is used to make inferences from data to more general conditions, and the use of descriptive statistics is simply to describe what's going on in research data (Trochim, 2006).

In most research studies, the analysis section follows the abovementioned three phases of analysis. Descriptions of how the data was prepared tend to be brief and focus on only the more unique aspects of the study, such as specific data transformations that are performed. The descriptive statistics can be voluminous. In most write-ups, these are carefully selected and organized into summary tables and graphs that only show the most relevant or important information (Leedy and Ormond, 2001).

Usually the researcher links each of the inferential analyses to specific research questions or hypotheses that were raised at the end of the literature review and notes any models that were tested that emerged as part of the analysis. In most analysis write-ups it is important not to present too much detail, as the reader may not be able to follow the central line of the results. Often, extensive analysis details are appropriately relegated to appendices, reserving only the most critical analysis summaries for the body of the report itself (Trochim, 2006). Both descriptive and inferential statistical analyses will be used in this research paper.

3.8 Limitations of the study

The limitation in this research relates to the fact that the composition of the top 40 listed shares on the JSE changed during the period (December 1997 to December 2007) forming the subject matter of the study. Some companies were dropped from the list and new companies were added. Therefore, only companies that were in the top 40 index of the JSE throughout the period of this study were included in this research.

3.9 Validity and reliability

The exact nature of 'validity' is a highly debated topic in both educational and social research, since there currently exists no single or common definition of the term. Therefore, in order to understand something of the range of meanings attached to 'validity', it is essential to review a selection of the range of definitions offered by leading authors.

A much-cited definition of 'validity' is that of Hammersley's (1987, p. 69) who asserts: "An account is valid or true if it represents accurately those features of the phenomena that it is intended to describe, explain or theorise." Although this would seem to be an all-encompassing and reasonable description, many other definitions fail to envisage such a realist approach (Denzin & Lincoln, 1998). The fact is that there are many possible definitions, and replacement terms that have been offered suggest that it is a concept entirely relative to the person and belief system from which it stems.

Validity is concerned with the soundness or effectiveness of the measuring instrument (Leedy, 1980). According to Leedy (1980), validity will raise these questions:

- What does it measure?; and
- How well does it measure?.

Therefore, validity deals with effectiveness of the instrument.

Insofar as validity definitions are concerned, two common strands begin to emerge: Firstly, whether the means of measurement are accurate. Secondly, whether the measurements are actually measuring what they are intended to measure.

The notions of accuracy, more commonly attributed to validity, appears to be also associated with reliability. What authors do seem to attribute to reliability, more commonly than to validity, is the degree of replicability. From this summary, it is possible to suggest that the aggregated definition of validity could be that of accuracy, and the definition of reliability could be replicability.

Whatever the differences in definition and classification are amongst the above authors, it is these two concepts, accuracy and replicability, that appear to underpin their aggregated goals and means (Winter, 2000).

Whereas quantitative researchers attempt to disassociate themselves as much as possible from the research process, qualitative researchers have come to embrace their involvement and role within the research (Winter, 2000).

Reliability and validity are tools of an essentially positivist epistemology. They have proved useful in providing checks and balances for quantitative methods (Simco and Warin, 1997) (Winter, 2000).

Wainer and Braun (1988) describe the validity that concerns quantitative research as construct validity. The construct is the initial concept, notion, question or hypothesis that determines which data is to be gathered and how it is to be gathered. Wainer and Braun (1988) assert that quantitative researchers actively cause or affect interplay between construct and data in order to validate their investigation, usually by the application of a test or other process. Data can either support or reject this construct that can be put forward as a theory or further hypothesis. There are two types of validity, namely external and internal validity, and these will be described below.

3.9.1 External validity

Validity refers to the approximate truth of propositions, inferences, or conclusions, and external validity refers to the approximate truth of conclusions that involve generalizations (Trochim, 2006). Therefore, external validity is related to generalizing.

The ability to generalise findings to wider groups and circumstances is one of the most common tests of validity for quantitative research and yet is considered to be of little, or even no, importance for many qualitative researchers (Maxwell, 1992).

Maxwell (1992) also notes that sampling, a vital consideration in establishing the validity of a statistical test, is random in quantitative research. Qualitative research almost exclusively limits itself to internal generalisations. Quantitative research, on the other hand, attempts to deal with both internal and external generalisations, referring to these as internal validity and external validity respectively (Maxwell, 1992).

Hence, quantitative research, whilst able to claim validity for wider populations and not just merely samples, is restricted to measuring those elements that, by definition and distortion, are common to all [Maxwell (1992) as cited by Winter (2000)].

In science there are two major approaches to how evidence is provided for a generalization. The first approach is called the Sampling Model.

In the sampling model, one starts by identifying the population one would like to generalize to. Then, a fair sample for research is drawn from that population. Finally, because the sample is representative of the population, one can automatically generalize the results back to the population (Trochim, 2006).

According to Trochin (2006), being able to easily draw a fair representative sample is important, and in this study the top 40 listed shares on the JSE is a fairly representative sample because different sectors are represented within this sample and the shares within this sample are highly liquid on the JSE all share index.

Trochim (2006) mentions that one way of improving external validity is by carefully selecting a sample from a population. For instance, one should use random selection if possible, which was not the case with this study, rather than a non-random procedure (Trochim, 2006). The use of non-random sampling procedure for this study is compensated for by the fact that the top 40 listed shares on JSE are highly liquid, account for most of the trading value on the JSE and, therefore, options are more likely to be written on the top 40 listed shares on the JSE.

3.9.2 Internal validity

Internal Validity is the approximate truth about inferences regarding cause-effect or causal relationships. Thus, internal validity is only relevant in studies that try to establish a causal relationship (Trochim, 2006).

According to Trochim (2006) internal validity is only relevant to the specific study in question and can be thought of as a ‘zero generalizability’ concern. Internal validity means is that one has evidence that what was done in the study (i.e., the program) caused what was observed (i.e. the outcome) to happen.

Causal relationships are not studied in this research and, therefore, internal validity is not considered.

3.9.3 Reliability

According to Lehner (1979) and Trochim (2006), reliability has to do with the quality of measurement. Black and Champion (1976) define reliability as the ability to measure consistently. Therefore, reliability is the consistency or repeatability of the measures. Measures used in this study are reliable because these measures are consistent and repeatable. Winter (2000) defines reliability as the replicability. This study is replicable and, therefore, reliable.

CHAPTER 4: PRESENTATION OF RESULTS

4.1 Introduction

This chapter starts by describing the demographic profile of the sample, followed by both descriptive and inferential statistical analyses. Firstly, descriptive statistics are presented, followed by inferential statistical analysis under the heading ‘hypothesis tests’.

4.2 Demographic profile of the sample

There are three portfolios, namely: unhedged portfolio, hedged-call portfolio and hedged-put portfolio. The unhedged portfolio consists of the top 40 listed shares on the JSE as at April 2007, and the following shares (see table 2 below) were excluded from the portfolio because they were listed after the start date, which is 29 August 1997 or delisted before December 2007. All the shares were equally weighted within the portfolios.

