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Covered Call Trading Strategies in the South African Retail Equity Market

MMFI Thesis

Wits Business School

University of the Witwatersrand

February 2014

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In partial fulfilment of the requirements for the degree

Master of Management in Finance and Investment

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Declaration

I, Mark Bevan Humphreys declare that the research work reported in this dissertation is my own, except where otherwise indicated and acknowledged. It is submitted for the degree of Master of Management in Finance and Investment at the University of the Witwatersrand, Johannesburg. This thesis has not, either in whole or in part, been submitted for a degree or diploma to any other universities.

Signature of candidate: Date:

ABSTRACT

The use of a Covered Call strategy has long been favoured by investors the world over for its potential to enhance yield in a long-only equity portfolio. There already exists a wealth of research examining the risk and return features and theories of this strategy. This paper aims to contribute to this debate by conducting research that is specific to the South African equity market and considered from the perspective of a retail investor, particularly by tracking the negative friction induced by transaction costs. It also seeks to answer the question of which Covered Call strategies provide the best risk-adjusted returns by pricing various expiry range and moneyness combinations over differing market trend phases during a 13-year period of trade on the JSE.

Keywords: Covered Call, Option Strategy, Moneyness, Sortino Ratio, JSE, Retail share investing, Retail equity investing, Equity call option, Risk-adjusted return

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1 INTRODUCTION

This chapter defines the purpose and the context of the study by explaining the basic mechanics of the Covered Call option strategy and thereafter delimiting the research problem and sub-problems.

1.1 Purpose of the study

The purpose of this research is to examine Covered Call option trading strategies available in the South African retail equity derivatives market and thereby ascertain if similar strategies found to be successful in more developed markets will likewise have similar significant return enhancing and risk reducing effects.

1.2 Context of the study

Equity markets are the traditional financial mixing and melting pot, bringing together many classes of investors, including local institutional, local retail and foreign retail and institutional. South Africa's equity market, traded on the JSE (Johannesburg Stock Exchange), is Africa's largest (by market capitalisation) and most active (by trade value and volume) equity market.

Of particular interest to this study are the avenues available to the typical South African retail investor. Many individuals turn to the equity market as a means of investment, but not many are aware of or comfortable using the tools available to them to enhance their returns and protect their wealth.

Retail investors by their nature are not expert market analysts, nor do they have the time or the inclination to become so. However, there is a large and growing community of so-called "do-it-yourself" (DIY) investors seeking to take advantage of the relatively low fees and automated risk management features provided by many online discount brokers; generally forgoing bespoke (and this proportionally expensive) portfolio management advice tailored to their needs and situation.

On the topic of fees, as the study will be from the perspective of the retail investor, it will be important to take cognisance of the frictional effects of transaction fees. Academic studies often overlook these as at sufficiently low margins and high volumes such as those used in institutional trade, their effect is negligible. However, for the so-called "man on the street" these costs are a

very real barrier to entry and consideration when entering into a transaction; consequently, every effort will be made to consider this angle.

There is a wide spectrum of product offerings among these brokers, including ordinary equity and various derivatives (such as CFDs (Contract For Difference), Futures and Options) in both an OTC (Over the Counter) and listed form.

Where investing is considered to be taking a position with a long-term view and allowing time for the compounding of returns, trading would conversely be the relatively frequent and rapid entering and exiting of short-term speculative positions attempting to profit from marginal price movements. Retail market participants would be classified as falling somewhere on the scale between investing and trading depending on their risk appetite, time horizons and return expectations. Because of the high degree of risk generally associated with derivatives most "investor" archetypes would tend to avoid them. There is, however, some room for the overlap of investment-focussed goals and the use of derivatives in the same portfolio - this will be a primary theme of this research.

To this end, this study seeks to examine one simple option trading strategy which could be used to undertake this task, namely the use of Covered Calls in a long equity portfolio to enhance returns. It further seeks to define some simple conditions and rules for applying this strategy effectively, and examine whether it can provide excess returns and simultaneously reduce, or at least not increase the level of risk in an investor's portfolio.

1.3 Overview of Basic Covered Call Mechanics

A Covered Call position is arrived at by the combination of a long equity position and a short call option written over that equity. Premium income is received for the sale of the call option. In the following example, stock was bought at a price of R20 per unit, and a call option (OTM) sold over the same stock at a strike price of R25, for a premium of R5.40 (the derivation of this price is not relevant at this point). This situation can be seen below in Figure 1, which shows the potential profit arising from these two separate positions. Here it is clearly evident that the equity position has zero profit when its price is R20 (its cost price). In the case of the option position, it can be seen that for prices at and below R25 the profit is R5.40, and from there on each unit increase in the underlying price increases the loss on the option position by the same amount.

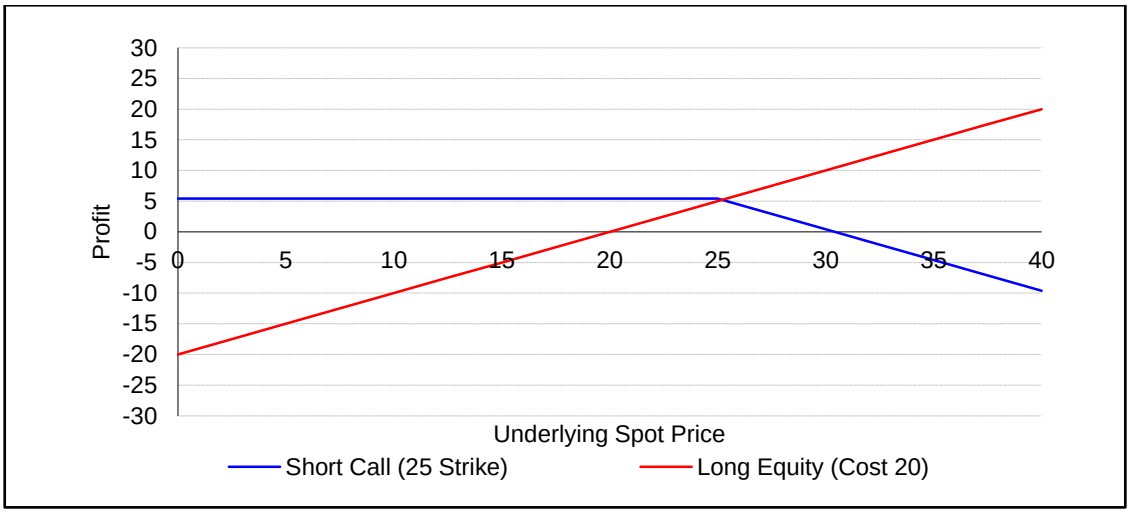


Figure 1: Profit chart of Short Call Option and Long Equity

When viewing these two positions as one composite position (creating a synthetic short put position), the profit profile is that of Figure 2 below. Here it can be noted that the position is profitable at any price above R14.60 with the maximum profit occurring at an underlying price of R25 and above.

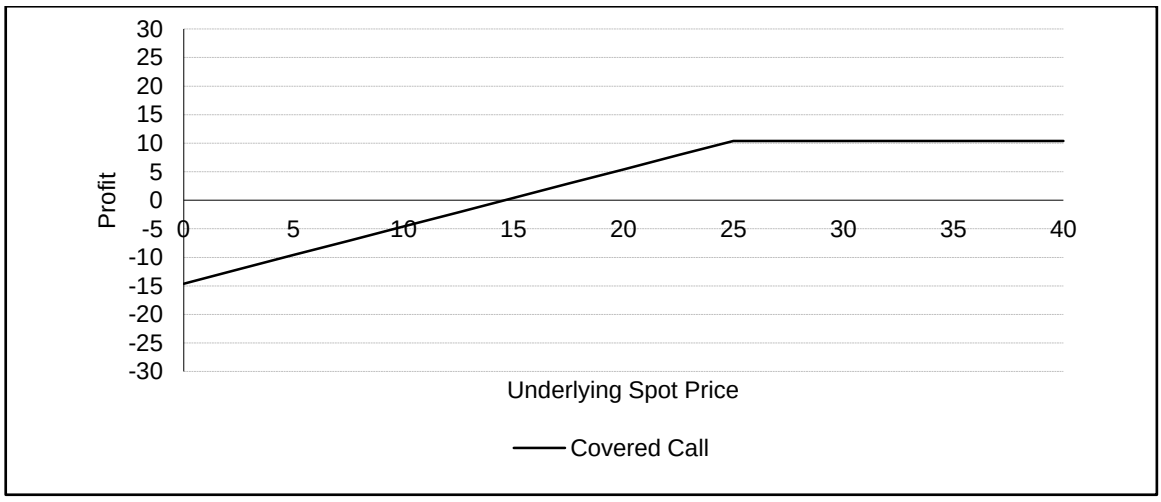


Figure 2: Profit Chart of Covered Call Strategy

Figure 3 provides a comparison of the profit profile of the long equity position and the Covered Call position (from Figure 2 above), forming the basis of comparison which will be used throughout the study.

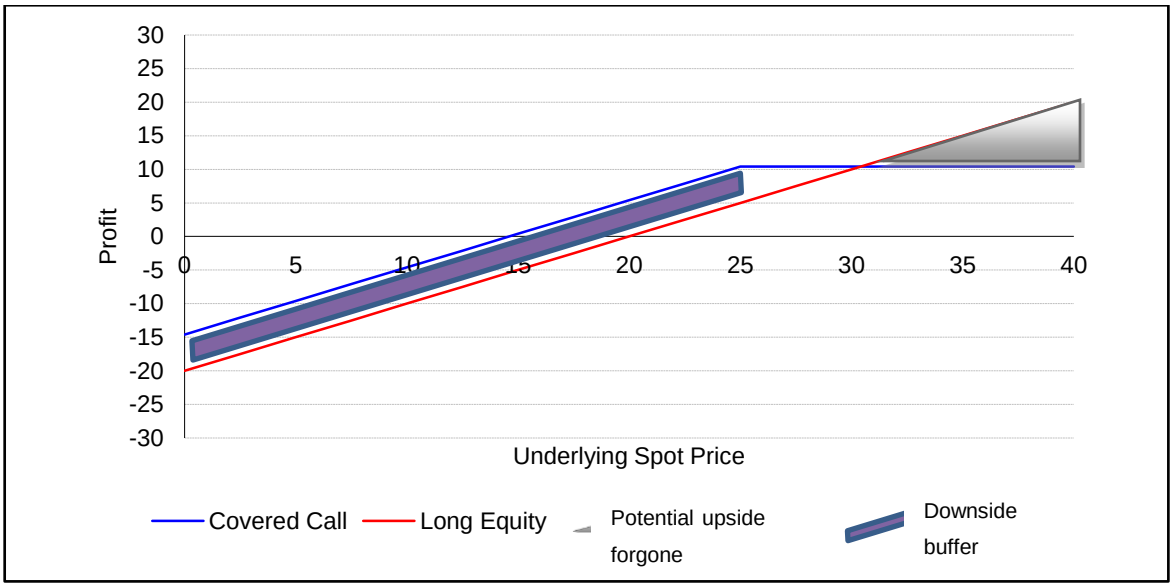


Figure 3: Profit comparison of Covered Call vs. Long Equity

Essentially, the option writer is giving up the potential upside (above the strike price) in exchange for premium income received at the time of entering into the transaction. This premium income is also the extent of the downside buffer, which is a cushion against a fall in the underlying price. Simply, income already earned in the form of premium "cushions" the blow to the investor of a drop in the share price, but it can only afford protection to the extent of the premium paid and is not a hedge so much as a counter benefit. Thus the maximum profit from a Covered Call position occurs at the strike price, and consists of the option premium plus the difference between the strike price and the cost price of the long equity (Cohen, 2005). In this case, that is R10.40 (R5.40 option premium and R5.00 favourable price movement).

One of the advantages of the Covered Call strategy is that if the option expires OTM the investor will keep both the premium and stock over which they wrote the call. Provided that the underlying price has not fallen by more than the value of the premium earned, the option writer will make a profit without incurring any further transaction costs.

However, as a call option provides its owner with the right to buy, the higher the underlying price at the time of exercise, the more upside on the underlying is sacrificed by the writer. In the event of exercise, regardless of the prevailing underlying price at the time, the investor walks away with the maximum profit that was attainable under the Covered Call structure.

The Covered Call structure provides a small measure of buffer against falling underlying prices. If the underlying price at the time of expiry is below the strike price, the option will not be exercised but at the same time the investor will experience losses on their "covering" underlying position

which may exceed the premium earned. To this end, a Covered Call does not provide a great measure of protection in a falling market, and is thus not considered a hedging strategy.

The above considerations are those which face the typical retail investor considering the use of Covered Calls as a "yield enhancer" in their portfolio. Thus it is around this framework that the research takes place.

1.4 Definition of terms

Term	Definition
Abnormal return	The amount by which a security's actual return differs from the expected return
Alpha	A portfolio manager's abnormal rate of return, which is the difference between the return the portfolio actually produced and the expected return given its risk level
ATM (At-The-Money)	Option status when the exercise price is the same as the underlying asset price
Back testing	Testing a model using historical data
Bear market	A falling market over a period of time
Black-Scholes Model	A model for valuing European options on equity stock
Bull market	A rising market over a period of time
Buy-write	Sub type of a Covered Call. Occurs when investor simultaneously buys stock and writes a call option over it
Call option	An option contract the gives the holder the right to buy the underlying security at a specified price for a fixed period of time
Covered Call	A strategy in which call options are sold while simultaneously owning an equivalent position in the underlying security
Derivative	A financial instrument whose value is derived in some way from the value of an underlying asset
European-style option	An option which cannot be exercised before the expiration date
ETF	Exchange Traded Fund. An index fund that seeks to achieve the same return as a market index or basket of stocks
Exchange	An institution which provides facilities for the trading of listed securities
Exercise	The activation of the right to buy or sell the underlying security
Exercise price	The price at which the underlying asset can be bought or sold by the buyer of a call or put option. Also known as Strike Price
Expected return	Average return on a risky asset expected in the future
Expiration Date	The date at which the option's ability to be exercised ceases
ITM (In-The-Money)	Option status when an exercise would yield profit Calls: Underlying Spot Price > Strike Price Puts: Underlying Spot Price < Strike Price
Intrinsic Value	The amount by which an option is ITM
Listed Securities	Securities traded on an exchange
Long Equity Portfolio	Being a net buyer (owner) of equity

Moneyness	"Deepness" of in / out the money strike prices
Option	A financial instrument which gives the buyer the right but not the obligation to buy (call) or sell (put) an underlying asset at a fixed price before a predetermined date
Option premium	The price of an option
Option writer	The seller of an option
OTM (Out-the-money)	Option's status when it has no intrinsic value (cannot exercise for profit) Calls: Underlying Spot Price < Strike Price Puts: Underlying Spot Price > Strike Price
OTC (Over the Counter)	Securities market in which trading is done directly with dealers who buy and sell for their own inventories. (Not over exchange)
Over-Writing	Sub type of a Covered Call. Occurs when investor who owns a stock, writes call options on this stock
Plain vanilla	Term used to describe a standard deal
Put Option	An option contract the gives the holder the right to sell the underlying security at a specified price for a fixed period of time
Retail Investor	A (non-juristic) individual who seeks to invest.
Sharpe Ratio	Measures investment performance as the ratio of portfolio risk premium over portfolio return standard deviation
Short sale	A sale in which the seller does not actually own the security that is sold
Sortino Ratio	Adjusts the Sharpe ratio by considering only downside risk and a minimum acceptable return.
Spot Price	Actual price in the market
Strike Price	See Exercise price
Treynor Ratio	Measures investment performance as the ratio of portfolio risk premium over portfolio beta
Underlying	The asset on which a derivative structure is dependent
Volatility	(1)Measure of the fluctuation of price movement in a security over a period of time
	(2)A measure of the uncertainty of the return realised on an asset

Table 1: Definition of terms used in the study

1.5 Problem statement

1.5.1 *Main problem*

Using a Covered Call buy-writing strategy in the South African equity environment can significantly enhance return without an undue increase in risk for retail investor portfolios.

1.5.2 *Sub-problems*

i. An analysis of the current South African equity and equity derivative environment, and which instruments best lend themselves to this study.

ii. The creation of a model which can demonstrate the effect of a Covered Call trading strategy and assist in producing data suitable for the analysis below.
iii. A methodology to define and measure the impact on risk and return of the implementation of the Covered Call strategy and considerations around the validity of these measures.
iv. An assessment of the impact of various factors at play when writing the call options with a view to their effect on risk and return, and any insights these have to offer with a view to creating some guidelines for the successful implementation of the strategy. In conducting this assessment, the following considerations form part of the model:

a) The impact of the remaining time until expiry ("**expiry range"**) at the time of transaction on both risk and return, and whether there is an optimal expiry term which best balances risk and return
b) The effect on return of the degree of "**moneyness**" at the time of executing the option transaction;
c) How the strategy is affected by the prevailing **market phase** (bull / bear / sideways etc.);
d) The impact of **transaction costs** on return, and whether these costs have a material effect on the implications of other findings
e) Any other factors which come to the fore during the study which may be of interest.

1.6 Significance of the study

Various studies such as (Board et al., 2000) , (Isakov and Morard, 2001) and (Gregory, Marshall, Fogertey, Jha and Rangel, 2012) have been conducted in this field; however, these have focussed on either the American or European markets. This study aims to close this gap in two ways; firstly, by examining the topic in the context of the South African market and, secondly, under a framework which would be accessible to a typical retail investor. As a result, it would provide tangible evidence of the usefulness or lack thereof of these investment strategies to the South African retail investor.

The study will provide guidance to retail investors in the South African equity market seeking to better returns without unduly leveraging up their risk. It is hoped that by examining the South African market and building a model to simulate the effect on returns of writing Covered Calls over an equity portfolio that simple guidelines might be deduced which would be of use to the South African retail investor.

1.7 Delimitations of the study

Options have traditionally been available to institutional investors and fund managers in South Africa through their relationships with corporate banks that provide OTC (Over-the-Counter) prices in these instruments to them. These products are now becoming available to the South African retail investor. These types of option products have been available to foreign retail investors in more advanced markets overseas for some time and consequently have generated some hype around their apparent ability to enhance returns and, some say, reduce risk. Therefore, the ability for retail investors to write (sell) options over their stock is a relatively new development in South Africa and consequently the study seeks to focus specifically on this area.