Table 2: Shares listed after the start date or delisted before December 2007

Code	Share	Year of Listing
ECO	Edgards Cons Stores Ltd[1]	1978
EXX	Exxaro Resource Ltd	2001
GFI	Gold Fields Ltd	1998
INP	Investec Plc	2002
KIO	Kumba Resources Ltd	2001
LBT	Liberty International Plc	1999
OML	Old Mutual Plc	1999
REM	Remgro Ltd	1998
SHF	Steinhoff International Holdings	1998
SLM	Sanlam Ltd	1998
TKG	Telkom SA Ltd	2003

[1] Edgards Consolidated Stores Ltd (ECO) was excluded from the portfolio even though the company was listed on the JSE before the start date of the research, because it was delisted in May 2007.

WHL	Woolworths Holdings Ltd[2]	1997

A hedged-call portfolio consists of a combination of covered call options with underlying stocks, that consists top 40 listed shares as listed on table 1 and excluding those shares listed in table 2 above. A hedged-put portfolio is similar to a hedged-call portfolio except that covered call options are replaced by a put protective strategy.

4.3 Descriptive statistics

The descriptive statistics of the three portfolios, namely unhedged portfolio, hedged-call portfolio and hedged-put portfolio, are presented in table 3 below:

[2] Woolworths Holdings Ltd was listed on 17 October 1997. This was after the portfolio start date of August 1997 and it was therefore excluded from the portfolio.

Table 3: Descriptive statistics of the three portfolios

	Unhedged Portfolio	**Hedged-Call Portfolio**	**Hedged-Put Portfolio**
Mean	6.1%	7.6%	-0.7%
Standard Error	1.8%	1.2%	2.1%
Median	5.2%	8.6%	-1.3%
Standard Deviation	11.4%	7.6%	13.0%
Sample Variance	1.3%	0.6%	1.7%
Kurtosis	-0.0048	0.3693	-0.1144
Skewness	0.1037	-0.6923	-0.1694
Range	49.3%	33.2%	57.0%
Minimum	-17.2%	-12.4%	-30.9%
Maximum	32.1%	20.8%	26.2%
Sum	2.45621	3.05682	-0.27553
Count	40	40	40

Largest (1)	32.1%	20.8%	26.2%
Smallest (1)	-17.2%	-12.4%	-30.9%
Confidence Level (95.0%)	±3.7%	±2.4%	±4.1%

The portfolio with the highest mean, i.e. mean equals average portfolio quarterly returns, is the hedged-call portfolio with a mean of 7.6 percent, followed by the unhedged portfolio with a mean of 6.1 percent. The portfolio with the lowest mean is the hedged-put portfolio with a mean of minus 0.7 percent. If an investor invested one rand at the start date of the simulation (December 1997), the returns for the unhedged portfolio, hedged-call portfolio and hedged-put portfolio at the end of the period would be R8.63, R17.20, and R0.54 respectively. The performances of the three portfolios with annualised mean are shown in table 4 below.

Table 4: Portfolios' returns

	Unhedged Portfolio	**Hedged-Call Portfolio**	**Hedged-Put Portfolio**
Portfolio Returns	8.63	17.20	0.54
Annualised Mean	26.92%	34.25%	-2.73%

The portfolio performances are illustrated graphically in figures 3, 4 and figure 5.