Owing to the lack of commonly traded exchange-based (listed) options in South Africa, option prices have to be retrospectively calculated from available historical data rather than quoted from actual trade history. This is a departure from the methods commonly used in many of the foreign-based research papers, which could potentially lead to the introduction of oversights not present in the literature under review.

As the study is exclusively from the perspective of the retail investor it will seek to define the "average retail investor" in a manner which suitably covers most relevant individuals, where possible taking a lowest common denominator approach.

The data used for the back-testing model is for the period 1 January 2001 through 31 December 2013, covering a 13-year period of trade in the market. The range has been chosen because it contains distinct periods of "bull", "bear" and "sideways" trends, which are factors thought to have a considerable influence on the performance of the strategy.

The premise used in constructing the model is that of a buy-writing strategy rather than an over-writing one. This is meant as a conservative approach to the research as in most cases positive findings for a buy-writing strategy would be equally applicable to an over-writing strategy, but the same is not true in reverse.

Volatility data used in the model is historic (as opposed to implied) and is computed from the price movement of the underlying share rather than implied by backing it out of the price of actual option trades. This is unavoidable as no suitable option price history exists for this purpose. This is also a departure from the methodology used in other studies, and leads to the likelihood that real-world volatility risk premiums are not present in the data (see discussion below).

1.8 Assumptions

A primary assumption in the construction of this study is that the use of the Black-Scholes option pricing model utilising historical volatility rather than implied volatility is a suitable methodology for creating option prices for use in the back-testing model. In reality, evidence from liquid listed options markets suggests that a phenomenon known as the “volatility risk premium” tends to skew option prices upwards (in favour of sellers). Therefore, for the purpose of this study, as this “real-world” bias would tend to enhance returns and thus also the results this study is seeking to provide, will not exist in the data utilised, one could consider the study to have been done under more conservative conditions than the typical real-world investor would encounter. Thus one might expect the true performance in the real market to be better than that found in the model. This provides both an additional level of comfort to the investor and credibility to the results. Please see the literature review for a further discussion on the topic of the volatility risk premium.

2 LITERATURE REVIEW

This chapter discusses and compares themes found in previous research conducted on elements of the topic. Various recurrent themes are discussed for their relevance to this study and those factors which may make them more or less applicable in the case of this study.

2.1 Introduction

In seeking to ascertain the potential positive and negative effects on a portfolio of engaging in Covered Call writing by South African retail investors this paper will need to examine a few key areas. These are:

i. Consideration of factors unique to the South African retail investor market;
ii. The construction of a model to simulate the impact of Covered Call trading on a portfolio in such an environment with tools that a retail investor commonly has at their disposal;
iii. How to observe and quantify risk and return in the model and the use of metrics to gauge improvement or degradation in these areas; and
iv. A study of which factors primarily influence the successful outcome of this strategy, ultimately leading to the creation of guidelines for the retail investor to consider.

The writing of call options by retail investors is common in large, highly liquid developed world markets and in particular the USA, UK, Australia and Europe. The Covered Call strategy has been singled out in a positive light as a source of low-risk steady returns (Radoll, 2001) and (Tergesen, 2001) but also negatively for firstly its lack of downside protection (Leggio and Lien, 2005) and secondly for the potentially inappropriate frameworks used to measure risk when engaging in such strategies (Lhabitant, 2000) and (Figelman, 2008), which result in findings that appear to violate the efficient market hypothesis by showing a simultaneous reduction in risk and increase in return.

A recent study by Goldman Sachs suggests that overwriting (the selling of Covered Calls) is the most common strategy used by fund managers who prefer to be long in the equity market both because of its simplicity and its ability to extract yield in flat markets while providing a measure of downside cushioning. (Marshall, Fogertey and Jha, 2012). One of the primary goals of this research is to establish whether the same would hold true for the South African retail investor. This is of interest to retail investors both because as individuals their only pure exposure to the

equity market is of a long-position nature and this strategy potentially provides an easy way to extract additional yield from these long-only portfolios.

2.2 Definition of Trading Strategy

A Covered Call **over-writing** strategy comprises the selling of call options using already purchased stock as cover. This differs from **buy-writing** in the sense that the covering stock is already owned by virtue of a prior transaction and thus from the point of view of transaction costs overwriting is slightly cheaper (Board et al., 2000). It also differs from the taking of an uncovered (or naked) call position, in the sense that should the call option be exercised by the buyer the underlying stock is already owned and there is no need to venture into the market and purchase it (potentially at great cost) in order to make good on the exercise. Thus in the case of a Covered Call, the presence of this underlying cover provides a form of hedge which limits the risk introduced into the portfolio by the option. This feature of built-in cover makes it an attractive product in the retail market where credit is seldom extended to the investor. It is also common that the type of call options used are of the European style (which can only be exercised at maturity).

2.3 The South African Retail Investor Context

The South African context of this research poses a new dynamic relative to other research already conducted. The size of the South African bourse, the JSE, is relatively small when compared with the likes of its American, European and even Australian counterparts (see **Table 2** below). In particular, the focus of this study on the retail portion of the market further narrows the focus and thus also the existence and availability of relevant prior research and data.

Exchange	Market Cap (USD - millions) as at Jan 2013
NYSE Euronext (US)	$ 14 758 386.70
NASDAQ OMX	$ 4 770 998.40
London SE Group	$ 3 846 076.08
Deutsche Börse	$ 1 574 752.48
Australian SE	$ 1 442 172.73
Johannesburg SE	$ 895 545.49

Table 2: Market Capitalisation of selected stock exchanges. Source: (Exchanges, 2014)

Due to the relatively small size of the South African Market (approximately ~4.5% of the size of the American market) it is noted that there is not a liquid listed options market from which to obtain historical options prices such as there is in most developed world countries. However,

consultation with the equity derivative team responsible for options price making at a major local corporate bank has confirmed the use of the Black-Scholes model in pricing options for sale “over-the-counter” (OTC). Consequently, the same model can be used to retrospectively price options that would have been available to retail investors at a particular point in time.

2.4 Considerations in the Construction of a Model

Most of the research reviewed to date that involves the construction of a model to evaluate the performance of a Covered Call portfolio against that of a regular long-only portfolio used an index as its underlying asset, and listed options traded over that index. (Board et al., 2000; Isakov and Morard, 2001; Gregory et al., 2012).

Board et al. (2000) chose to consult with a fund manager familiar with option strategies in order to construct realistic portfolios over which to test Covered Call performance. The outcome of this was to construct five different strategies for application of Covered Call trades. The primary determinants were the level of volatility and price-earnings ratios. Of significance is that Board et al. (2000) allowed for transaction costs, bid-offer spreads and other statutory costs in designing their model.

Isakov and Morard (2001) built an optimisation model in which they only consider OTM options, as they consider this to be the primary strategy of the conservative investor wishing to earn incremental income without ever having to lose their covering stock. They also state that this represents the largest portion of the Covered Call market.

Landes and Seifert (1986) built a simpler model, and perhaps one that better lends itself to the constraints applicable to the South African retail context. They opted to construct their own basket of shares (effectively a custom index), which allowed them the flexibility to exclude certain stocks if they were not suitable. This allowed them to construct a more realistic trading programme not based solely on an index. They also took cognisance of the prevalent rates charged by brokers on both the equity and options markets and applied these throughout their study.

Adam and Maurer (1999) built a model to simulate covered short calls and put hedges intending to evaluate risk and return. They proposed and developed a risk analysis method based on shortfall risk measures, which involved analysing only the “negative deviation of the return expected by the investor”. Ultimately, they found that the Covered Call strategy enabled risk

reduction when compared with an equivalent equity-only investment, but this was achieved by lowering return, a finding which is fully in line with the efficient market hypothesis.

Another prevalent theme recurrent in most papers studied, is the best manner in which to measure both risk and return. Board et al. (2000); Lhabitant (2000); Isakov and Morard (2001); Leggio and Lien (2005) and Figelman (2008) all argue that the use of the Sharpe ratio or, in the case of Adam and Maurer (1999), its input components of expected return and standard deviation of return, which all rely on the mean-variance framework to deduce measurements for risk and return, is not suitable for evaluating options portfolios because it assumes a normal distribution of return. However, the introduction of options into the portfolio results in a skewing of the distribution and consequently makes these results questionable. Consequently, many results drawn in this manner tend to suggest a violation of the efficient market hypothesis, specifically that a reduction in risk can readily increase return. Between them they suggest the use of stochastic dominance and Treynor ratios (Board et al., 2000; Isakov and Morard, 2001), Sortino ratios and the Upside Potential ratio (Leggio and Lien, 2005), Semi-Standard Deviation (Figelman, 2008) and shortfall risk (Adam and Maurer, 1999) as alternative risk measures.

The presence of a volatility risk premium is a common phenomenon in foreign-listed option markets. Essentially, this is uncovered by comparing the implied volatility backed out of the price at which listed options actually traded (arrived at by manipulation of the Black-Scholes option pricing formula) and the calculated historical volatility for the underlying instrument for the same period. As the implied volatility is typically higher than the historical volatility it is said that there is a volatility premium in the option market which favours sellers (actual option prices are higher than their theoretical price). Bollen and Whaley (2004) note that this is not the result of "inappropriate assumptions" regarding the "movements of asset price and volatility" but rather because of the inability of arbitrageurs to close this gap because real-world costs make this not viable. This is also not a new phenomenon as Black and Scholes (1973) (who gave their names to the famous option pricing methodology), noted that "*the actual prices at which options are bought and sold deviate in certain systematic ways from the values predicted by the formula. Option buyers pay prices that are consistently higher than those predicted by the formula….There are large transaction costs in the options market, all of which are effectively paid by options buyers*". Kapadia and Szado (2007) and Figelman (2008) found that the contribution to return of the volatility risk premium was the most significant factor in the success of an overwriting investment strategy. Therefore, it stands to reason that if there is evidence to suggest the superiority of returns for a Covered Call strategy unassisted by the volatility risk premium phenomenon, as is the case when using historic volatility, then there is merit in the argument that the real-world returns would likely be even better.

2.5 Determination of Factors that Primarily Influence Successful Outcomes

Gregory et al. (2012), which is exclusively an investigation on over-writing, devote much of their study to modelling different types of strategies. Factors they take into consideration in trying to find an optimal model are the degree of moneyness, time to expiry at inception of the option trade, the probability of exercise and the targeting of a fixed delta. They then attempt to guide the choice of option attributes through knowledge of prevailing volatility levels. Consequently, they proceed to construct portfolios for various combinations of the above criteria to ascertain under which prevailing market conditions, knowledge of which would be available prior to entering a position, would best guide the level of moneyness and time to expiry in order to be most profitable. However, they do not take cognisance of transaction costs or the tax implications of exercise occurring. Their study also relies on the comparison of a portfolio consisting of listed options written over a tradable index compared to another containing just that index, and as such is not entirely applicable in the framework this research intends will pursue.

2.6 Conclusion

There are many published studies on the risk and return performance of Covered Calls and the various strengths and weaknesses of the frameworks for calculating and interpreting this information. However, it appears there are none specifically regarding the retail market nor the South African context, and certainly not in the space where these two overlap. Therefore, the research which follows will hopefully uncover new academic ground.

3 RESEARCH METHODOLOGY

This chapter explains the design of the model which was built in order to produce data to analyse, and the derivation of several key metrics which were used to conduct the comparative analysis found in the results.

3.1 Introduction

The research methodology used is of a quantitative nature as the answers to the research questions posed all required some form of quantitative analysis in order to arrive at a conclusive answer.

3.2 Research Model Design

The research has primarily taken the form of a back-testing model constructed in Microsoft Excel. All input data has been sourced either from local stock and derivative market brokers and market-makers or the exchange. The model consists of several parts each of which will be discussed in greater detail below.

A key design feature of the model is the ability to iterate through thousands of market phase, moneyness and expiry range combinations in order to assess and rank the performance of each aspect. This is a departure from the methodology used by most-all authors reviewed in the literature review who chose a handful of combinations on which to conduct their research. It is intended that the output generated by this will allow a more complete picture to be formed, to remove the element of random luck, and perhaps uncover a few unexpected quirks too.

In essence, the model will rely firstly on the construction of a suitable portfolio for a typical South African retail investor. Thereafter, financial input data in the form of historical prices, dividends, volatilities and interest rates are required. This will allow for the creation of two simultaneous synthetic portfolios. One a long-equity portfolio and the other starting from the same point but using various parameters to guide the writing of call options in an attempt to enhance returns in the option portfolio. The pricing of these options and consequent premium flows are as determined by a Black-Scholes vanilla options pricing Excel plug-in.

Once various combinations of the option strategy have been generated one is then able to directly compare it to the equity-only portfolio and assess whether there was any above-average return (Alpha) and what impact it had on the risk profile of the portfolio.

3.2.1 *Defining the Average Retail Investor*

As the market participant of interest for this study is the "DIY" retail investor. A leading discount stock broker that offers its clients the ability to trade in both ordinary listed equity shares (via the JSE) and to write Covered Call options over these shares was consulted in order to gain a greater understanding of the make-up of the typical retail investor.

This "average" investor was defined by the following metrics:

i. The average value in (ZAR) as at 31 December 2013 of a portfolio consisting of cash and shares.
ii. Descriptive statistics of the distribution of portfolio sizes
iii. The average number of shares held by investors.
iv. The most popular shares, by the frequency with which they were owned
v. The most popular shares, by the average value held

The results of this investigation were as follows:

Portfolio Property	**Result**
Mean portfolio size	R585,982.76
Median portfolio size	R67,015.94
Average number of shares	5.3 (rounded down to 5)
Six most common shares by frequency held	Anglo American plc (AGL) BHP Billiton plc (BIL) MTN Group Ltd (MTN) Standard Bank Group Ltd (SBK) Sasol Limited (SOL) Satrix 40 Portfolio (STX40)
Six most common shares by value held	Anglo American plc (AGL) BHP Billiton plc (BIL) Naspers Ltd -N- (NPN) SABMiller plc (SAB) Standard Bank Group Ltd (SBK) Sasol Limited (SOL)

Table 3: Descriptive statistics of the average retail investor

Based on the results of the above, it is possible to design a model portfolio which is both suitably flexible so as to allow the easy construction of the rest of the model around it and sufficiently representative so as to be a fair proxy for that which the average retail investor already holds.

In terms of the model this base equity portfolio was defined by the following variables in the model:

a. **Value in ZAR of cash and shares**. Effectively, this is the start cash balance of a portfolio to be tested. It was important to retain flexibility here as it may be necessary to configure this value to represent the present value of the portfolio as described by the data extract above so that one might surmise what growth could be in store for current investors going forward; or alternately to reverse engineer the present value of the portfolio to what it would have been at some past point in time such that back testing the model arrives at the present value of the portfolio as the terminal value, and thus one could demonstrate the tangible difference the strategy would have made if applied some years ago.
b. **Choice of shares**. In order to make the model descriptive of more investors rather than of most wealth held by investors, it was decided to use those shares which were most commonly held, rather than those which comprised the greatest value of the holdings. As can be seen above, these lists are quite similar and so it would only require minor alterations to the model to switch. There was an additional "tweak" here, in that it was decided to leave the SATRIX40 (STX40) share out of the model entirely for several reasons. Firstly, STX40 is itself an ETF (exchange traded fund) and as such sourcing the requisite dividend, other payments and volatility data is more challenging, the data quality is less reliable than for ordinary shares and it brings an additional level of complexity to the model design as it operates slightly differently from the other shares in terms of the structure of its cash flows. Secondly, because STX40 is an ETF that comprises the entire TOP40 index it would, by design, have a relatively lower volatility than the other shares being considered and is thus immediately a poorer candidate for a strategy seeking additional yield from option premiums (these premiums depend on volatility). As the "average" portfolio comprised five shares, the final model portfolio comprised the following shares: SOL, MTN, SBK, BIL and AGL. It is assumed that at inception the available cash is evenly distributed between these shares.

3.2.2 *Input Data for Black-Scholes Pricing*

Owing to limited availability of data the date range for the back-testing model was confined to 1 January 2001 through 31 December 2013. For each of the five shares in the portfolio historical closing prices and dividends (with their ex dates) were obtained from a local stock broker. Additionally, a historical interest rate (in the form of the Repo rate) was obtained for the same period.

Due to the nature of the study being undertaken, in that various expiry ranges would be used, it was necessary to make the calculation of volatility dynamic based on the expiry range in the given iteration, so that volatility was calculated over the same time duration. This would prevent the scenario where, for example, 90-day volatility was used to price a 30-day option. This was achieved using the following calculation assuming an expiry range of y days for share z:

$$\text{Vol}\,(y_z) = \text{Standard Deviation (\% change in price of } z \text{ over preceding } y \text{ days)}$$

This figure was then annualised by multiplying it by the square root of the number of trading days in the year to arrive at a more familiar looking percentage.

3.2.3 *Configurability*

The requirement of output of the model is to be able to assess the returns and risk of Covered Call portfolios based on various combinations of the prevailing market trend (controlled by setting the dates between which to run the model), the moneyness and the expiry range of the option. Hence these variables are controlled centrally to the model and are applicable to all calculations therein. The below figure illustrates an example of a single model iteration.



Figure 4: Control of variables central to the output of the model

3.2.4 *Single share portfolio design and rules for transaction progression*

Each of the five shares required two portfolios to track the progression over time; firstly, the portfolio selling calls over those shares and another which only bought those shares. Transaction costs, interest calculations, dividends, repurchase threshold and equity purchases were common to both streams and so are discussed first; thereafter, the rules for progressing the options portfolio are discussed in more detail.

a. ***Transaction costs***

After consultation with a discount stock broker the following costs were used for equity and option transactions as they are representative of what is presently available to the average investor:

a i. **Share Purchases**

Charge	Rate
Equity Brokerage	0.50% (minimum of R50)
Securities Transfer Tax (STT)	0.25%
STRATE	R 10.92
Investor Protection Levy (IPL)	0.0002%
VAT	14.00%

Table 4: Costs applied to share purchase transactions

a ii. **Share Sales**

In the case of the model, share sales only occurred when a call option was exercised and as such no brokerage is charged for this as it is a particular type of transaction which does not attract brokerage. Additionally, SARS (South African Revenue Service) does not charge STT on a sale transaction; hence the costs applicable to share sales were as follows:

Charge	Rate
Equity Brokerage	0.0%
Securities Transfer Tax (STT)	0.0%
STRATE	R 10.92
Investor Protection Levy (IPL)	0.0002%
VAT	14.00%

Table 5: Costs applied to share sale transactions

a iii. Covered Call Sales

When an investor writes an option as would be the case for a Covered Call strategy, the opening transaction is a sale. Option sales are relatively straight forward, incurring a flat brokerage rate of R50 plus VAT at 14%, totalling R57.00.

a iv. Covered Call Expiries

When the option expires, regardless of whether it is called, there is no transaction charge as it simply disappears from the portfolio. The model did not cater for the possibility that an investor might prefer to close their option position by buying back the options rather than holding on to them until expiry. In reality, an investor may prefer this course of action in order to avoid the tax consequences of a share sale, or to avoid incurring the transaction fees of rebuying the shares at a later stage.

b. *Interest*

Unutilised cash in the portfolio earned interest, which was accrued daily. As historical interest rates were available in the form of the Repo rate, a fixed spread was applied to this rate as in reality investors would not earn the Repo rate on their free cash. The spread used was -3.00%

c. *Dividends*

Both portfolios earned dividends based on the balance of shares held in the portfolio the day before the share went “ex-dividend”. This is a slight departure from the real world as typically this cash is only deposited in the investor’s account (usually) five trading days later (from the perspective of accruing interest), but many brokers make the cash available for the purchase of other shares immediately. It is impossible to model both of these features simultaneously and so the lesser of the errors would be in the calculation of interest on a slightly overstated balance rather than delaying the purchase of the shares by five days. As will be seen later in the results, interest earned contributes a very small proportion of the total return and as such the overstatement here is not significant.

d. *Repurchase threshold*

Both portfolios have cash income streams in the form of dividends and interest, and the Covered Calls portfolio additionally in the form of premium income; consequently, the cash available for the purchase of further shares builds up over time. Owing to the presence of transaction charges it is not feasible to purchase additional shares immediately there is free cash available in the

account, otherwise there will be many small transactions where a large portion of the cost is attributed to transaction fees and not to the acquiring of additional shares. Therefore, a repurchase threshold of R10,000 was set, requiring the account to have this as a minimum cash balance before purchasing additional shares. For the purchase of exactly R10,000worth of stock using the above costs would result in R94.47 in transaction costs. This is less than 1.00% and is considered a normal and reasonable cost. The number of shares to purchase was calculated as the maximum given the transaction costs and share price of the day such that the purchase did not result in a negative cash balance.

e. ***Initial Setup***

Both the equity only and Covered Call portfolio purchase the maximum number of shares possible with the given cash and transaction cost constraints on day one. Hence in all cases, both portfolios start out with the same number of shares at the same cost price. However, from there on, the equity-only portfolio only buys additional shares once the available cash reaches the repurchase threshold, whereas the Covered Calls portfolio sells calls over these same shares immediately, resulting in both additional income and costs.

f. ***Covered Call portfolio transaction rules***

For each iteration of the model the moneyness and expiry term were defined for each of the five shares, an example of which can be seen in Figure 5 below.

Setup		
Share		SBK
Moneyness		110%
Expiry range		30
Cash Available at inception	R	20 000.00

Figure 5: Single Share Portfolio Setup

The Covered Call portfolio sells calls either when it is the first day after an expiry or when additional shares are purchased (see discussion on repurchase threshold above). The sale of call options results in premium income determined as:

Option Premium = Option price x Number of contracts sold.

The option price is determined by using a vanilla Black-Scholes option pricing plug-in for Excel (see the section “QuantTools Black Scholes Vanilla Option Price Excel Plugin” on page 92 for further details), which required the following input:

Black-Scholes Variable	Model usage
Valuation date	Date given by position in back-test
Maturity date	The expiry term was set globally and so the maturity date would be the date of writing the option plus the number of days defined in the expiry term. There were three exceptions to this; firstly, where the expiry date fell on a non-business day, in which case the next business day was used (this could, for example, result in an option that has 32 days to expiry when the expiry term for that test iteration was 30 days. Additionally, if the equity position grew mid-term then the same expiry date as the options already in force was used for selling additional options. Lastly, for the very last option tranche in the given date range the expiry date would always be the last date of the range of the study meaning the last day would always be an expiry day.
Option style	European
Call or Put	Call
Spot	Historical closing share price for that valuation date
Strike	Moneyness was a built-in variable and as such on the date of writing an option the strike price was calculated as the moneyness (eg.110%) x the spot price of that day. Resulting in an option that has a strike price (in this example) of 10% OTM.
Dividends	Attained from source data as at valuation date
Volatility	Attained by dynamic calculation using the expiry range as the duration over which to calculate the volatility
Interest rate (Zero Curve)	Attained from source data as at valuation date

Table 6: Black-Scholes Option Price Input Variables

When an expiry date was reached the options were always removed at no cost (irrespective of exercise); however, if the option expired ITM then this resulted in a share sale at the strike price for the relevant option and transaction costs as described above.

g. ***Portfolio Valuation***

The equity-only total portfolio value is calculated as:

Total Portfolio (Eq) = Value of shares held + Available cash

The Covered Calls portfolio value is calculated as:

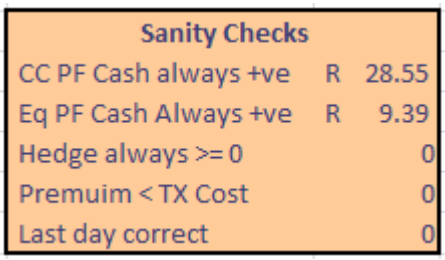
Total Portfolio (CC) = Value of shares held + Available cash + Value of short Call Options

The value of the short call options is negative as it represents the potential cost to exit the option position. However, on the expiry date this value is zero as the option expires with no further cash impact. If there is any impact due to exercise it is reflected in the sale of shares. For this reason it is tempting not to include this value as it has no impact on the final return of the strategy,

however, later on when one is assessing the risk of the two portfolios it is important to have accurate daily valuations.

h. ***Sanity Checks***

With so many formulas and variables it was necessary to apply some independent sanity checks to the output produced in order to detect possible flaws. An excerpt of these is provided in Figure 6 below



Sanity Checks		
CC PF Cash always +ve	R	28.55
Eq PF Cash Always +ve	R	9.39
Hedge always >= 0		0
Premuim < TX Cost		0
Last day correct		0

Figure 6: Sanity checks on single share portfolios

Check	Description
CC PF Cash always +ve	Ensures that the cash balance on the Covered Calls portfolio is always positive, displays the minimum cash balance in the period under review
Eq PF Cash Always +ve	Ensures that the cash balance on the equity portfolio is always positive, displays the minimum cash balance in the period under review
Hedge always >= 0	Ensures that there are always the same number or more shares in the account than there are call options preventing a situation where the portfolio has a naked options position
Premium < TX Cost	Check is calls are sold where the premium earned is less than the transaction cost of doing so
Last day correct	Checks that the last date populated is the same as the defined end date

Table 7: Sanity Checks for Single Share Portfolio

i. ***Performance Comparison and Summary***

For each of the five portfolios a summary of their performance under the defined conditions is produced as below in Figure 7

Performance		
	CC	Equity
Terminal Value	R 178 200.62	R 121 447.40
Cumulative TX Costs	R -19 967.79	R -386.25
Number of Purchase Transactions	21	3
Cumulative Premuim Income	R 69 722.76	R -
Cumulative Divi Income	R 39 250.53	R 29 311.91
Cumulative Interest Income	R 2 303.06	R 2 360.02
PV of premuim income	R 91 630.46	

Summary		
Number of Expiries		151
Number of Exercises		17
% Exercised		11.26%
Terminal Value Diff	R	56 753.23
% Outperformance		46.73%
Terminal Share Differential		151.97%
Average Premuim Yield		0.71%

Figure 7: Performance Comparison and Summary

The meaning of most of these is self-evident, some clarity on some of the less obvious ones is provided below:

Metric	Description
PV of premium income	As the prevailing interest rate is available for each day of the study, it is possible to calculate the present value of all the premium income. This perhaps provides a more meaningful figure than the total premium income as it correctly weights it for the time value of money, and provides some insight when compared to the total premium income as to whether the bulk of income was earned early/late in the time period and its equivalent value compared to the terminal value of the portfolio.
Terminal Share Differential	A large part of the difference in performance comes not from the additional cash earned in premium but the ability to buy additional shares with this cash, and thus gain additional market participation. In portfolios that outperform it is often the case that the Covered Call portfolio has more shares in it than its equity-only counterpart. This is the ratio of the two terminal share quantity values.
Average premium yield	Calculates the average premium yield across the full term of the strategy. Premium yield is the option price divided by the share price on the day of writing the option. The higher the yield the more cash is received in premium.

Table 8: Single Share portfolio metrics

3.2.5 *Combined Portfolio Construction and Performance Measurement*

a. ***Combined Portfolio***

As the overall intent of the research is to compare a typical portfolio of shares (Buy and hold strategy) against a portfolio of shares and options (Covered Call strategy) it is necessary to combine the total return of each individual share into a basket portfolio representing all the shares. This is relatively simple as the total portfolio on any given date is equal to the sum of its constituent parts. This is done for each of the two strategies arriving at a portfolio value for each for every date in the defined date range.

See the model expert below for more detail:

	Covered Calls																	
Date	SBK		MTN		BIL		AGL		SOL		TOTAL		Change (ZAR)		Change (%)			
31/12/2008	R	44 000.00	R	44 000.00	R	44 000.00	R	44 000.00	R	44 000.00	R	220 000.00						
02/01/2009	R	44 828.81	R	45 369.01	R	47 176.71	R	47 059.40	R	46 111.11	R	230 545.05	R	10 545.05				4.79%
05/01/2009	R	46 645.32	R	48 288.40	R	47 858.45	R	47 859.27	R	49 525.02	R	240 176.47	R	9 631.42				4.18%
06/01/2009	R	46 811.17	R	49 932.83	R	49 762.81	R	51 352.12	R	51 015.62	R	248 874.55	R	8 698.08				3.62%
07/01/2009	R	46 699.33	R	47 878.26	R	49 070.42	R	50 858.26	R	49 153.72	R	243 660.01	R	-5 214.54				-2.10%
08/01/2009	R	44 964.14	R	45 926.44	R	47 677.73	R	49 718.39	R	48 184.34	R	236 471.04	R	-7 188.96				-2.95%
09/01/2009	R	47 271.32	R	44 961.02	R	47 753.80	R	46 752.97	R	49 095.33	R	235 834.45	R	-636.59				-0.27%
12/01/2009	R	47 443.12	R	44 592.41	R	47 558.99	R	46 138.59	R	49 529.24	R	235 262.35	R	-572.10				-0.24%

	Equity Only																	
Date	SBK		MTN		BIL		AGL		SOL		TOTAL		Change (ZAR)		Change (%)			
31/12/2008	R	44 000.00	R	44 000.00	R	44 000.00	R	44 000.00	R	44 000.00	R	220 000.00						
02/01/2009	R	43 651.07	R	43 651.04	R	43 651.43	R	43 651.78	R	43 651.06	R	218 256.38	R	-1 743.62				-0.79%
05/01/2009	R	45 466.76	R	46 569.23	R	44 330.70	R	44 449.27	R	47 063.25	R	227 879.22	R	9 622.83				4.41%
06/01/2009	R	45 632.33	R	48 213.26	R	46 234.24	R	47 941.32	R	48 553.28	R	236 574.44	R	8 695.22				3.82%
07/01/2009	R	45 520.22	R	46 158.29	R	45 541.03	R	47 446.67	R	46 690.81	R	231 357.03	R	-5 217.41				-2.21%
08/01/2009	R	43 784.75	R	44 206.07	R	44 147.52	R	46 306.00	R	45 720.85	R	224 165.20	R	-7 191.83				-3.11%
09/01/2009	R	46 091.67	R	43 240.25	R	44 222.76	R	43 339.80	R	46 631.27	R	223 525.74	R	-639.46				-0.29%

Figure 8: Total portfolio construction

b. *Performance and Comparative Metrics*

The comparison of the above two portfolios is the heart of the research, and so an array of comparative metrics was built into the model dashboard, an excerpt of which is provided below in Figure 9, an explanation of each metric follows in Table 9 below.

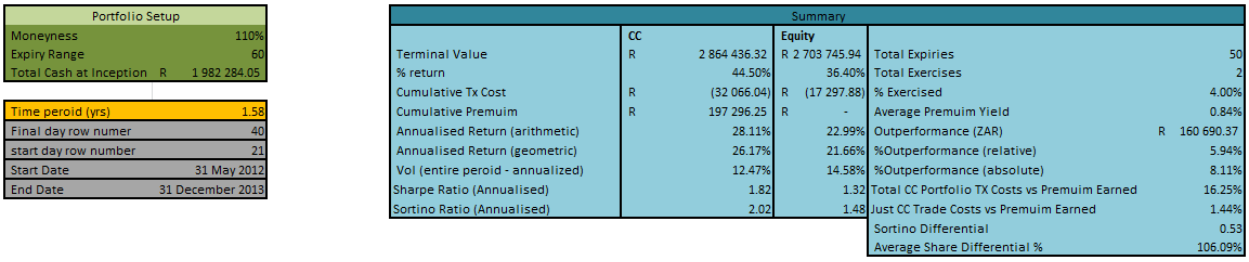


Figure 9: Comparative strategy performance metrics

Metric	Description and calculation method
Terminal Value	The value of the combined portfolio on the last day of the defined date range
% return	The absolute % return of the portfolio over the full time period, calculated as (terminal value / start value)
Cumulative Tx Cost	Total transaction costs incurred
Cumulative Premium	Total premium earned through the life of the strategy
Annualised Return (arithmetic)	% return (above) / time period in years of the strategy
Annualised Return (geometric)	The compound annual return of the portfolio
Vol (entire period - annualised)	Volatility for the entire period

Sharpe Ratio (Annualised)	The Sharpe ratio is defined as the excess return (above the risk-free rate RFR) divided by the standard deviation of the return. Excess return was calculated for each day in the life of the portfolio as: (Actual Return) – (RFR x days x previous day portfolio value) The risk-free rate is assumed to be the rate of interest earned on free cash in the portfolio Useful advice on how to structure this calculation was attained from (Khan, 2013)
Sortino Ratio (Annualised)	The Sortino ratio is defined as : S = (R – MAR) / DR Where: R = realised return MAR = minimum accepted return DR = downside risk as measured by the standard deviation of negative portfolio returns. In this case (R-MAR) is equivalent to the excess return defined for the Sharpe ratio above. Thereafter it is simply a case of calculating the standard deviation for negative return days only. Useful advice on how to structure this calculation was attained from (Khan, 2012)
Total Expiries	Total number of expiries across all stocks over the period under consideration
Total Exercises	Total number of positions exercised
% Exercised	Total exercises/total expiries
Average Premium Yield	Average premium yield across the all the stocks in the portfolio
Outperformance (ZAR)	The rand value of the over/under performance of the Covered Call portfolio as compared with the buy and hold equity portfolio
%Outperformance (relative)	Outperformance (ZAR) / terminal value (Equity only), gives the percentage relative to the equity-only portfolio by which the Covered Call portfolio over or underperformed
%Outperformance (absolute)	(%return Covered Call) – (%return Equity). Gives the percentage relative to the starting value by which the Covered Call portfolio over or under performed
Total CC Portfolio TX Costs vs. Premium Earned	The percentage of total premium earned spent on transaction costs. No account of time value of money is taken here.
Just CC Trade Costs vs. Premium Earned	The percentage of total premium earned spent specifically on the option trades (ignoring the equity leg)
Sortino Differential	The difference between the Sortino ratio of the Covered Call portfolio and that of the equity only portfolio. This gives an indication of the extent to which the risk adjusted returns of one portfolio are better or worse than the other.
Average Share Differential %	The average number of shares in the Covered Call portfolio versus those in the equity only portfolio, expressed as a percentage. 110% would imply that the Covered Calls portfolio has 10% more shares at terminal value than its equity only counterpart.

Table 9: Combined portfolio performance comparison metrics

3.3 Data analysis and Interpretation

The key factors on which the portfolios are to be evaluated are the resultant risk and return, produced by the manipulation of the date range (to focus on a particular market trend), option moneyness and expiry range.

As discussed in the literature review, there are a number of methods available to analyse the results obtained from the portfolio construction exercise. The two methods used in this study as a basis for comparing returns and risk are the Sharpe ratio and Sortino ratio. Both are intended as means for comparing and ranking various portfolios taking account of both risk and return

3.3.1 *Return*

For the basis of comparing portfolios, be they Covered Call vs. the buy and hold equity portfolio or one Covered Call portfolio with another. Annualised compound return was the primary means of evaluation.

3.3.2 *Risk*

Traditionally, risk is measured by expressing the portfolio's standard deviation of returns in an annualised form. This value is captured in the model under the portfolio performance metrics section as "*Vol (entire period - annualised)*" as it is also the measure of a portfolio's volatility.

3.3.3 *Sharpe Ratio*

The Sharpe ratio is a simple metric intended to allow investors to compare returns on a risk-adjusted basis. It is based on the mean-variance framework of risk and return measurement (which is how they have been measured in this study) and so at first glance it would appear the ideal metric. However, it is based on the premise of returns being normally distributed; in the case of a portfolio containing options, this is not the case. In particular for this study, when dealing with call options the positive return is truncated by the presence of the strike price and consequently the distribution is skewed (see Figure 10 below). This results in an apparent reduction in risk (even though it is upside risk). In reality, the risk that has been removed is the upside potential, which has in fact been sacrificed. This so-called "risk reduction" would hardly appeal to an investor. Additionally, this could incorrectly lead one to conclude that the results

obtained violate the efficient market hypothesis (a simultaneous increase in return and decrease in risk).