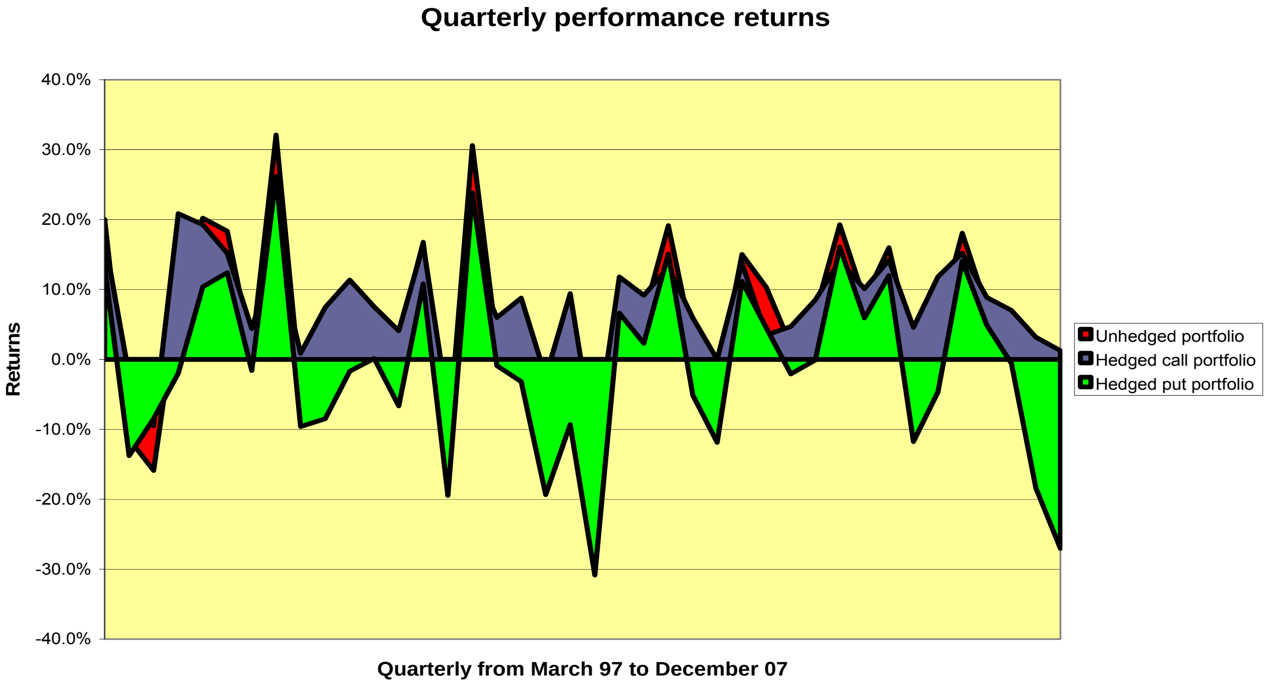

Figure 3: Portfolio performance

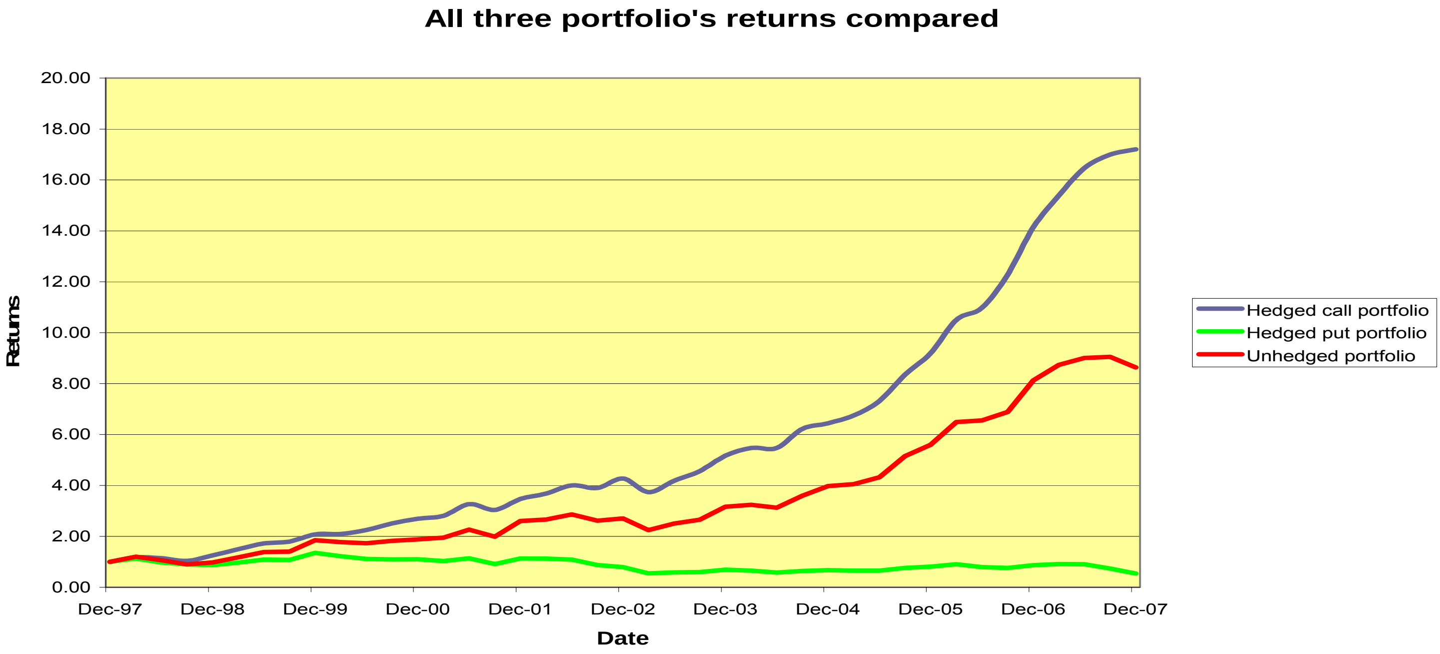

Figure 4: Comparison of all portfolio returns

Figure 4 shows that the hedged-call portfolio had the highest returns when compared to other two portfolios, namely the unhedged and hedged-put portfolio. The unhedged portfolio had higher returns than the hedged-put portfolio and lower returns than the hedged-call portfolio. Lastly, the hedged-put portfolio had the lowest returns when compared to the hedged-call and unhedged portfolios.

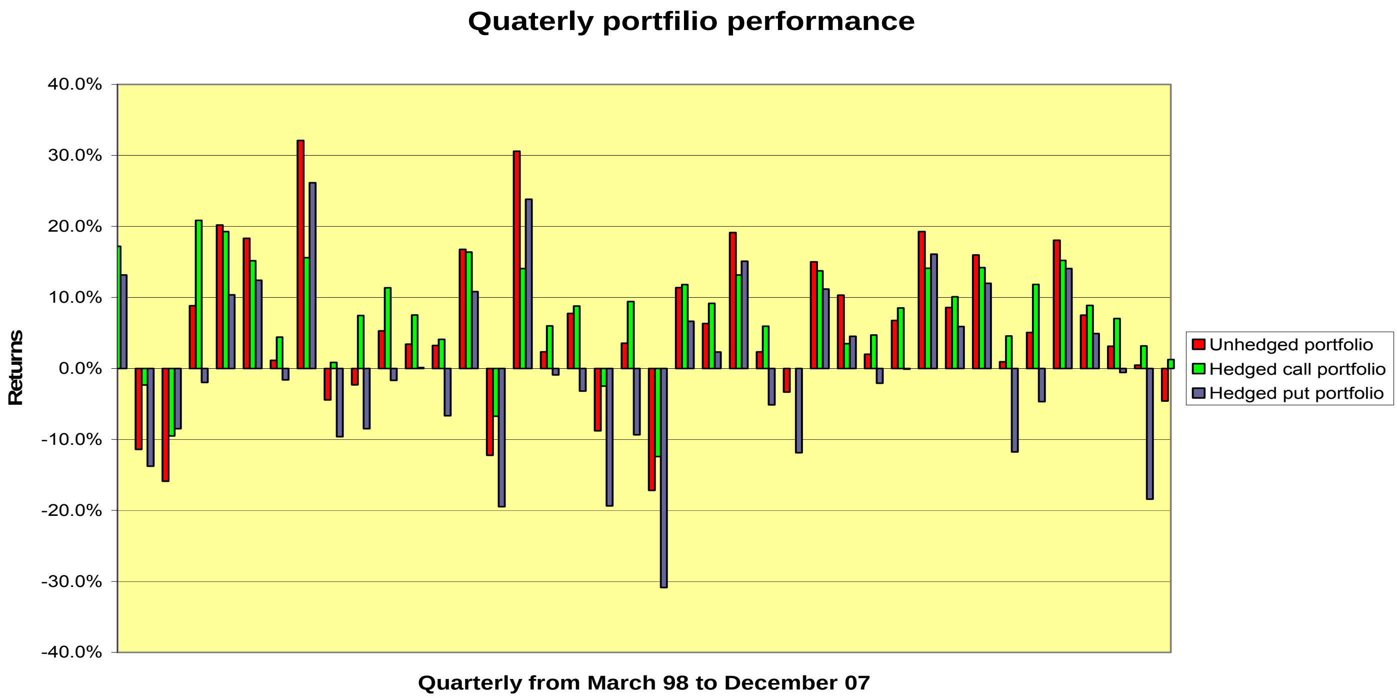

Figure 5: Quarterly portfolio performance

The standard deviation of each of the portfolios measures the risk associated with that portfolio. The risk associated with each of the three portfolios, as measured by standard deviation, is 11.4% for the unhedged portfolio, 7.6% for the hedged-call portfolio and 13% for the hedged-put portfolio. The hedged-call portfolio showed better returns when compared to the unhedged portfolio and one would expect the hedged-call portfolio to be riskier than the unhedged portfolio, but the standard deviation of the hedged-call portfolio is less than that of the unhedged portfolio. This suggests that even though the hedged-call portfolio had better returns compared to unhedged portfolio, the hedged-call portfolio is less risky compared to unhedged portfolio. This implies that the hedged-call portfolio might be a better portfolio for an investor who wants to maximise returns while at the same time minimising the risk of the portfolio.

When comparing the hedged-put portfolio to the unhedged portfolio, average returns of the hedged-put portfolio are less than the average returns of the unhedged portfolio, but the standard deviation of the hedged-put portfolio is

13%, which is more than that of the unhedged portfolio, which is 11.6%. This means that the hedged-put portfolio is riskier than the unhedged portfolio and offers lower returns when it is compared to the unhedged portfolio. The difference between the two standard deviations of the hedged-put portfolio and the unhedged portfolio is 1.4 percent. This suggests that while the hedged-put portfolio offers lower returns compared to the unhedged portfolio, minus 0.7 percent for the hedged-put portfolio compared to 6.1 percent of the unhedged portfolio, the hedged-put portfolio is riskier when compared to the unhedged portfolio. The hedged-put portfolio appears not to suit an investor who aims to maximise returns while at the same time minimising risk associated with a portfolio.