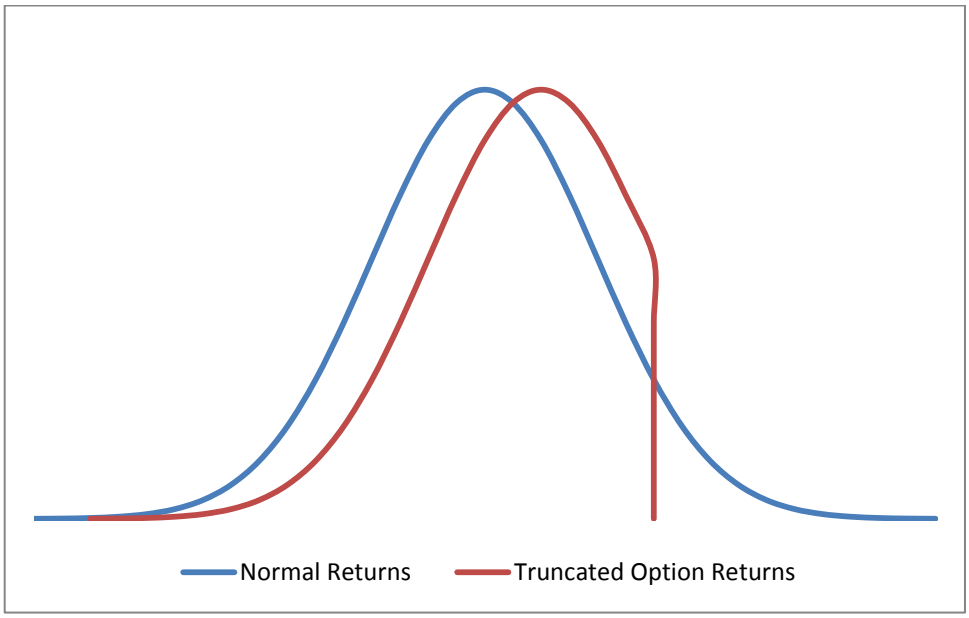


Figure 10: Comparison of typical distribution of normal and skewed call option returns

The ratio is still useful in that it provides a simple basis for comparing like with like, such as one Covered Calls portfolio with another or an equity buy and hold portfolio with another and hence it has been retained in the result set.

The Sharpe ratio will “punish” those portfolios that have achieved additional return by taking on additional risk. The higher the Sharpe ratio the greater the risk-adjusted returns and therefore the better the investment.

3.3.4 *Sortino Ratio*

The Sortino ratio incorporates a small change to the Sharpe ratio, which immediately addresses both issues identified above. Firstly, it recognises that investors are far more concerned with downside risk than upside risk, and so upside risk is removed entirely, and it focuses exclusively on downside risk (the probability of loss or negative return). As a consequence, for both the equity and option portfolio it is only the negative side of the distribution which is considered in the calculation of the risk metric (See Figure 11 and Figure 12 below). In the case of the call option, the negative risk distribution (the shaded left-hand side of the curve) still resembles a normal distribution and is now more readily comparable with its equity-only competitor.

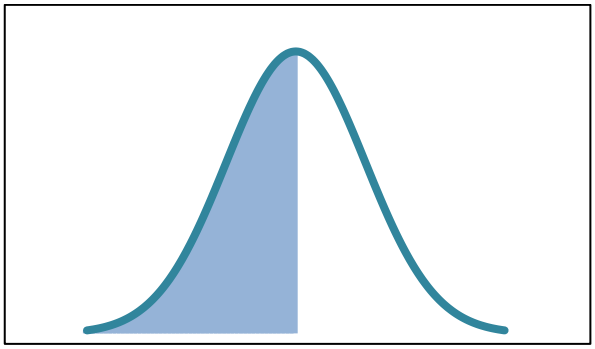


Figure 11: Negative returns (shaded area) of normally distributed equity portfolio

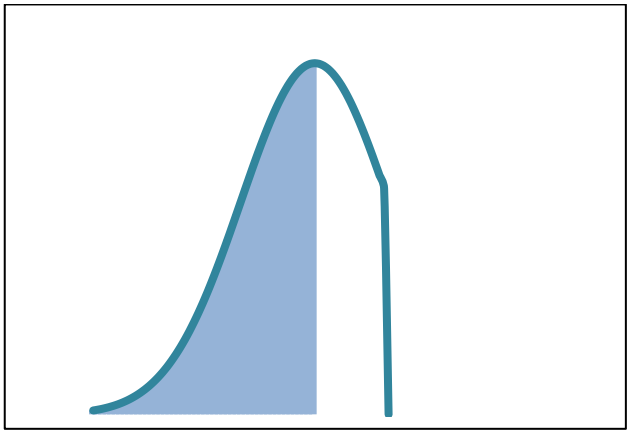


Figure 12: Negative returns (shaded area) of a risk truncated option portfolio

By implication one can therefore use the Sortino ratio to directly compare and rank the risk adjusted return of both the buy and hold equity portfolio with that of the Covered Calls portfolio.

3.3.5 *Percentage outperformance*

This is one of the primary means of detecting the superiority or lack thereof of the Covered Calls portfolio. It is based on the relative outperformance metric; the higher the outperformance the greater the returns on the Covered Call portfolio. The outperformance is charted against the outperformance of various other expiry range and moneyness option combinations. For each combination the performance of the equity-only portfolio is identical, so the outperformance is calibrated against an equal base for each iteration.

3.3.6 *Sortino Differential*

The Sortino differential is arrived at by subtracting the Sortino ratio of the equity-only portfolio from that of the Covered Calls portfolio. It shows the extent by which the Covered Calls portfolio delivered better or worse risk-adjusted returns (risk-adjusted outperformance). It must be borne in mind when observing the consequent charts that a high difference does not necessarily mean a better actual returns outperformance. There could be a scenario where the negative return of the Covered Calls portfolio was worse than the negative return of the equity portfolio; however, when adjusting these returns for risk, the Covered Calls portfolio may come out better if its losses were accrued in a less volatile way (bear in mind that risk is the tendency to deviate from the mean, and here the mean return is a loss). A key part of the study is to conduct a regression on the Sortino differential and % outperformance to see to what extent the two are correlated, which will enable one to get a feel for whether the outperformance achieved has a significant effect on the portfolio's risk.

3.3.7 *Model Starting Point*

All models were run using R100,000 as the start balance. This number was chosen for the following reasons:

- As the portfolio contains five shares this money was immediately split five ways into equal lots of R20,000. The figure couldn't go much lower than this due to the repurchase threshold without introducing considerable noise into the model for the early stages.
- This figure is less than the value that the current average retail investor holds, making the study meaningful to a wider audience, who might consider this a starting balance in today's terms.
- The value of an equity-only portfolio after 13 years starting at R100,000 is R967,036.81 (at a compound rate of 19.07% p.a.). This value, while higher than the size of a present-day retail equity investor portfolio is close enough so as to be meaningful to the investor who would like to know what their portfolio could have done over this period.
- This value is relatively close to the median portfolio size of the retail investor

3.3.8 *Analysis of the Effect of Market Trend, Moneyness and Expiry Range*

As the market phase certainly has an impact on the performance of the Covered Call portfolio the study will be broken down into an analysis per market phase. This will be obtained by observing

the return on the equity buy and hold portfolio over the time period under review and then noting which trends (bull, bear, neutral etc.) are visible. These phases were delimited by noting their start and end dates to define the time frame over which to run the model.

For each trend phase identified above, the model was recursively run through 2116 iterations each with a different moneyness and expiry range combination. This was made up of all possible permutations of 46 expiry ranges (5 days through 230 days in 5-day increments) and 46 moneyness factors (85% through 130% in 1% increments). The resultant data contained all the performance metrics previously discussed for each expiry range and moneyness combination.

As the intention is to find the best return and best risk-adjusted return these combinations of expiry range and moneyness with either outperformance % or the Sortino ratio differential are plotted on a 3D surface to give colour and shape to the model's performance.

Additionally, a regression analysis is run on the outperformance % and Sortino ratio differential to determine the extent to which these factors are related. In other words, to determine whether the best outperformance also scores highly once adjusted for risk. In light of the questions posed by the research problem, if there is high correlation between these factors one can deduce that performance has been improved without an adverse increase in risk.

Thereafter the best five Covered Call portfolios (as determined by outperformance %) are shown and their make-up analysed.

Lastly, the best-performing portfolio is plotted against the equity-only portfolio for the same time period, additionally showing premium yield and expiry points.

3.3.9 *Analysis of Other Factors*

With the ability to rank the risk-adjusted returns of various portfolios in place, an investigation into the significance of various contributory factors was undertaken.

Primarily of interest was the relationship to outperformance and risk-adjusted return of the following measures:

- Average premium yield
- Percentage of options exercised
- Average share differential at termination
- Percentage of premium earned spent on transaction costs

- The effect on return of the starting balance

3.4 Limitations

Considering the need to make the model computationally efficient as many thousands of iterations were required to acquire the data for analysis; the intended design of adhering to strict modelling of real-world behaviours had to be loosened with regard to the timing of selling call options. The effect of doing so would only worsen underperformance, but never improve over-performance and as such was a reasonable compromise without putting the validity of results at risk. More specifically, the model did not prevent the selling of call options in a situation where the resultant premium income was less than the transaction cost of doing so. This is something a real-world investor would not do; they would instead prefer to not cover their portfolio at all, or to leave the uncovered portion as is until the next expiry when they can take advantage of the fixed transaction costs. The effect of this was monitored by using the sanity checks discussed earlier. The reason for this is that short of calculating an option price for every price point it is impossible to determine whether this situation will be encountered without incurring the time cost of the calculation, and doing so results in a significant increase in the time required to iterate through the model.

4 RESULTS AND FINDINGS

The results of the model are presented and analysed, based on delimitation by market phase, moneyness and expiry range. Other findings of interest are also discussed.

4.1 Basis for comparison

Using R100,000 as the starting cash balance, and splitting this evenly over a portfolio of five shares (MTN, SOL, SBK, AGL, BIL) the performance noted below in Table 10 was observed for the period 1 January 2001 through 31 December 2013. This serves as the benchmark for the out/under performance of equivalent Covered Call strategies:

Measure	Value
Start Value	R100 000.00
Terminal Value	R967 036.81
% return	867.04%
Cumulative Transaction Costs	R (2 392.78)
Annualised Return (arithmetic)	66.70%
Annualised Return (geometric)	19.07%
Volatility (Annualised)	20.39%
Sharpe Ratio (Annualised)	0.75
Sortino Ratio (Annualised)	0.84

Table 10: Performance measure of base equity portfolio

4.2 Overview of Market Phases

A graphic representation of the above portfolio is shown below in Figure 13. This also provides the basis to identify and delimit the various market phases which occurred during the period as summarised in Table 11. Consequently, the following five sections are divided into the phases as delimited based on the findings in Table 11 and Figure 13, providing the first part of the framework to investigate performance based on market phase, moneyness and expiry range.

With regard to the slope of the graph in Figure 13, it is worth noting that a constant compound return results in exponential rather than linear portfolio growth. For this reason both compound and arithmetic growth rates are provided in Table 11 to avoid the misunderstanding that might otherwise occur when, for example, comparing the growth rates of the Sideways and Slow Bull phases.

Market Phase	Start Date	End Date	Duration (years)	Equity Compound Return	Equity Arithmetic Return
Sideways	01/01/2001	30/04/2004	3.3	17.8%	21.8%
Bull 1	01/05/2004	30/05/2008	4.1	42.9%	80.6%
Bear	01/06/2008	31/10/2008	0.4	-60.7%	-77.3%
Slow Bull	01/11/2008	31/05/2012	3.6	9.3%	10.5%
Bull 2	01/06/2012	31/12/2013	1.6	20.9%	22.2%
Entire Period	01/01/2000	31/12/2013	13	19.1%	66.7%

Table 11: Market Phases 2001 – 2013

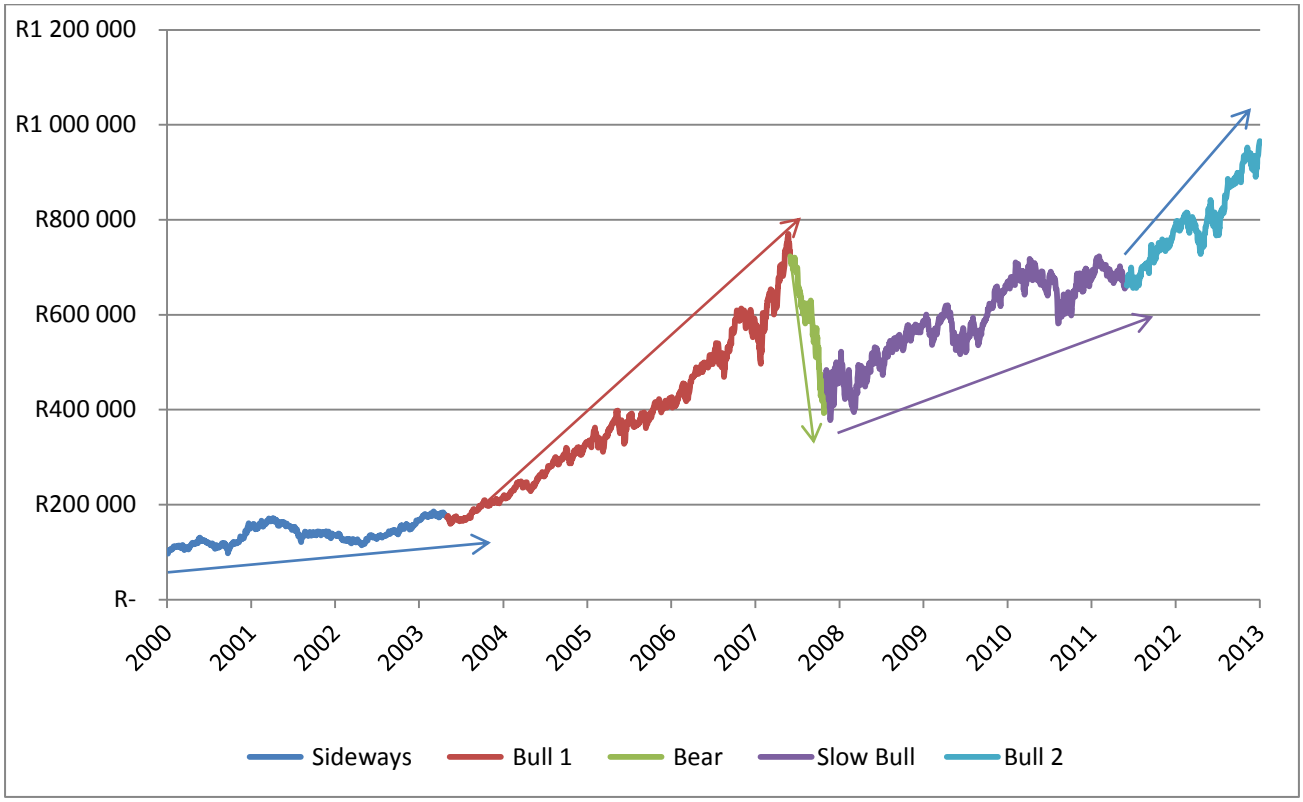


Figure 13: Equity portfolio performance and market phases

4.3 Sideways Phase

The Sideways phase occurred in the date range 01/01/2001 - 30/04/2004 based on the findings in Table 11 and Figure 13.

4.3.1 *Results*

During this period the equity-only portfolio was characterised by the following statistics:

Measure	Value
Compound Annual Return	17.78%
Volatility (risk)	23.57%
Sharpe Ratio (risk-adjusted return)	0.53
Sortino Ratio (Downside risk-adjusted return)	0.68

Table 12: Market characteristics for Sideways period 01/01/2001 - 30/04/2004

The Covered Calls portfolio achieved outperformance, risk-adjusted return differentials (Sortino) and correlation between these variables as follows:

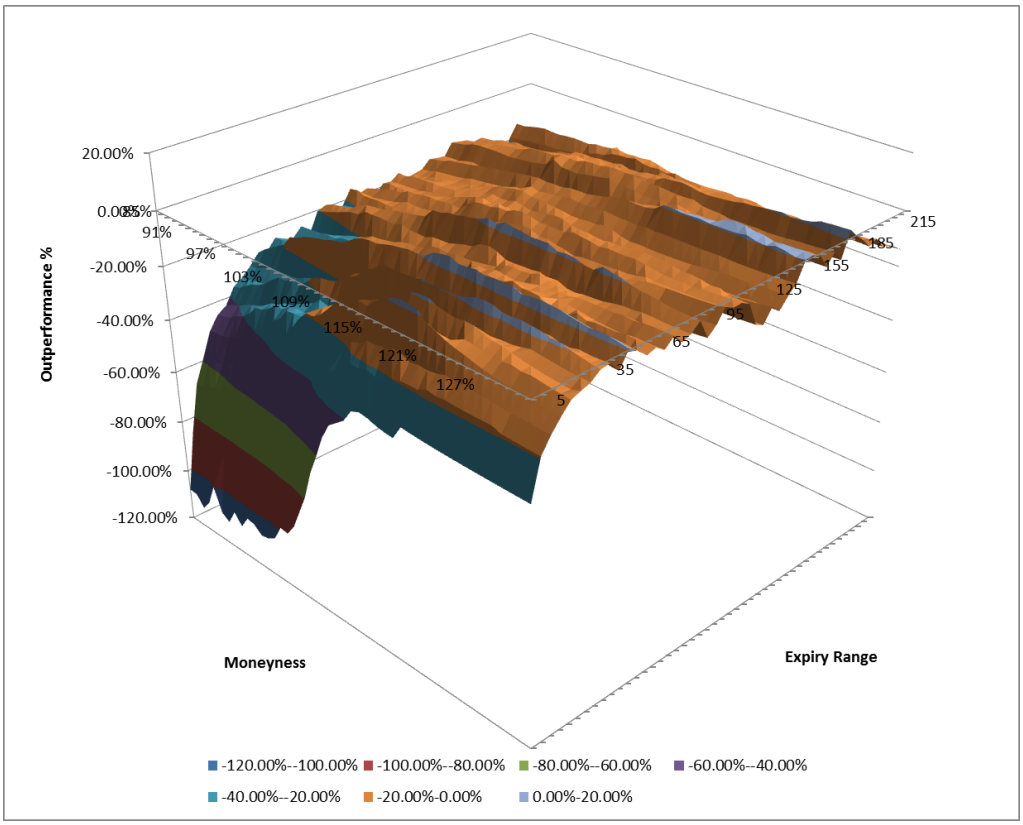


Figure 14: Covered Call Portfolio outperformance for period - Sideways 01/01/2001 - 30/04/2004

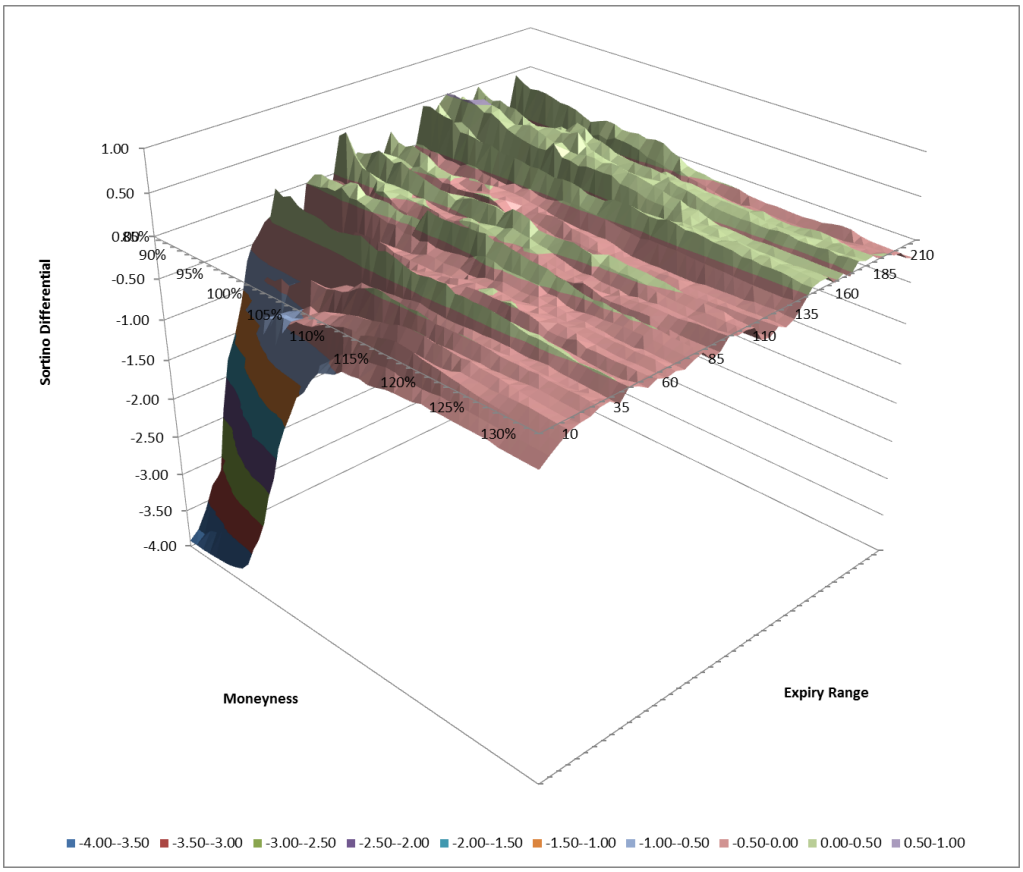


Figure 15: Covered Call Sortino differential for period: Sideways 01/01/2001 - 30/04/2004

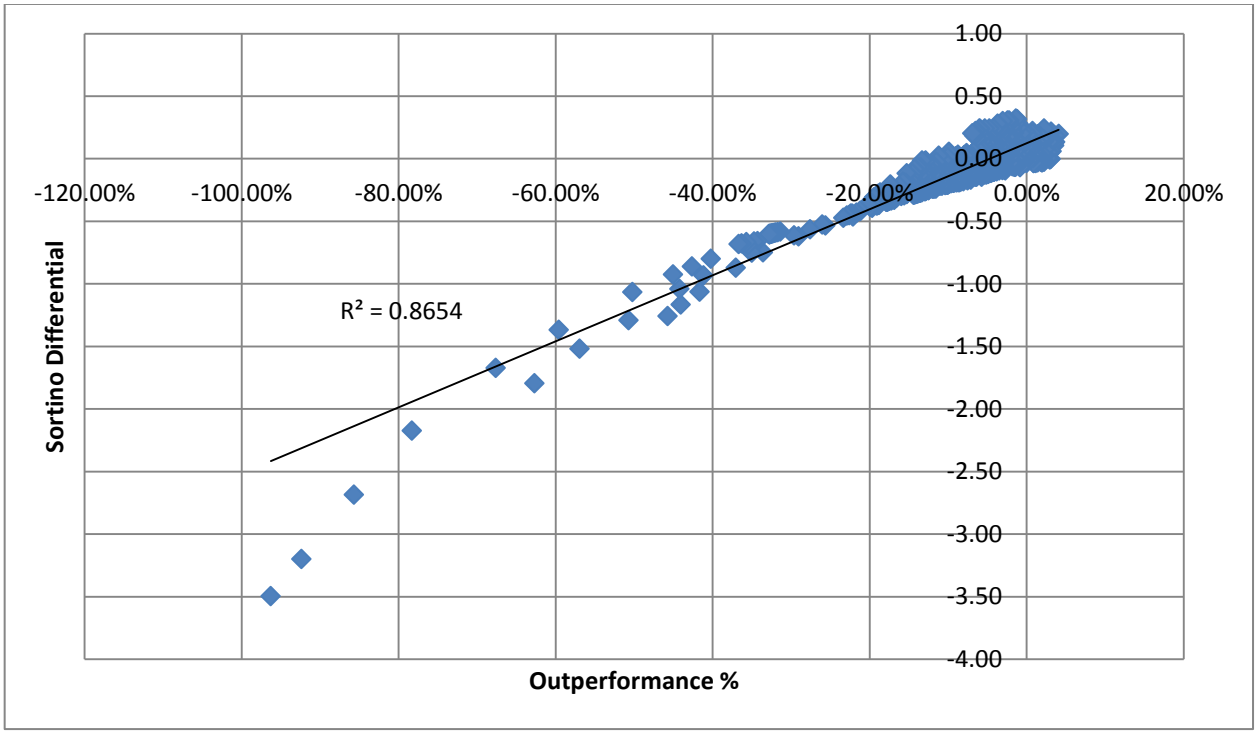


Figure 16: Regression of Sortino differential and outperformance % for period Sideways 01/01/2001 - 30/04/2004

The best-performing Covered Calls portfolios were as follows (best performing illustrated):

Rank	Moneyness	Expiry Range	Compound Return	Volatility	Sharpe Ratio	Sortino Ratio	%Out performance (relative)	Sortino-Outperformance
1	111%	55	19.20%	16.61%	0.75	0.87	4.08%	0.20
2	110%	55	19.05%	16.07%	0.76	0.86	3.64%	0.18
3	114%	55	19.04%	17.89%	0.70	0.81	3.63%	0.13
4	118%	55	19.01%	19.39%	0.66	0.78	3.52%	0.11
5	117%	55	18.97%	18.88%	0.67	0.79	3.42%	0.12

Table 13: Best-performing Covered Call Strategies for period Sideways 01/01/2001 - 30/04/2004

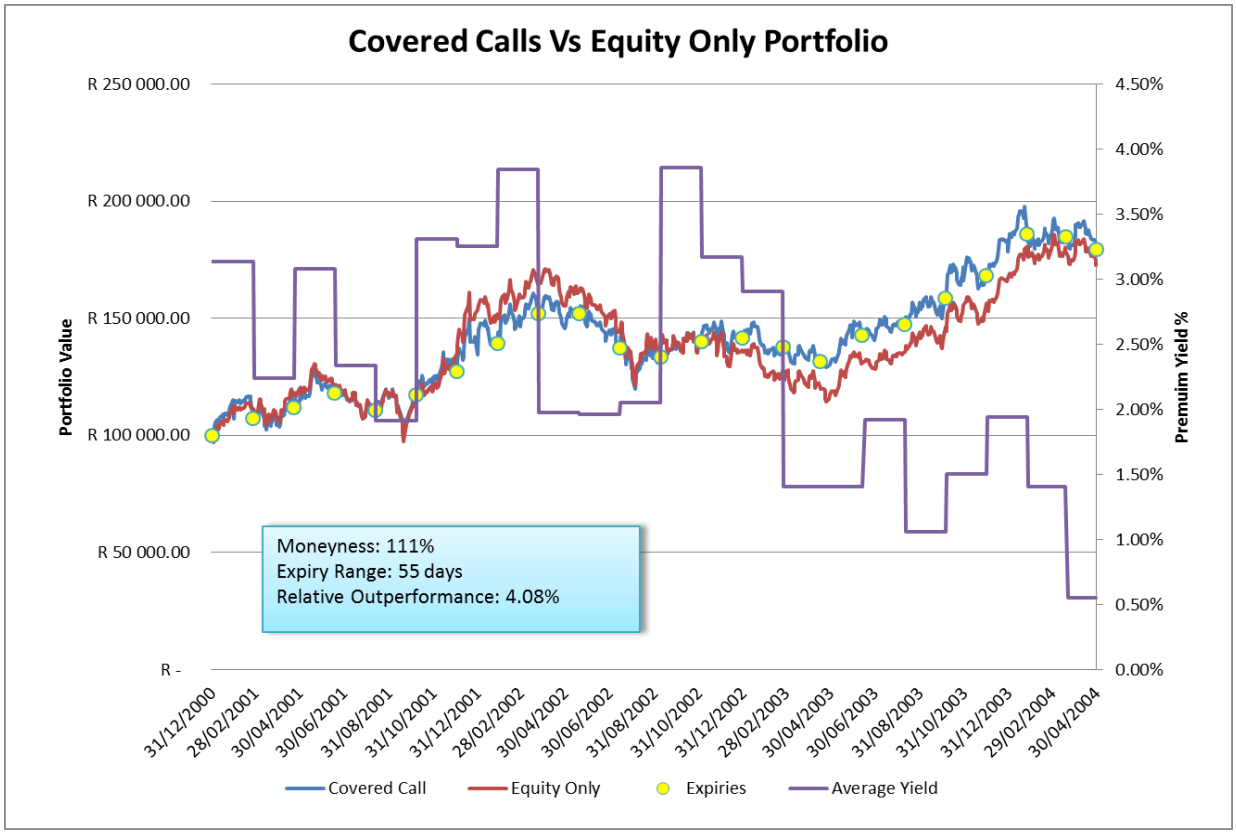


Figure 17: Performance comparison for period Sideways 01/01/2001 - 30/04/2004

4.3.2 *Analysis*

Figure 14 suggests that during this relatively flat period in the market that writing options, which were only just OTM or ITM (moneyness 100%-105%) with near expiry terms (5-40 days), resulted in dramatic underperformance (and even large losses). The majority of strategies struggled to outperform the equity-only portfolio with only a few expiry range ridges managing consistent outperformance. The spread over the remaining expiry range and moneyness was relatively unremarkable as the over or underperformance was not that significant. Those strategies which achieved the best outperformance were clustered on the 55-day expiry ridge with moneyness ranging from 110% to 125%.

An analysis of the Sortino-outperformance graph in Figure 15 supports these findings as being good risk-adjusted returns, which is unsurprising given a good correlation co-efficient of 0.8654 (Figure 16), which describes the relationship between risk-adjusted return and outperformance. The overview provided in Figure 17 shows that even the best-performing Covered Calls portfolio was at times lagging its equity-only counterpart. Overall, owing to the rather flat market, premium yields were relatively low, as can be seen in Figure 17, making it difficult for the Covered Calls portfolio to generate enough additional income to get ahead.

4.4 Bull One Phase

The Bull One phase occurred in the date range 01/05/2004 - 30/05/2008 based on the findings in Table 11 and Figure 13.

4.4.1 *Results*

During this period the equity-only portfolio was characterised by the following statistics:

Measure	Value
Compound Annual Return	42.85%
Volatility (risk)	17.17%
Sharpe Ratio (risk-adjusted return)	1.92
Sortino Ratio (Downside risk-adjusted return)	2.41

Table 14: Market Characteristics for Bull One Peroid 01/05/2004 - 30/05/2008

The Covered Calls portfolio achieved outperformance; risk-adjusted return differentials (Sortino) and correlation between these variables as follows:

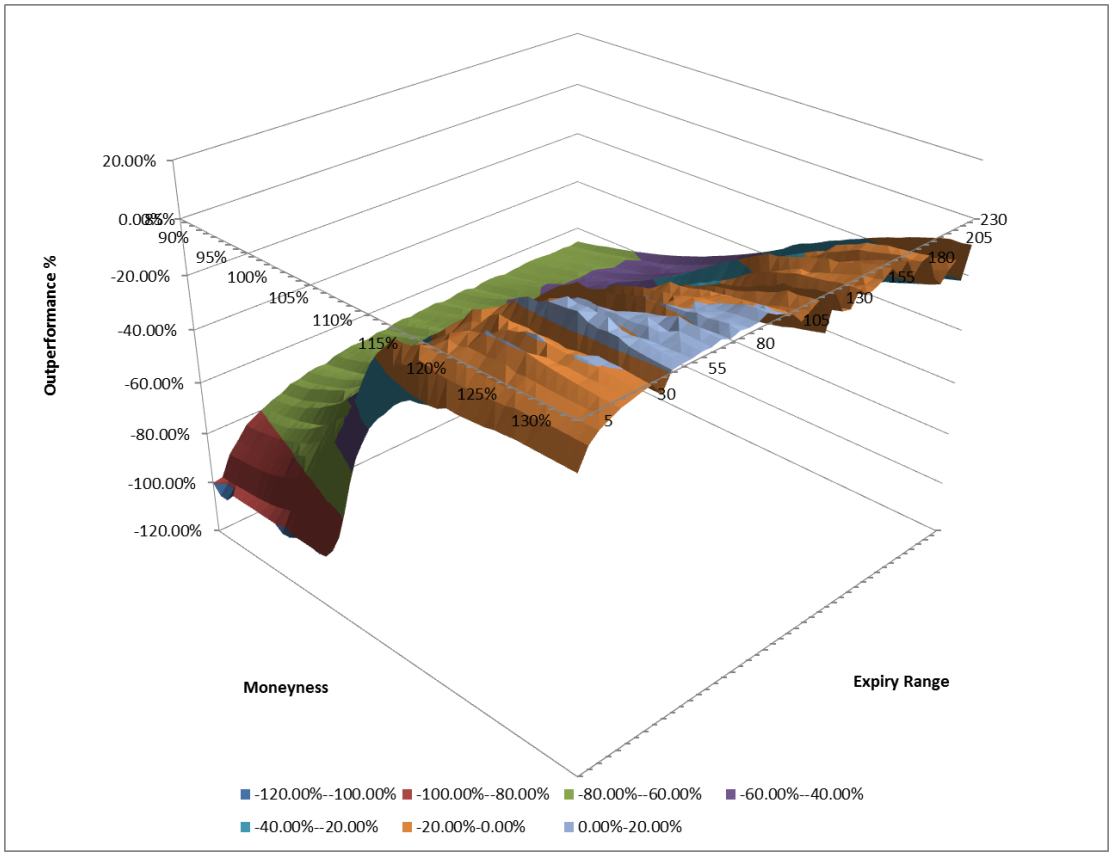


Figure 18: Covered Call portfolio outperformance for period Bull One 01/05/2004 - 30/05/2008

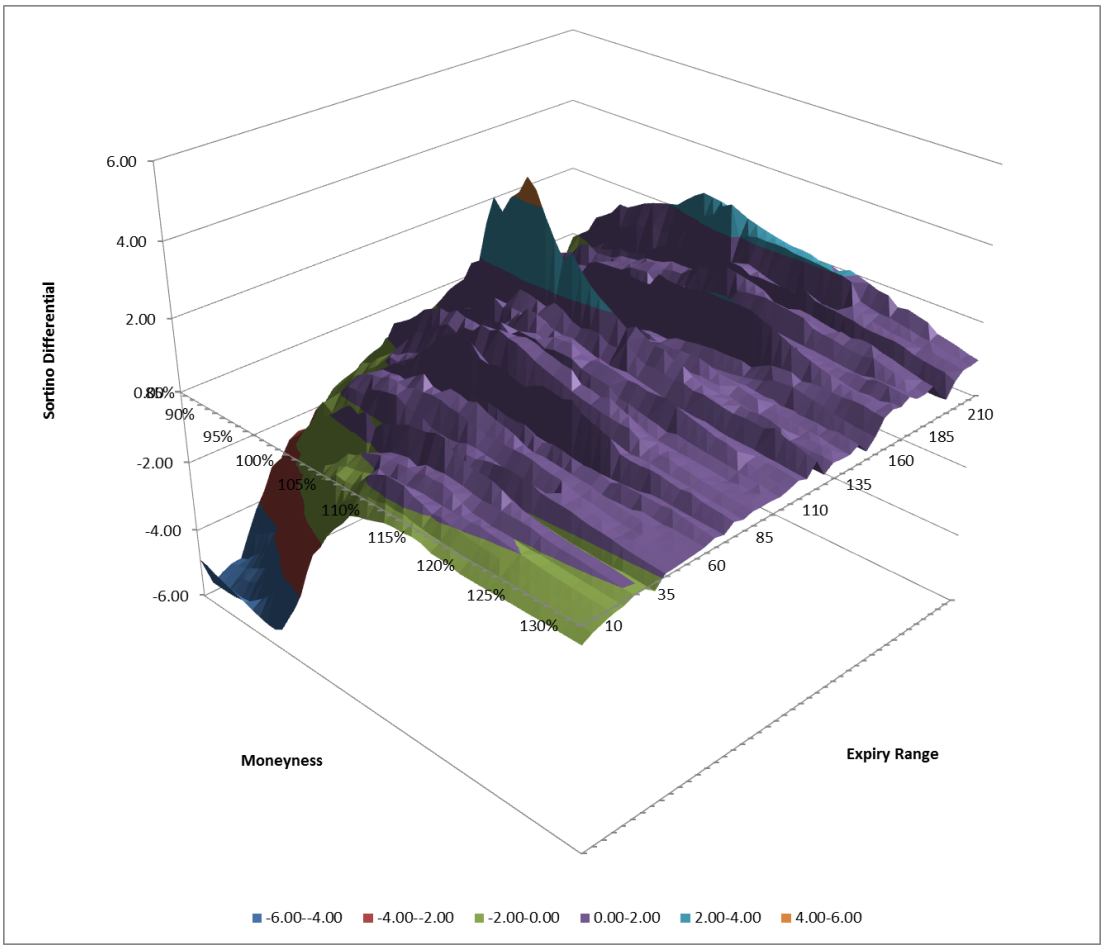


Figure 19: Covered Call portfolio Sortino differential for period Bull One 01/05/2004 - 30/05/2008