Albright, Winston and Zappe (2003) describe skewness as a measure of symmetry, or more precisely, the lack of symmetry. A distribution or data set is symmetric if it looks the same to the left and right of the centre point.

Kurtosis is defined as a measure of whether the data is peaked or flat, relative to a normal distribution (Albright, Winston and Zappe; 2003). That is, data sets with high kurtosis tend to have a distinct peak near the mean, decline rather rapidly, and have heavy tails. Data sets with low kurtosis tend to have a flat top near the mean rather than a sharp peak. A uniform distribution would be the extreme case.

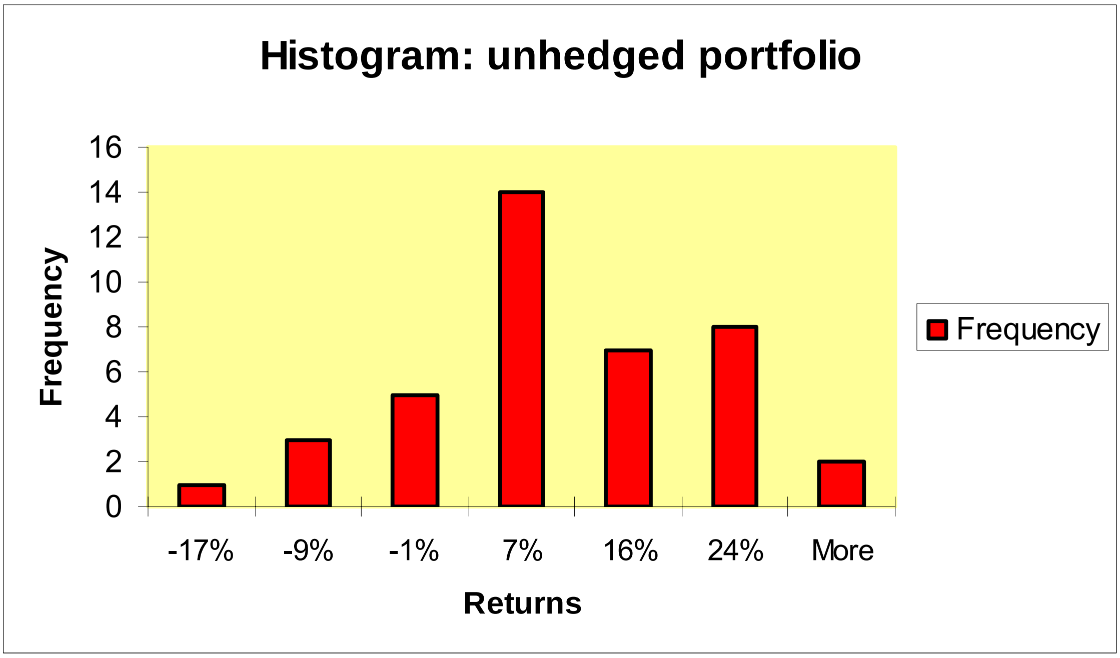

Figure 6: Histogram of the unhedged portfolio

The histogram is an effective graphical technique for showing both the skewness and kurtosis of a data set. Histograms for each of the portfolios are represented in this study.

The histogram of an unhedged portfolio, a hedged-call portfolio and a hedged-put portfolio are shown in figure 6, 7 and 8 respectively.

The kurtosis of the unhedged portfolio is -0.3693 and the skewness is 0.1037.

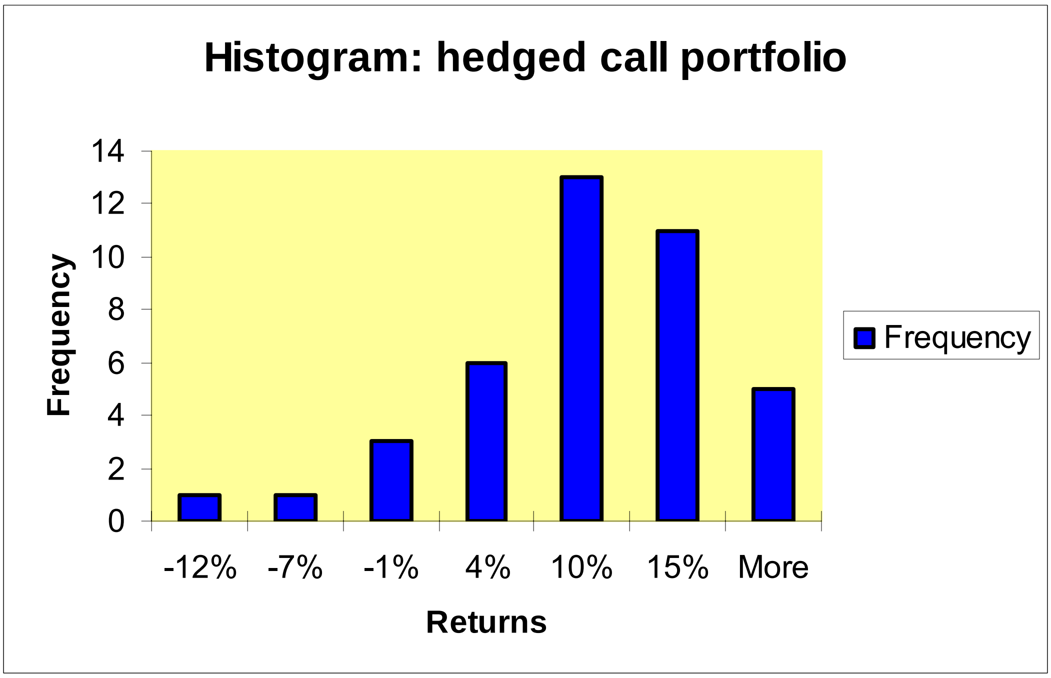

Figure 7: Histogram of hedged call portfolio

The kurtosis of the hedged-call portfolio is 0.0048 and the skewness is -0.6923. The histogram on figure 7 is negatively skewed.