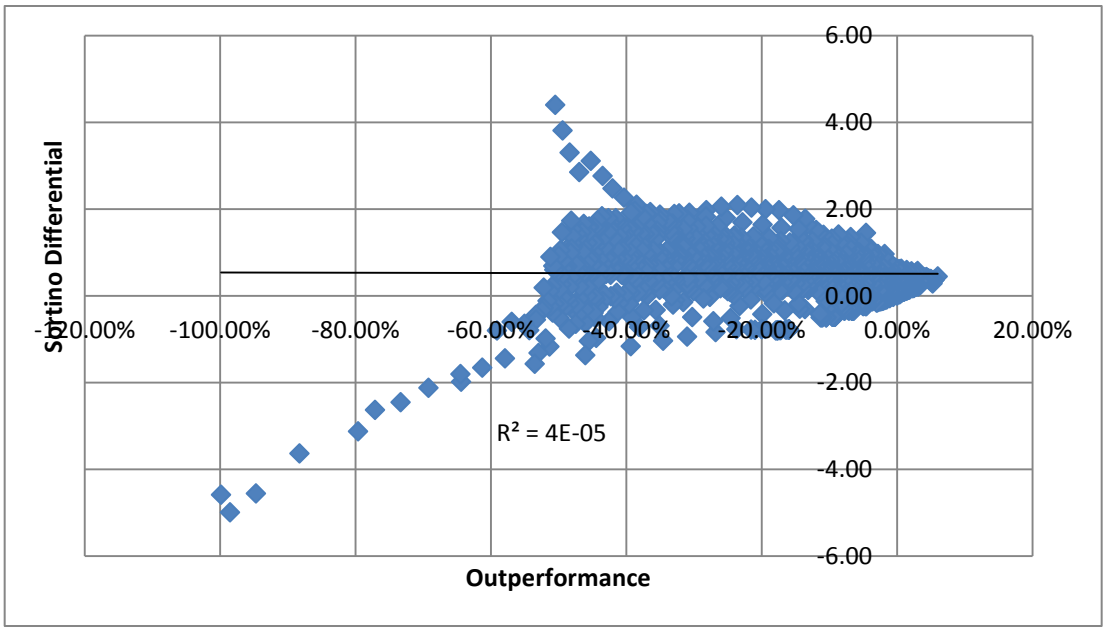


Figure 20: Regression of Sortino differential and outperformance for period Bull One 01/05/2004 - 30/05/2008

The best-performing Covered Calls portfolios were as follows (best performing illustrated):

Rank	Moneyness	Expiry Range	Compound Return	Volatility	Sharpe Ratio	Sortino Ratio	%Out performance (relative)	Sortino-Outperformance
1	119%	55	44.91%	16.02%	2.14	2.85	6.02%	0.44
2	121%	50	44.76%	16.53%	2.07	2.77	5.55%	0.36
3	121%	55	44.74%	16.22%	2.11	2.77	5.51%	0.36
4	123%	55	44.67%	16.55%	2.06	2.69	5.29%	0.28
5	122%	55	44.61%	16.36%	2.08	2.73	5.11%	0.32

Table 15: Best-performing Covered Call strategies for period Bull One 01/05/2004 - 30/05/2008

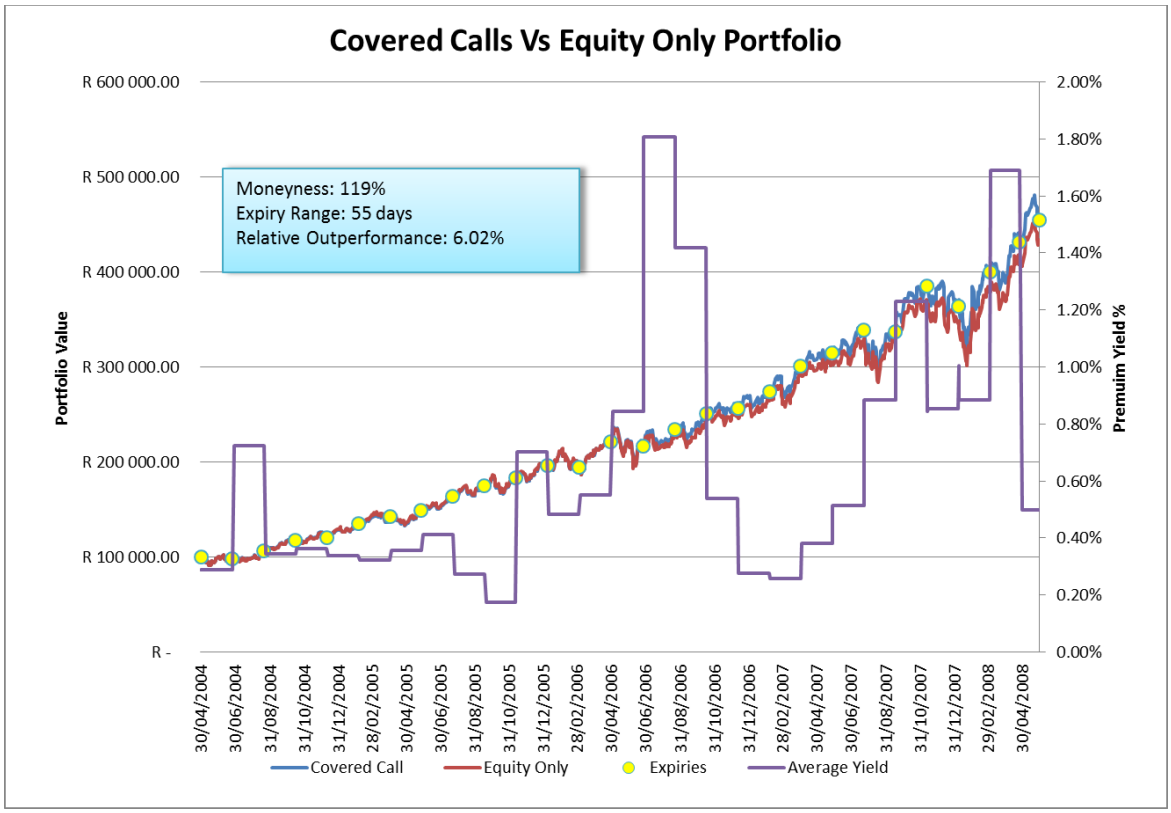


Figure 21: Performance comparison for period Bull One 01/05/2004 - 30/05/2008

4.4.2 *Analysis*

This was a period of very strong equity growth, achieving a compound annual return of 42.85%, yet with a relatively low level of risk, at only 17.17%. A Covered Call strategy is least suited to a strong bull market (due to the loss of upside potential) so it was not surprising to see that most strategies underperformed the equity-only portfolio. As was the case in the previous phase, selling near-dated Covered Calls close to ATM or ITM resulted in extensive losses to the Covered Calls portfolio. Based on Figure 18, the best performance was seen with far OTM moneyness (> 120%) and in the middle region of the expiry range (between 45 and 90 days). Conceptually, selling call options during a strong bull market will make it difficult to outperform a plain buy and hold equity portfolio, thus it is not surprising that the best performance was seen at high moneyness (minimising the loss of upside potential while still capturing some premium income). It is a balancing act to set the moneyness suitably low so as to earn sufficient premium to make the strategy viable but not too low such that the shares are frequently called away, resulting in high transaction costs to re-enter the market.

The analysis of the Sortino differential, as seen in Figure 19, is more complex than in the previous market phase. Consider that the Sortino differential is plotting risk-adjusted returns, not risk-adjusted outperformance and thus peaks for calls which had near ATM moneyness and mid- to high-level expiry ranges. What this means is that even though there was no outperformance, it was a very low-risk return (when compared to the risk-free rate of return). This makes sense as, conceptually, there were reasonable premiums rolling in steadily to keep the portfolio growing, but continually capping that growth due to being called away. This disparity is confirmed by the low correlation coefficient found in the regression shown in Figure 20 where there is almost no relationship between outperformance and risk-adjusted returns.

As seen in Table 15, the best-performing Covered Calls were 50/55 day expiries with moneyness between 119% and 123% (supported by the evidence in Figure 18). On reviewing the graphic performance of the best-ranked strategy for this period in Figure 21, it is noticeable that the average premium yields were generally quite low, with a maximum of around 1.8%, making it difficult to extract suitable yield to get ahead. The small gap in the portfolios only appears and then widens after two periods of still low, but relatively high yield.

4.5 Bear Phase

The Bear phase occurred in the date range 01/06/2008 - 31/10/2008 based on the findings in Table 11 and Figure 13.

4.5.1 *Results*

During this period the equity-only portfolio was characterised by the following statistics:

Measure	Value
Compound Annual Return	-60.69%
Volatility (risk)	17.30%
Sharpe Ratio (risk-adjusted return)	-5.68
Sortino Ratio (Downside risk-adjusted return)	-3.04

Table 16: Market characteristics for period Bear 01/06/2008 - 31/10/2008

The Covered Calls portfolio achieved outperformance; risk-adjusted return differentials (Sortino) and correlation between these variables as follows:

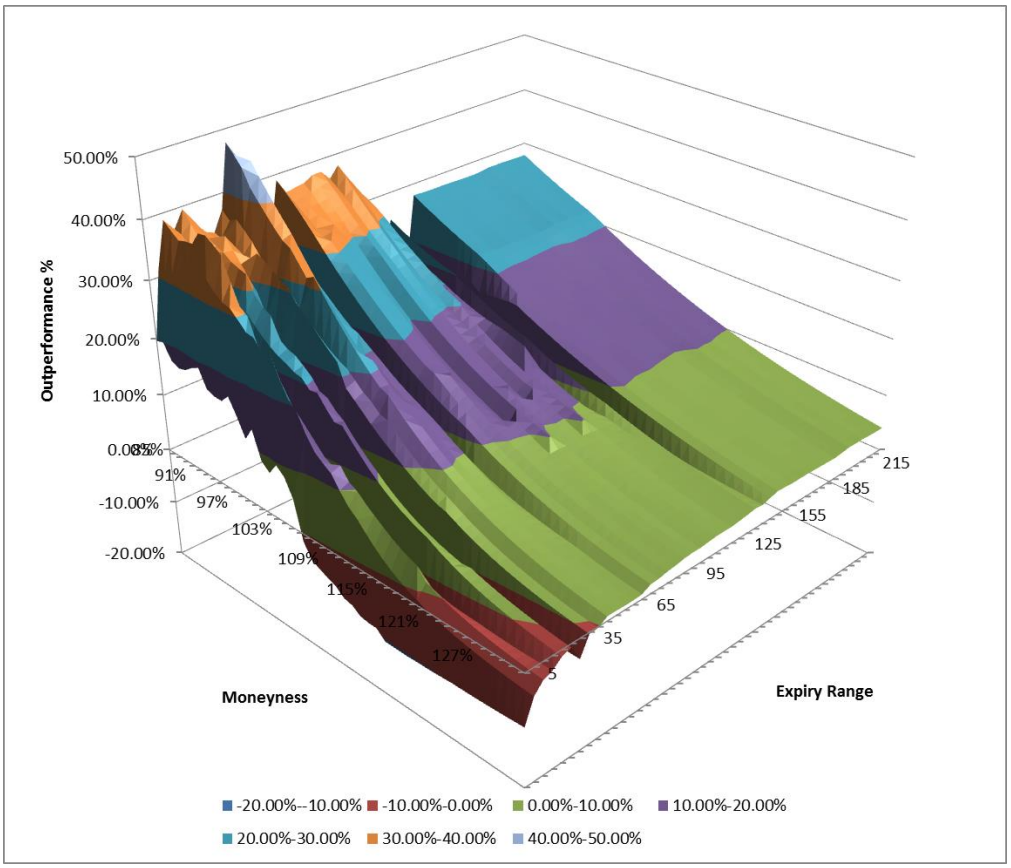


Figure 22: Covered Call portfolio outperformance for period Bear 01/06/2008 - 31/10/2008

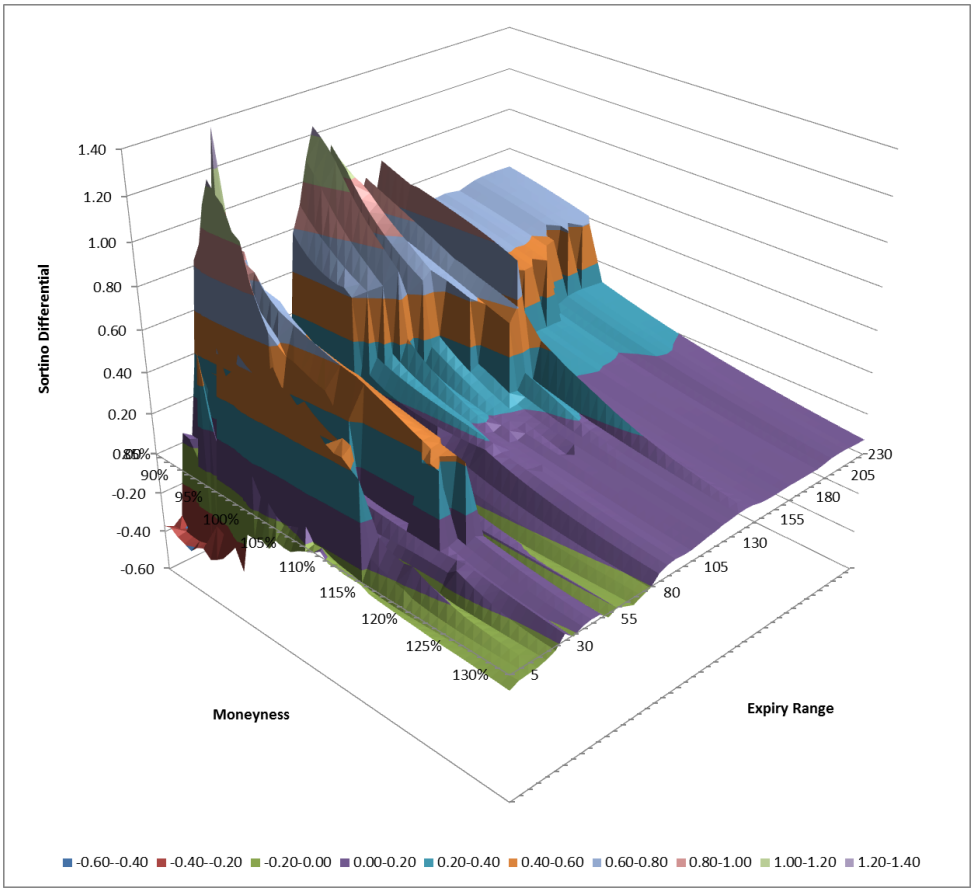


Figure 23: Covered Call portfolio Sortino differential for period Bear 01/06/2008 - 31/10/2008

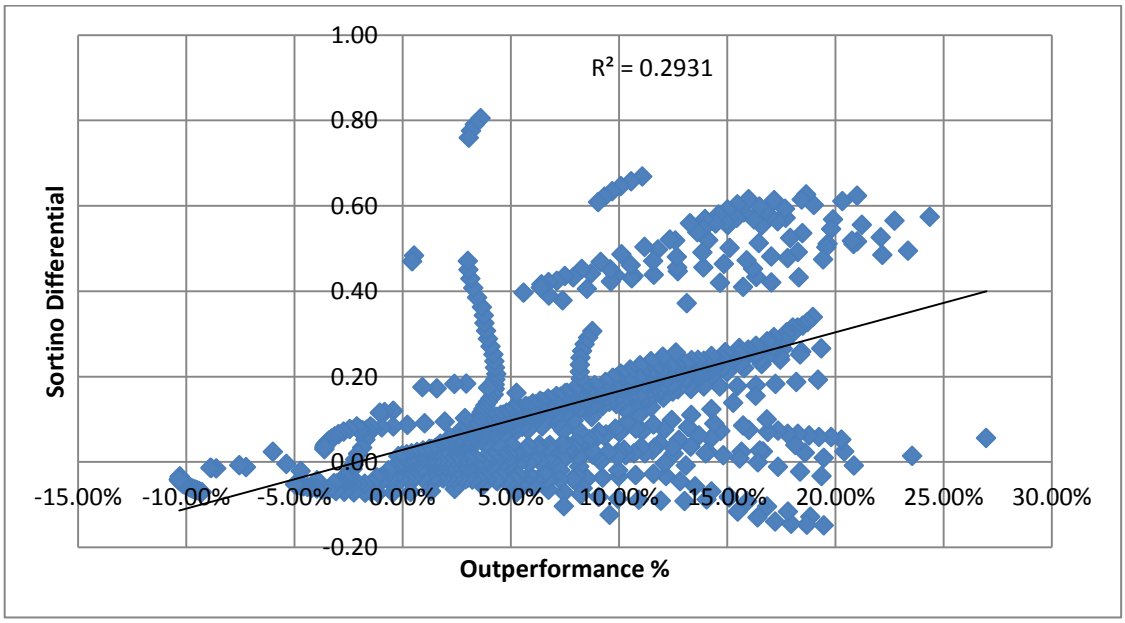


Figure 24: Regression of Sortino differential and outperformance for period Bear 01/06/2008 - 31/10/2008

The best-performing Covered Calls portfolios were as follows (best performing illustrated):

Rank	Moneyness	Expiry Range	Compound Return	Volatility	Sharpe Ratio	Sortino Ratio	%Out performance (relative)	Sortino-Outperformance
1	85%	50	0.46%	2.36%	-2.35	-1.66	47.84%	1.38
2	86%	50	-1.92%	2.73%	-2.98	-2.18	46.36%	0.86
3	87%	55	-3.59%	3.17%	-3.07	-2.21	45.32%	0.83
4	85%	55	-4.42%	3.23%	-4.24	-2.53	44.80%	0.51
5	87%	50	-4.49%	3.32%	-3.33	-2.30	44.75%	0.74

Table 17: Best-performing Covered Call portfolios for period Bear 01/06/2008 - 31/10/2008