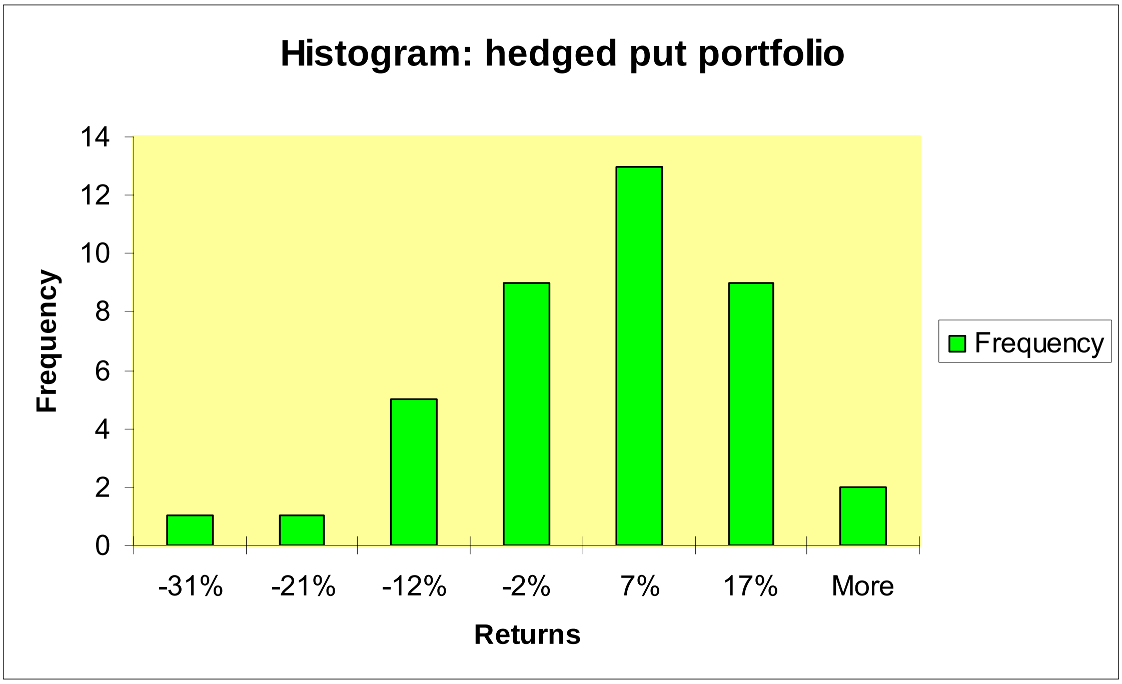

Figure 8: Histogram of hedged put portfolio

The kurtosis of the hedged-put portfolio is -0.1144 and the skewness is -0.1694 and is illustrated by the histogram in figure 8. Albright, Winston and Zappe (2003) define a range as the difference between the smallest value represented by minimum and the largest value represented by maximum. The ranges of the unhedged, hedged-call and hedged-put portfolios are 0.4929, 0.3324 and 0.5702 respectively.

The minimum values which represent the lowest return of the portfolio during the 10-year period are examined next. The minimum value of the unhedged portfolio is -17.2 %, which occurred in March 2003, the minimum value of the hedged-call portfolio is -12.4 %, which happened in March 2003 and the minimum value of the hedged-put portfolio is -30.9 %, which occurred in March 2003.

The findings on the maximum of each portfolio represent the highest return of each portfolio during the 10-year period. The maximum value of the unhedged portfolio is 32.1 %, 20.8% for the hedged-call portfolio, and the maximum value of the hedged-put portfolio is 26.2 %.

The hedged-call portfolio has the smallest range, followed by the unhedged portfolio, and the hedged-put portfolio has the largest range of the three portfolios. This is consistent with variances and standard deviations of the portfolios, which suggests that the hedged-call portfolio is less risky compared to the unhedged portfolio, while the hedged-put portfolio is more risky when compared to unhedged portfolio. The next element of descriptive statistics to be discussed is confidence interval.

A confidence interval gives an estimated range of values which is likely to include an unknown population parameter, the estimated range being calculated from a given set of sample data (Easton and McColl, 2004).

Easton and McColl (2004) further define confidence interval by stating that if independent samples are taken repeatedly from the same population, and a confidence interval is calculated for each sample, then a certain percentage (confidence level) of the intervals will include the unknown population parameter. Confidence intervals are usually calculated so that this percentage is 95%, but can be produced at 90%, 99%, and 99.9% confidence intervals for the unknown parameter.

The width of the confidence interval gives some idea as to the level of uncertainty about the unknown parameter. A very wide interval may indicate that more data should be collected before anything definite can be said about the parameter.

The confidence interval of the unhedged portfolio mean is 2.5 percent to 9.8 percent, the hedged-call mean's confidence interval is 5.2 percent to 10.1% and for the hedged-put portfolio the confidence interval is minus 4.8 percent to 3.5 percent. Therefore, one can be 95% confident that the quarterly mean returns for shares listed on the JSE are between 2.5 percent and 9.8 percent. If a covered call option strategy is added, the confidence interval of the quarterly mean is between 5.2 percent and 10.1%, and if a protective put strategy is added, the quarterly mean returns confidence interval is between minus 4.8 percent and 3.5 percent.

4.4 Hypothesis tests

Hypothesis 1:

H_0 : The null hypothesis states that there is no difference in portfolio returns when a portfolio consisting of the fully covered call option strategy in combination with underlying stocks is compared to a portfolio of just underlying stocks.

$H_0 : \mu = \mu_0$

H_A : The alternative hypothesis states that a portfolio that consists of the combination of a fully covered call option with underlying stocks offers different returns than holding a portfolio of just underlying stocks.

$H_A : \mu \neq \mu_0$

t-Test: Paired two sample for means was used because there is a natural pairing of observations in the samples. This occurs when a sample group is tested twice before and after an experiment. This analysis tool and its formula perform a paired two-sample student's t-test to determine whether observations taken before and after a treatment are likely to have come from distributions with equal population means. This t-test form does not assume that the variances of both populations are equal.

The results of the paired t-test between the hedged-call portfolio and the unhedged portfolio are shown in table 5 below:

Table 5: t-Test: Paired Two Sample for Means

	Hedged-Call Portfolio	Unhedged Portfolio
Mean	7.6%	6.1%
Variance	0.6%	1.3%
Observations	40	40
Pearson Correlation	0.88	
Hypothesized Mean Difference	0	
Df	39	
t Stat	1.6113	
P(T<=t) one-tail	0.0576	
t Critical one-tail	1.6849	
P(T<=t) two-tail	0.1152	
t Critical two-tail	±2.0227	

The correlation between the two portfolios is 0.88, which confirms the choice of the paired t-test. There are 40 observations, 39 degrees of freedom and the hypothesized mean difference is equal to zero. t-Test results are 1.6113, which is between the critical values for a two-tail test. P-value is the measured probability of a finding occurring by chance alone, given that the null hypothesis is actually true, i.e. rejecting the null hypothesis. By convention, a *p* value less than 0.05 is often considered significant (Medical University of South Carolina, 2001). The P-value for the two-tail test is 0.1152. The level of significance used is 0.05. Therefore, we accept the null hypothesis, H_0: $\mu = \mu_0$, and reject the alternative hypothesis, H_A: $\mu \neq \mu0$. There is no statistically significant difference (at the 95% confidence level) between the hedged-call portfolio and the unhedged portfolio.

Hypothesis 2:

H_0 : The null hypothesis states that there is no difference in portfolio returns when a portfolio that consists of the protective-put option strategy in combination with underlying stocks is compared to a portfolio of just underlying stocks.

H_0: $\mu = \mu_0$

H_A : The alternative hypothesis states that a portfolio that consists of the combination of a protective-put option strategy with underlying stocks offers different returns than holding a portfolio of just underlying stocks.

H_A: $\mu \neq \mu_0$

Paired Two Sample for Means t-test is used to compare if there is a difference in performance with reference to quarterly returns, between the hedged-put and the unhedged portfolio. The results of the paired t-test between the hedged-put portfolio and the unhedged portfolio are shown in table 6 below:

Table 6: t-Test: Paired Two Sample for Means

	Hedged Put Portfolio	Unhedged Portfolio
Mean	-0.7%	6.1%
Variance	1.7%	1.3%
Observations	40	40
Pearson Correlation	0.92	
Hypothesized Mean Difference	0	
df	39	
T Stat	-8.6767	
P(T<=t) one-tail	6.07E-11	
T Critical one-tail	1.6849	
P(T<=t) two-tail	1.21E-10	
T Critical two-tail	±2.0227	

The correlation between the hedged-put portfolio and the unhedged portfolio is 0.92, which suggests that the two portfolios are highly correlated, and this reaffirms the choice of paired two sample for means t-test. Each portfolio has

40 observations. There are 39 degrees of freedom, and the hypothesized mean difference between the hedged-put portfolio and the unhedged portfolio is equal to zero.

The t-test results for two sample means of hedged-put and unhedged portfolio is -8.6767, which is less than the lower limit of the two-tail test critical value. The P-value of the two-tail test is 1.21E-10 at 0.05. level of significance.

This leads to the following conclusion:

- we reject the null hypothesis, H_0: $\mu = \mu_0$; and
- accept the alternative hypothesis, H_A: $\mu \neq \mu0$.

Therefore, there is statistically a significant difference (at the 95% confidence level) between the hedged-call portfolio and the unhedged portfolio. This suggests that the hedged-put portfolio performs worse than the unhedged portfolio.

CHAPTER 5: DISCUSSION OF THE RESULTS

5.1 Introduction

This chapter will focus on the discussion of the results of the study. The first results to be discussed are those relating to a portfolio formed by a combination of the underlying stocks with the fully covered option strategy. This is followed by a discussion of the results of a portfolio consisting of a combination of the underlying stock with the protective put strategy.

5.2 Stock portfolio with covered option strategy

The results of the current study show that the performance of the stock portfolio with the fully covered call option produced similar returns to a portfolio of underlying stocks without the covered call option. However, the stock portfolio with the fully covered call option strategy had a lower risk compared to the portfolio of underlying stocks only. The mean quarterly return for a stock portfolio with the fully covered call option was 7.6 percent while for underlying stock it was 6.1 percent.

The standard deviation of a stock portfolio with the fully covered call option strategy was 7.6 percent compared to just 11.4% standard deviation for a portfolio of underlying stock. The variance of a stock portfolio with fully covered call options was 0.6 percent, while the variance of underlying stocks was 1.3 percent. Therefore, a portfolio with a fully covered call option strategy has a lower variance compared to a portfolio of just underlying stocks.

The international research comparing a stock portfolio with fully covered call options to a portfolio of only underlying stocks in terms of returns, had mixed results. Kassouf (1977) cited by Gastineau and Madansky (1979), Morard and Naciri (1990), Pounds (1978), Yates and Kopprasch (1980) and Trennepohl and

Dukes (1981) showed that a portfolio with a fully covered call option strategy produced substantially higher returns than just buying and holding a portfolio of underlying stocks.

On the other hand, Boness (1964), Bookstaber and Clarke (1983, 1984), Booth, Tehranian and Trennepohl (1985), Merton, Scholes and Gladstein (1978, 1982) and Trennepohl, Booth and Tehranian (1988) all showed that a portfolio with fully covered call options produced lower returns compared to buying and holding a portfolio of only underlying stocks.

The results of this study showed that there was no significant statistical difference between the returns of a portfolio with fully covered call options compared to buying and holding a portfolio of underlying stocks using, a t-test at 5 percent significant level. These results are consistent with the findings of international research (Grube and Panton, 1978 and Mueller, 1981).

Therefore, the null hypothesis of Hypothesis One, which states that there is no difference in portfolio returns when a fully covered call option strategy is used in combination with underlying stocks, is accepted, and the alternative hypothesis is rejected. The alternative hypothesis states that a combination of a fully covered call option with underlying stocks offers better or worse returns than holding a portfolio of only underlying stocks.

Even though there is no significant statistical difference at 5 percent significant level between a portfolio with a fully covered call option and one where one buys and holds underlying stocks, there is a difference between the two portfolios' variances. The portfolio with a fully covered call option has a lower variance than a portfolio of only underlying stocks.

This is consistent with the results of the following research: Benet and Luft (1995), Bookstaber and Clarke (1983, 1984), Booth, Tehranian and Trennepohl (1985), Grube, Panton and Terrell (1979), Merton, Scholes and Gladstein (1978, 1982), Mueller (1981), Pounds (1978), Trennepohl, Booth and Tehranian (1988), Trennepohl and Dukes (1981) and Yates and Kopprasch (1980).

Therefore, a portfolio with fully covered call options has lower risk compared to buying and holding a portfolio of underlying stocks, and the study's results in terms of variance are consistent with other findings of international research (Grube, Panton and Terrell, 1979; Grube and Panton, 1978).

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In reality, financial theory suggests that these strategies will partially hedge market risk at the expense of the portfolio's return, this being the market price of risk reduction (Lhabitant, 2000).

Mueller (1981) has shown the covered call option strategies may be used to reduce risk, with no subsequent reduction in wealth. The findings in this study are consistent with Mueller (1981) with regard to the fact that the returns of the hedged-call portfolio are similar to those of the unhedged portfolio, while the risk associated with holding a hedged-call portfolio is lower compared to the risk associated with the unhedged portfolio, as measured by standard deviation of each portfolio. Grube et al (1979) concurs with Mueller (1981) that investing in a portfolio with fully covered call options offers less risk compared to investing in a portfolio of just underlying stocks. Therefore, the results of the study showed that risks are significantly reduced with a well-diversified portfolio utilizing a covered option strategy.

Merton, Scholes and Gladstein, (1978) support the notion that a portfolio with a fully covered call option strategy is less risky than holding the underlying stocks alone, and they suggest that an investor investing in a portfolio with a covered call options strategy should not expect higher average returns than holding only the underlying stocks. This is consistent with the findings of this study.

Covered call writing is often presented as an efficient way to increase income from stock ownership through the received option premium and to convert the prospects for uncertain future capital gains into immediate cash flows (Lhabitant, 2000). Lhabitant (2000) generally concluded that writing options was a better strategy than buying them, and frequently observed that writing calls against a diversified portfolio would increase portfolio returns while lowering risk.

Covered calls are among the most popular options trading strategies. They should lower the variance of returns, and this is supported by the present study. Covered calls should also lower the expected return, but there was no evidence of a change in the actual returns. Hence, there is support for the general statement, made by options exchanges, that writing covered calls is a beneficial strategy (Board, Sutcliffe and Patrinos, 2000).