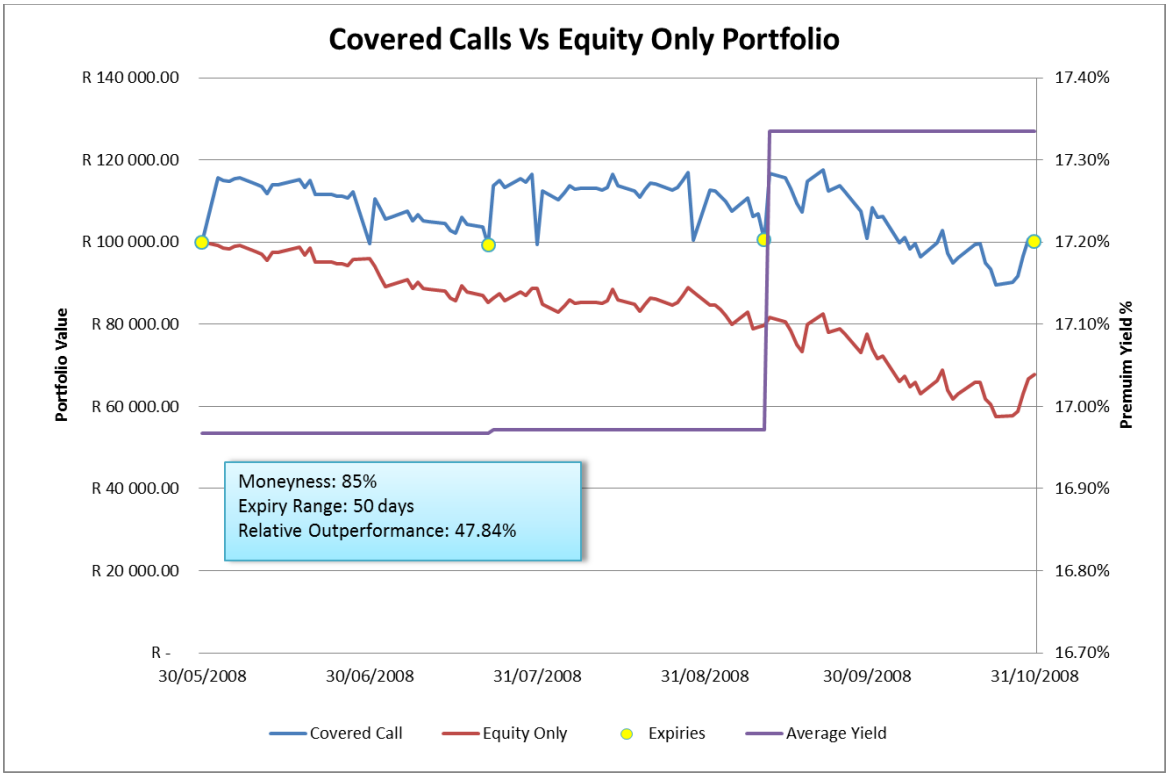


Figure 25: Performance comparison for period Bear 01/06/2008 - 31/10/2008

4.5.2 *Analysis*

This is the shortest period under review at only five months. During this time the equity-only portfolio saw considerable losses culminating in a -60.69% return for the period. It is interesting to note that the volatility was relatively low (considering that it is a measure of risk). This is because it is measuring the tendency to deviate from the mean return, and in a heavily plunging market over a short period of time there is not that much deviation from the strong downward trend. Covered Calls are not best suited as a hedge against a falling market but, as previously mentioned, they do soften the blow by providing a "downside buffer" (see Figure 3). Thus it is not surprising to see in Figure 22 that outperformance was best where premiums would have been close to their highest – ITM moneyness in the 85% to 90% range and near-term expiry (best in the 15-30 day range). Additionally, most option combinations outperformed the equity-only portfolio as any additional income yielded a better performance with the very low probability of being exercised; hence most outperformance metrics in Figure 22 are seen to be greater than 0%. A further quirk of Figure 22 is the flat portion that can be seen for expiry ranges beyond 150 days. This is because the period was only five months and is thus the maximum expiry range.

The Sortino differential chart in Figure 23 suggests that returns had good risk-adjusted performance for the same combinations as those that achieved best outperformance. Intuitively, this makes sense (when thinking around risk) – in a falling market selling the right to buy shares at their current level will yield both reasonable premium and is unlikely to ultimately be called away, hence the low level of risk. However, it also reveals that the equally good risk-adjusted returns occurred on options written ITM, but with much further out expiry ranges (60 – 100 day range). Again, in terms of risk it makes sense that ITM far-dated calls would fare well, as the ITM options earn a relatively high premium yet many days later in the steeply falling market they are unlikely to be exercised.

The relationship between risk-adjusted returns and outperformance is not as close as Figure 22 and Figure 23 suggest, as seen in Figure 24 they only have a correlation coefficient of 0.2931. This is likely caused by a number of anomalies that lie well outside an otherwise visible trend. These are likely quirks caused by the combination of the short period under review and the effect of transaction costs over such a short period.

The best-performing strategy was a 50-day, 85% ITM Covered Call, outperforming the equity-only portfolio by nearly 48%, and only just yielding a positive return. As can be seen in Figure 25, in the steeply falling market as volatility over the period rapidly increases, option premiums (premium yield) also increase and so the outperformance gap steadily increases.

4.6 Slow Bull Phase

The Slow Bull phase occurred in the date range 01/11/2008 - 31/05/2012 based on the findings in Table 11 and Figure 13.

4.6.1 *Results*

During this period the equity-only portfolio was characterised by the following statistics:

Measure	Value
Compound Annual Return	9.32%
Volatility (risk)	19.82%
Sharpe Ratio (risk-adjusted return)	0.39
Sortino Ratio (Downside risk-adjusted return)	0.50

Table 18: Market characteristics for period Slow Bull 01/11/2008 - 31/05/2012

The Covered Calls portfolio achieved outperformance; risk-adjusted return differentials (Sortino) and correlation between these variables as follows:

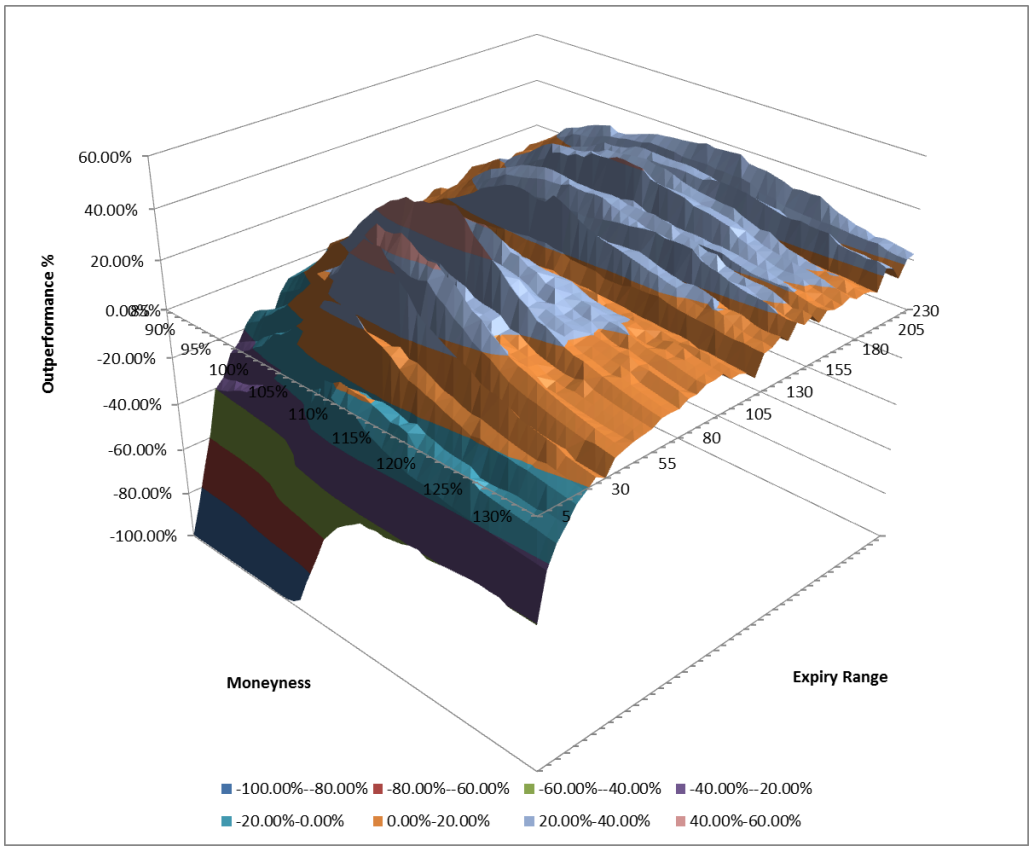


Figure 26: Covered Call portfolio outperformance for period Slow Bull 01/11/2008 - 31/05/2012

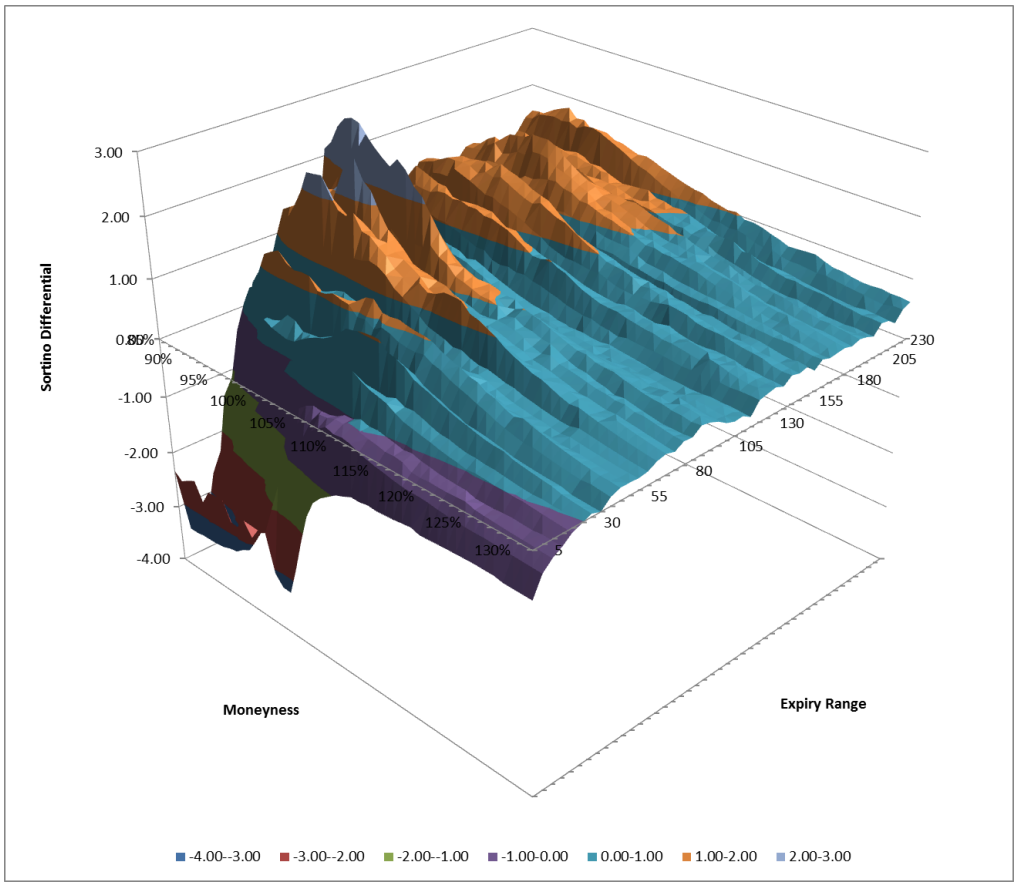


Figure 27: Covered Call portfolio Sortino differential for period Slow Bull 01/11/2008 - 31/05/2012

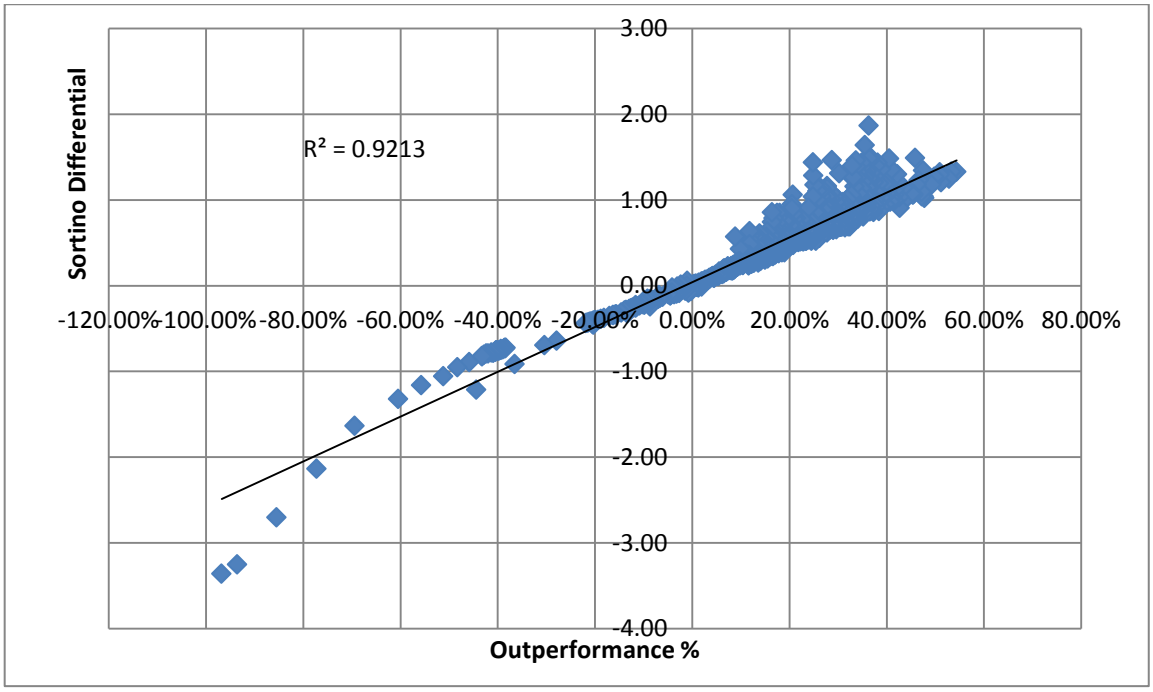


Figure 28: Regression of Sortino differential and outperformance for period Slow Bull 01/11/2008 - 31/05/2012

The best-performing Covered Calls portfolios were as follows (best performing illustrated):

Rank	Moneyness	Expiry Range	Compound Return	Volatility	Sharpe Ratio	Sortino Ratio	%Out performance (relative)	Sortino-Outperformance
1	108%	70	23.39%	15.76%	1.22	1.83	54.35%	1.33
2	107%	70	23.16%	15.54%	1.23	1.83	53.29%	1.33
3	106%	70	23.06%	15.00%	1.26	1.75	52.86%	1.25
4	105%	70	22.68%	14.61%	1.27	1.71	51.19%	1.20
5	109%	70	22.63%	15.79%	1.18	1.82	50.94%	1.32

Table 19: Best-performing Covered Call portfolios for period Slow Bull 01/11/2008 - 31/05/2012

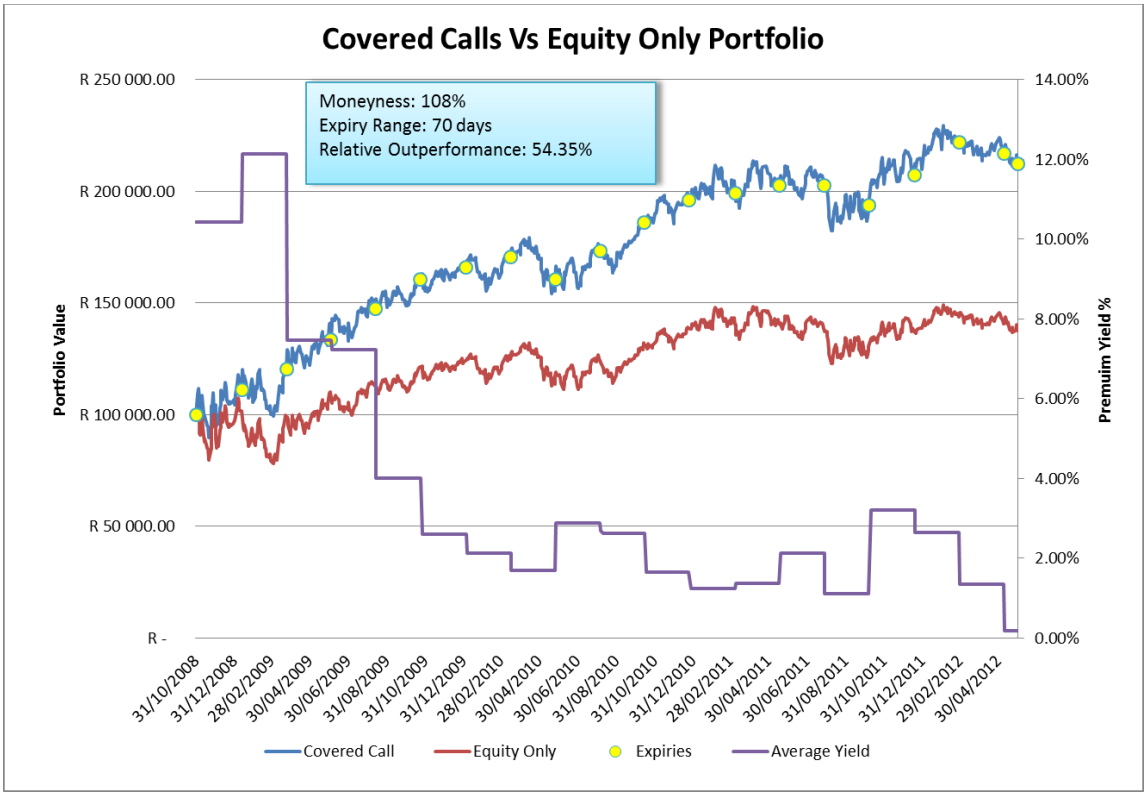


Figure 29: Covered Call portfolio performance for period Slow Bull 01/11/2008 - 31/05/2012

4.6.2 *Analysis*

While this was regarded as a bull market phase the equity portfolio had a relatively meagre compound annual return of just 9.32%, which is equally reflected in relatively poor Sharpe and Sortino ratios of 0.39 and 0.5 respectively. This period also followed a violent plunge in prices during the bear phase immediately preceding it, which is key to the performance metrics regarding the Covered Calls portfolios which follow. As can be seen in Figure 26, the majority of Covered Call portfolios outperformed the equity-only portfolio, with only the near-dated contracts having an underperformance. Performance was best with middle of the road expiry ranges 30 – 85 days and near ATM the strikes (100%-112%).