Covered call option portfolios exhibit lower variance of returns and a smaller interquartile range than a portfolio of the underlying stocks only. However, they typically possess negative skewness of returns (Booth et al, 1985). This is consistent with the findings of this study: the covered call option portfolio variance is 0.6 percent, the range is 33.2% and skewness of returns is -0.6923. The results are compared to a portfolio of the underlying stocks which has a higher variance of returns of 1.3 percent, a larger interquartile range of 49.3% and the skewness of the portfolio of the underlying stocks is 0.1037.

Pounds (1978) finds that an equally weighted portfolio using the covered call strategy outperformed the stock portfolio by yielding a higher return and lower variance. In this study the hedged-call portfolio yielded higher returns compared to the unhedged portfolio and this is shown in figure 4. The mean of returns for the hedged-call portfolio was 7.6 percent versus 6.1 percent of the unhedged portfolio, but they are not statistically different using paired two sample mean t-test at 5 percent significant levels.

The hedged-call portfolio variance was 0.6 percent versus 1.3 percent of the unhedged portfolio. Pounds' (1978) work was based on observed option prices for 43 underlying securities over the period from 1968 to 1976's quarterly returns that included transaction costs. Isakov (2001) states that hedging using covered call options reduces the standard deviation of a portfolio, as was the case in this study when comparing the hedged-call portfolio's standard deviation of 7.6 percent to the 11.4% of the unhedged portfolio.

As one expects, in a 'normal' environment, the selection of a higher strike price should increase both expected return and volatility for covered call writing. Deeply in-the-money covered call writing is equivalent to holding a risk-free bond, and deeply out-of-the-money covered call writing is similar to holding a naked stock (Lhabitant, 2000).

Traditional modern portfolio theory holds that an investor should select the strategy with the highest Sharpe ratio, in other words, the strategy that is expected to give an investor the highest expected return per unit of risk (Sharpe, 1966). Using paired two sample mean t-test at 5 percent significant levels, there was no difference in means of the two portfolios, namely hedged-call and unhedged portfolio, and the standard deviation of the hedged-call portfolio was lower compared to the unhedged portfolio. Therefore, the hedged-call portfolio had a higher Sharpe ratio when compared to the unhedged portfolio in this study.

Lhabitant (2000) suggests that when increasing the exercise price of a covered call position, we move from a pure bond to a pure stock position, and the Sharpe ratio increases accordingly. However, for a set of exercise prices that are just out-the-money, the Sharpe ratio of the covered call exceeds the Sharpe ratio of the long stock position, and this is consistent with the findings of this study.

Therefore, for a traditional investor an optimal strategy will consist of selling slightly out-the-money covered calls, since this dominates the pure stock strategy, compared to just buying and holding the underlying stock (Lhabitant, 2000).

5.3 Portfolio with protective put strategy

The results of the current study show that the performance of the stock portfolio with a protective put strategy produced lower returns compared to a portfolio of just underlying stocks. The mean of returns of the portfolio with protective put is minus 0.7 percent, and the return of the underlying stocks portfolio is 6.1 percent.

The standard deviation of the portfolio with a protective put strategy is 13%, compared to the 11.4% of the underlying stocks portfolio. Therefore, the portfolio with protective put strategy has a higher risk than a portfolio of underlying stocks alone.

The shifts in the return distribution lead to a smaller variance and narrower range of observed returns for the protective-put strategy (Merton, et al, 1982).

The aforementioned is not consistent with the results of this study, which show that the hedged-put portfolio (portfolio with protective put strategy) had a higher variance and bigger range than the unhedged portfolio (portfolio of underlying stocks alone).

Merton, et al (1982) concluded that if the put and stock were correctly priced, the expected return on any protective-put strategy would be lower than on the underlying stock. This is consistent with the findings of this study, which showed that the hedged-put portfolio had lower returns when compared to the unhedged portfolio. The observed returns are reduced because the insurance of the put eliminates large losses and the upside rate of return is also reduced due to the cost of purchasing the insurance.

Therefore, the null hypothesis that states that there is no difference in portfolio returns when a protective-put option strategy is used in combination with underlying stocks, was rejected at 5 percent significant levels in favour of the alternative hypothesis. The alternative hypothesis states that a combination of a protective-put option with underlying stocks offers better or worse returns than holding a portfolio of underlying stocks only, and, in this study, the hedged-put portfolio performed worse than the unhedged portfolio.

According to Clarke and Arnott (1987) a portfolio with protective put strategy will underperform the portfolio of underlying stocks and this is represented by reduced returns on a portfolio with protective puts due to cost of protective puts. Protective puts offer high cost protection and it is usually not cost-effective to have protection for long periods (Australian Stock Exchange, 2005). Therefore, this strategy is generally appropriate for shorter periods where one anticipates that the share price may decline. A long run portfolio with a protective put typically costs about 150 to 200 basis points per year (Clarke and Arnott, 1987). Therefore, the longer you keep this strategy running, the more it will cost - a position supported by this study.

This study was conducted on a portfolio with a protective put strategy running over a 10-year period. The cost of a protective put strategy combined with underlying stocks will be high, and this might explain reduced returns compared to a portfolio of only underlying stocks.

Protective put strategies are usually less volatile than the underlying stocks (Merton, et al, 1982), but in this study the portfolio with a protective put strategy has standard deviation of 13%, which is higher than 11.4% standard deviation of the underlying portfolio.

According to Muller and Ward (2006) a more realistic strategy would be to purchase 31 day at-the-money puts in August and October because this was found to significantly out-perform the buying-and-holding of an index by an average annual amount of around 1 percent. This strategy was better than a crash protection strategy of purchasing cheaper out-the-money puts in these two months (Muller and Ward, 2006).

5.5 Conclusion

In summary, by insuring against large losses on the underlying stocks, the investor who follows a protective put strategy can significantly reduce the risk of his stock portfolio (Clarke and Arnott, 1987). The aforementioned assertion was not realised in this study because of the cost associated with the chosen duration of the study, which was 10 years. However, the cost of this insurance is reflected by a reduction in expected returns.

When comparing a hedged-call portfolio to an unhedged portfolio in terms of returns, there was no difference between the hedged-call portfolio and the unhedged portfolio, and the difference was in the risk associated with each portfolio, as measured by a standard deviation. The risk of the hedged-call portfolio was lower compared to the risk of the unhedged portfolio.

Therefore, the null hypothesis of Hypothesis One, which states that there is no difference in portfolio, returns when a fully covered call option strategy is used in combination with underlying stocks is accepted, and the alternative hypothesis is rejected. The alternative hypothesis states that a combination of a fully covered call option with underlying stocks offers better or worse returns than holding a portfolio of underlying stocks.

The null hypothesis of the second hypothesis states that there is no difference in the returns of a portfolio formed by a combination of a protective put option strategy with the underlying stocks, was rejected in favour of the alternate hypothesis at 5 percent significant levels. The alternate hypothesis states that there is a difference between a hedged-put portfolio and an unhedged portfolio.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter covers the conclusion of the study relating to the use of both the fully covered call option strategy and the protective put strategy in portfolio management. This is followed by the recommendations from the study and finally by suggestions for further research.

6.2 Conclusions of the study

Derivatives, and options in particular, have progressively established themselves as common tools in portfolio management for asset allocation, hedging, diversification, and/or leverage. Their non-linear payoffs enable investors to create return profiles that are unachievable by simple combinations of conventional investment vehicles such as stocks and bonds.

The combination of underlying stocks with a fully covered call option strategy leads to similar returns when compared to a portfolio of the underlying stocks only, but the risk as measured by standard deviation is lower on a portfolio with fully covered call options when it is compared to a portfolio of underlying stocks. Therefore, a combination of an underlying portfolio with a quarterly covered call option strategy might be useful for an investor seeking to minimize the risk of his/her portfolio of shares over the long term.

The combination of an underlying portfolio with a protective put options strategy lowers the returns when it is compared to a portfolio of only the underlying stocks. This could be ascribed to the costs of combining a protective put strategy with the portfolio of the underlying stock. These costs are between 150 to 200 basis points, as indicated by Clarke and Arnott (1987).

In this study, a portfolio with a protective put strategy has a higher risk profile compared to a portfolio of underlying stock, as measured by standard deviation. Therefore, a combination of underlying stocks with a quarterly protective put strategy over a 10-year period investment horizon is not a good investment strategy for a traditional investor.

6.3 Recommendations

This research report has shown that a combination of an underlying portfolio of shares or stocks with fully covered call options leads to similar returns when compared to a portfolio of the underlying stocks, and the combined portfolio offers lower risk than a portfolio of stocks only. Therefore, a combination of a portfolio of shares with fully covered call options is recommended for an investor wanting to maximise returns while minimising the risk associated with his/her portfolio.

A combination of underlying stocks with a quarterly protective put strategy over a 10-year period offers both lower returns and higher risk when compared to a portfolio of underlying stocks only, and would therefore not be suitable for an investor who has a long time horizon.

6.4 Suggestions for further research

A number of areas for further research were identified during the course of this study, and are listed below.

- A combination of the JSE top 40 index with fully covered call options over the same duration may be studied to ascertain if weighting of shares, using market capitalisation, has an impact on the performance of the index.

- A study using seasonal timing combined with the underlying portfolio with fully covered call options on the JSE Securities Exchange may be performed.

- A study of the combination of the underlying portfolio of stocks with a protective put strategy, and when it is optimal to use this strategy on the JSE Securities Exchange, may be performed.

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APPENDIX A

Portfolios' Performances

Date	Hedged-call Portfolio	Hedged-put Portfolio	Unhedged Portfolio
31-Dec-97	1.00	1.00	1.00
31-Mar-98	1.17	1.13	1.20
30-Jun-98	1.14	0.98	1.06
30-Sep-98	1.04	0.89	0.89
31-Dec-98	1.25	0.88	0.97
31-Mar-99	1.49	0.97	1.17
30-Jun-99	1.72	1.09	1.38
30-Sep-99	1.79	1.07	1.40
31-Dec-99	2.07	1.35	1.85
31-Mar-00	2.09	1.22	1.77
30-Jun-00	2.25	1.11	1.73
30-Sep-00	2.50	1.10	1.82
31-Dec-00	2.69	1.10	1.88
31-Mar-01	2.80	1.02	1.94
30-Jun-01	3.26	1.14	2.27
30-Sep-01	3.04	0.91	1.99
31-Dec-01	3.47	1.13	2.60
31-Mar-02	3.68	1.12	2.66
30-Jun-02	4.00	1.09	2.86
30-Sep-02	3.90	0.88	2.61
31-Dec-02	4.27	0.79	2.71
31-Mar-03	3.74	0.55	2.24
30-Jun-03	4.18	0.59	2.50
30-Sep-03	4.56	0.60	2.65
31-Dec-03	5.16	0.69	3.16
31-Mar-04	5.47	0.65	3.24
30-Jun-04	5.47	0.58	3.13
30-Sep-04	6.22	0.64	3.60
31-Dec-04	6.44	0.67	3.97
31-Mar-05	6.74	0.66	4.05
30-Jun-05	7.32	0.66	4.32
30-Sep-05	8.35	0.76	5.15
31-Dec-05	9.19	0.81	5.60
31-Mar-06	10.50	0.90	6.49
30-Jun-06	10.98	0.80	6.55
30-Sep-06	12.27	0.76	6.88
31-Dec-06	14.14	0.87	8.13
31-Mar-07	15.39	0.91	8.73
30-Jun-07	16.47	0.90	9.01
30-Sep-07	16.99	0.74	9.05
31-Dec-07	17.20	0.54	8.63

APPENDIX B

Portfolios' Quarterly Percentage Returns

Date	Unhedged Portfolio	Hedged-call Portfolio	Hedged-put Portfolio
31-Mar-98	20.0%	17.2%	13.2%
30-Jun-98	-11.4%	-2.3%	-13.8%
30-Sep-98	-15.9%	-9.5%	-8.5%
31-Dec-98	8.8%	20.8%	-2.0%
31-Mar-99	20.2%	19.3%	10.4%
30-Jun-99	18.3%	15.2%	12.4%
30-Sep-99	1.1%	4.4%	-1.6%
31-Dec-99	32.1%	15.6%	26.2%
31-Mar-00	-4.4%	0.9%	-9.6%
30-Jun-00	-2.3%	7.4%	-8.5%
30-Sep-00	5.3%	11.3%	-1.7%
31-Dec-00	3.4%	7.5%	0.1%
31-Mar-01	3.2%	4.1%	-6.7%
30-Jun-01	16.8%	16.4%	10.8%
30-Sep-01	-12.3%	-6.7%	-19.5%
31-Dec-01	30.6%	14.1%	23.8%
31-Mar-02	2.3%	6.0%	-0.9%
30-Jun-02	7.7%	8.8%	-3.2%
30-Sep-02	-8.8%	-2.5%	-19.4%
31-Dec-02	3.6%	9.4%	-9.3%
31-Mar-03	-17.2%	-12.4%	-30.9%
30-Jun-03	11.4%	11.8%	6.6%
30-Sep-03	6.3%	9.2%	2.3%
31-Dec-03	19.1%	13.2%	15.1%
31-Mar-04	2.3%	5.9%	-5.1%
30-Jun-04	-3.3%	0.0%	-11.9%
30-Sep-04	15.0%	13.8%	11.2%
31-Dec-04	10.3%	3.5%	4.5%
31-Mar-05	2.0%	4.7%	-2.1%
30-Jun-05	6.7%	8.5%	-0.1%
30-Sep-05	19.3%	14.1%	16.1%
31-Dec-05	8.6%	10.1%	5.9%
31-Mar-06	16.0%	14.2%	12.0%
30-Jun-06	0.9%	4.6%	-11.8%
30-Sep-06	5.1%	11.8%	-4.7%
31-Dec-06	18.0%	15.2%	14.1%
31-Mar-07	7.5%	8.9%	4.9%
30-Jun-07	3.1%	7.0%	-0.6%
30-Sep-07	0.5%	3.2%	-18.4%
31-Dec-07	-4.6%	1.2%	-27.0%