Figure 27 paints a very similar picture, showing outperformance on a risk-adjusted basis in the same expiry and moneyness region. As seen in Figure 28, the correlation between the two is very strong with a correlation coefficient of 0.9213. In the context of a gently rising (Slow Bull) market, selling calls, which are just OTM, with enough expiry range to reap some time value results in reasonably sized premiums, which tend not to be called away because the market is rising slowly. However, because the market is still rising the overall value of the portfolio continues to rise, particularly if, as is the case in this model, the premium income is reinvested in more shares which also continue to rise. The outperformance is primarily the result of the high volatility experienced from the preceding bear market producing high premium yields in the early part of this phase, which then precipitates the conditions described above. This concept is very clearly illustrated in Figure 29 where the rate of divergence between the portfolios is strongest in the early part of the period when premium yields are high, but thereafter the divergence continues during periods of low yield, largely on the back of the increased number of shares (now participating in a rising market and earning dividend income) in the Covered Calls portfolio as compared with its equity-only competitor.

These are in fact the most ideal conditions for achieving outperformance with a Covered Call strategy. As seen in Table 19, a strike range of 70 days and moneyness of 105%-109% all achieved very strong outperformance in excess of 50%.

4.7 Bull Two Phase

The Bull Two phase occurred in the date range 01/06/2012 - 31/12/2013 based on the findings in Table 11 and Figure 13.

4.7.1 *Results*

During this period the equity-only portfolio was characterised by the following statistics:

Measure	Value
Compound Annual Return	20.93%
Volatility (risk)	14.03%
Sharpe Ratio (risk adjusted return)	1.32
Sortino Ratio (Downside risk-adjusted return)	1.60

Table 20: Market characteristics for period Bull Two 01/06/2012 - 31/12/2013

The Covered Calls portfolio achieved outperformance; risk-adjusted return differentials (Sortino) and correlation between these variables as follows:

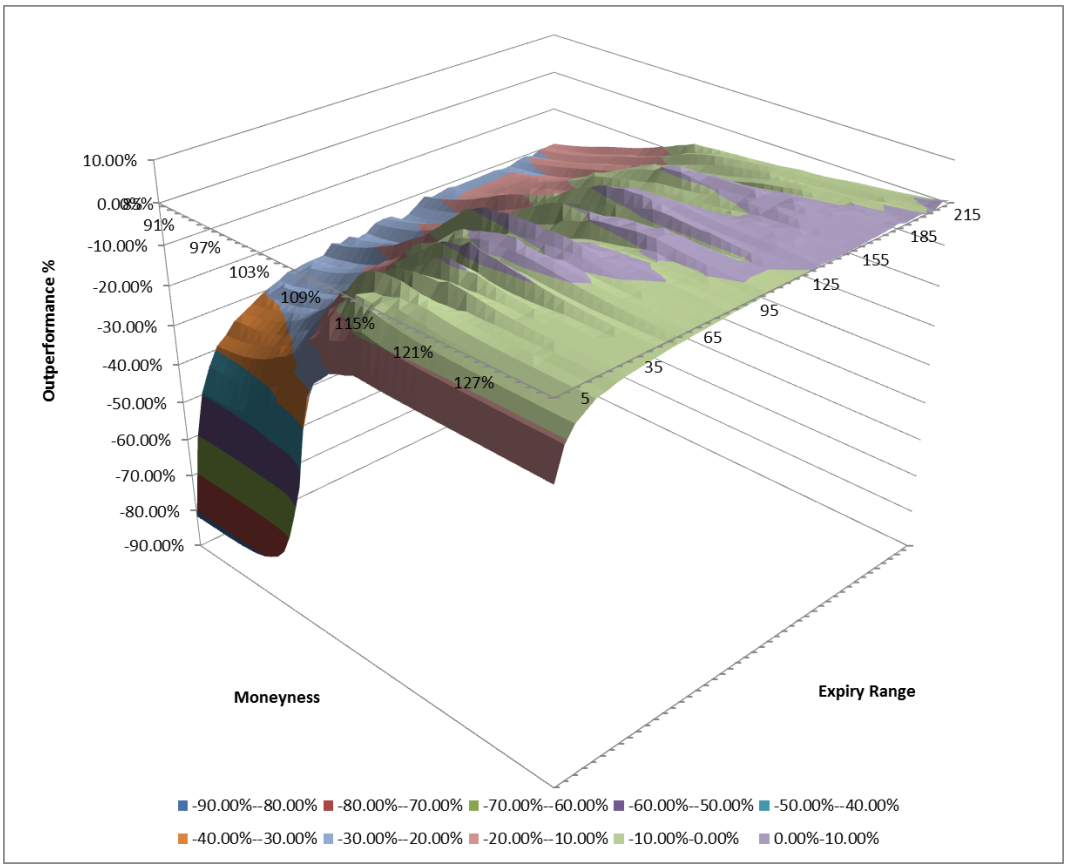


Figure 30: Covered Call portfolio outperformance for period Bull Two 01/06/2012 - 31/12/2013

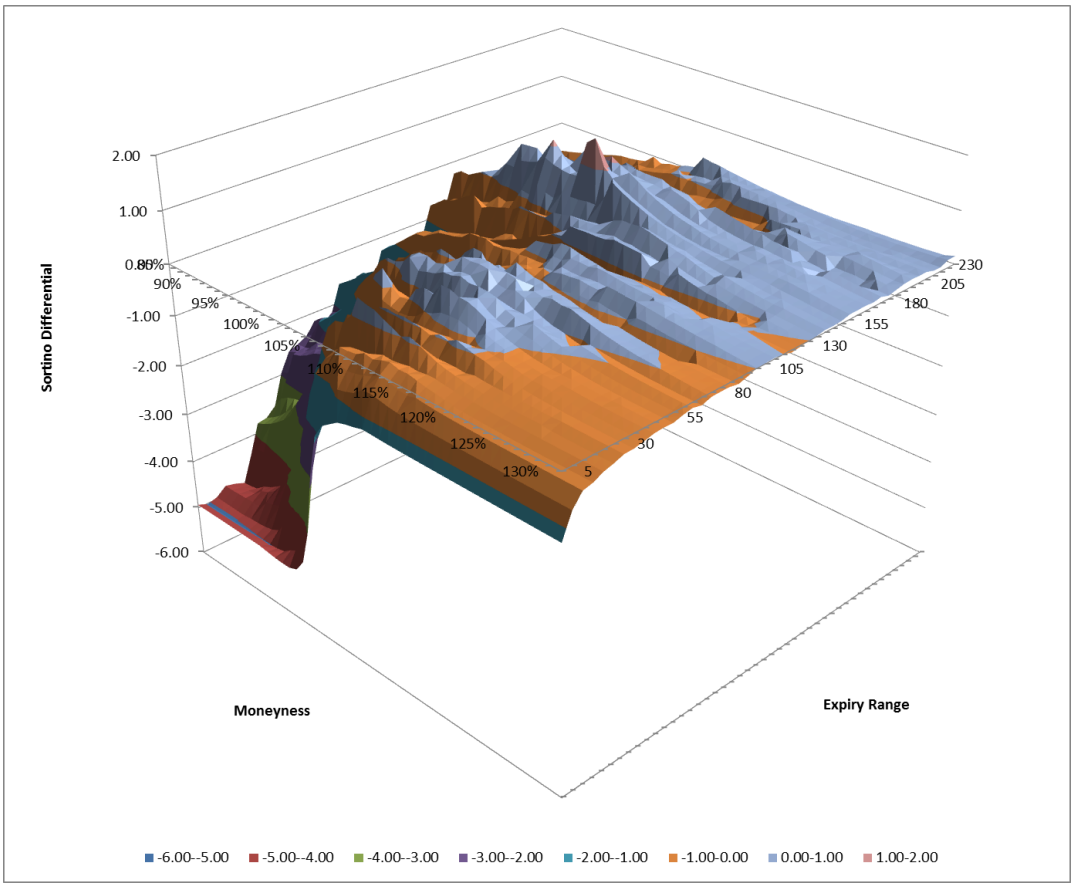


Figure 31: Covered Call portfolio Sortino differential for period Bull Two 01/06/2012 - 31/12/2013

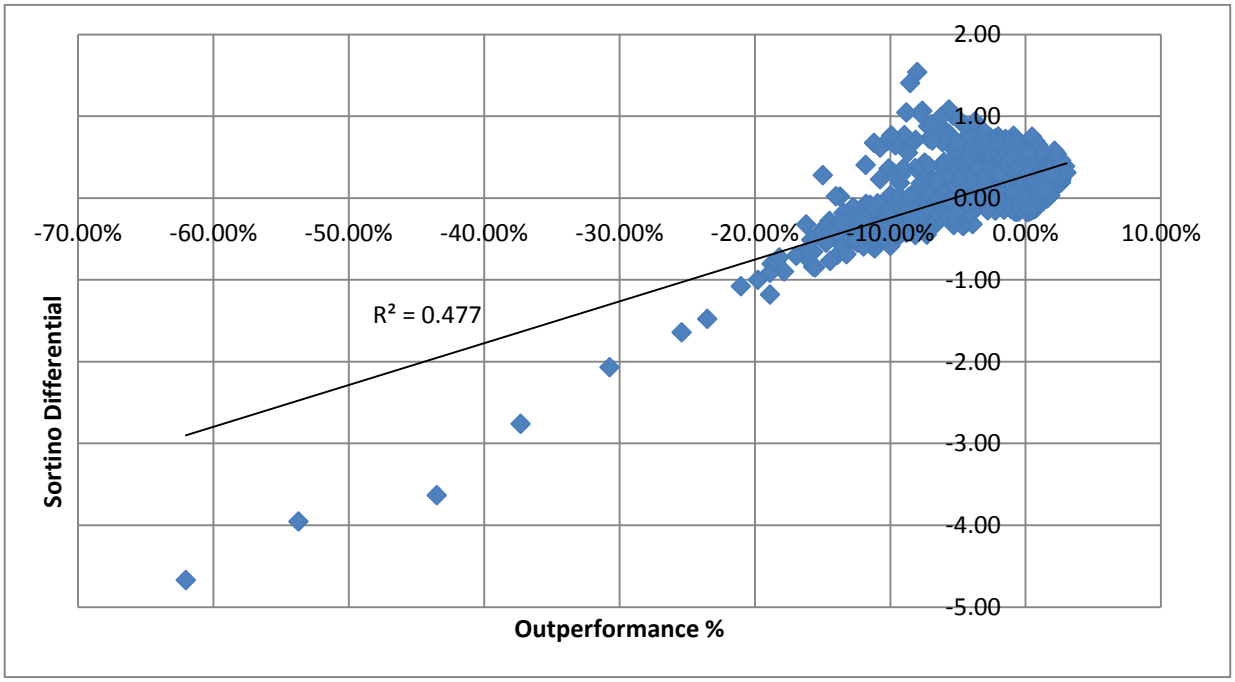


Figure 32: Regression of Sortino differential and outperformance for period Bull Two 01/06/2012 - 31/12/2013

The best-performing Covered Calls portfolios were as follows (best performing illustrated):

Rank	Moneyness	Expiry Range	Compound Return	Volatility	Sharpe Ratio	Sortino Ratio	%Out performance (relative)	Sortino-Outperformance
1	112%	75	23.23%	12.82%	1.59	1.91	3.03%	0.31
2	110%	60	23.17%	11.76%	1.71	1.99	2.95%	0.39
3	111%	75	22.99%	12.53%	1.60	1.98	2.71%	0.38
4	111%	90	22.99%	12.45%	1.62	1.91	2.71%	0.31
5	109%	90	22.96%	12.04%	1.66	1.98	2.67%	0.38

Table 21: Best-performing Covered Call portfolios for period Bull Two 01/06/2012 - 31/12/2013

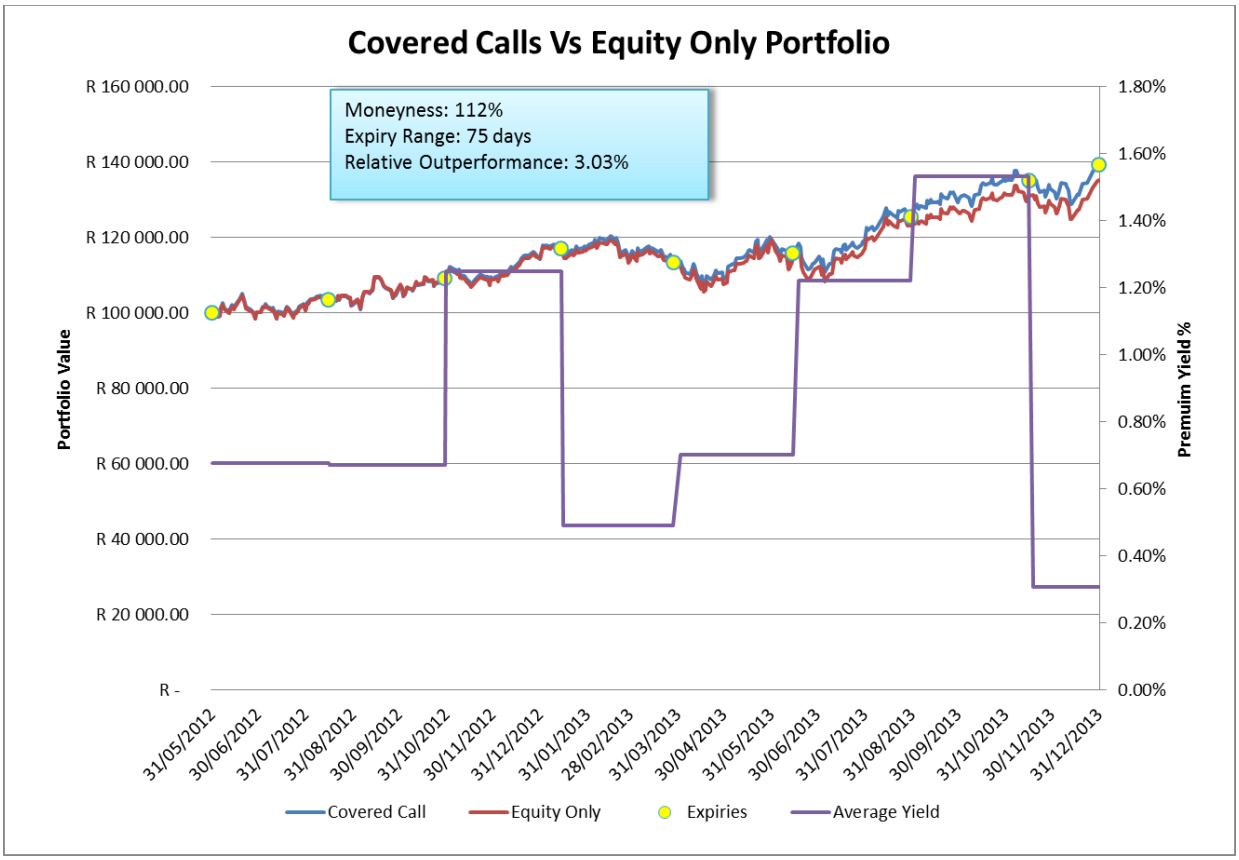


Figure 33: Covered Call portfolio performance for period Bull Two 01/06/2012 - 31/12/2013

4.7.2 *Analysis*

The market again experienced strong performance during this period seeing a compound annual return of 20.93% and relatively high Sharpe and Sortino ratios of 1.32 and 1.60 respectively. As was previously characterised by the Bull One phase in Figure 21, outperformance was best under similar conditions in Figure 30, those being far-dated expiries and high moneyness, but decent outperformance was reliably found in the higher expiry ranges. Also, the majority of portfolios struggled to outperform as is expected in a strong rising market. Those that managed a suitable balance between expiry range and moneyness so as to mostly avoid being called away and sacrificing upside (see Figure 3) would have achieved outperformance because they received the additional premium income in addition to matching the equity portfolio's share performance.

In terms of outperformance on a risk-adjusted basis, the Sortino differential chart in Figure 31 suggests that the best risk improvement of the Covered Calls portfolio occurred where outperformance was negative (although returns would still have been positive). This would be as a result of the smoothing effect that options can have on the portfolio's returns. Importantly, Figure 31 also indicates that there was risk improvement in the areas of the chart which saw the best outperformance (high moneyness and expiry ranges). This somewhat scrambled message is reflected in the regression analysis in Figure 32, which shows a relatively poor correlation coefficient of only 0.477, suggesting an uncertain impact to risk-adjusted returns by implementing the Covered Calls strategy.

The best-performing Covered Calls portfolio could only muster a 3.03% improvement over its equity-only competitor with the best-performing strikes being in the 109%-112% range and expiry tenors of 60-90 days. In addition to struggling against a rapidly rising market, the Covered Calls portfolio would also have struggled with low premium yields.

4.8 Entire Period 01/01/2000 - 31/12/2013

Having examined the performance for each of the five periods identified in the 13-year period covered by the data set; it is of interest to measure the outperformance which could have been achieved by using a Covered Calls strategy throughout this time. This outperformance is, of course, a best-case scenario, and such outperformance would be hard to achieve by a regular investor, but is nonetheless quite possible.

The most striking feature of Figure 34 is that the Covered Call portfolio achieves only moderate outperformance until the bear market begins in May 2008. At this point, volatility and hence premium yields rise dramatically; this gives the Covered Call portfolio a considerable edge both in the bear market (although it's not best used as a hedge in a falling market) and in particular at the start of the Slow Bull market which follows. At this point, volatilities and premium yield are still relatively high, but share prices then rise slowly. These are ideal conditions for extracting maximum yield from a Covered Calls strategy. The influx of large premiums is at the beginning of this period, which are then used to purchase additional shares at comparatively cheap prices; this is what really contributes to the outperformance. As time goes on the Covered Call portfolio then extracts relatively larger dividend flows and option premiums, and thus continues to gain on the equity-only portfolio.

It is also interesting to note that there is some consistency in the ideal option structure depending on the market phase. Across all market phases expiry ranges of 55-70 days were top-performing strategies; thereafter a market phase based calibration of the moneyness yields top results. In falling markets a lower moneyness (deep ITM) was best (in this case 85%), and in slow to rising markets 108% to 119% OTM performed well, the slower the market the lower the moneyness. This relationship is best seen in Figure 35, where it is clear that there is a very strong relationship between the compound return of the market (or, in this case, the basket portfolio of five shares) and the optimal moneyness factor.

As can be seen from the preceding sections and as summarised in Table 22, the Covered Calls portfolio outperformed at each market phase and ultimately achieved a return that was superior to the magnitude of 195.4%. This was a compound annual return throughout the 13-year period of 29.4%, compared to the 19.1% achieved by the equity-only portfolio. There are also slight differences in the compound returns achieved by the Covered Calls in Table 22 as compared to those in the preceding sections as the earlier comparisons were done against a starting balance of R100,000, whereas for the optimised portfolio the starting balance used was the closing

balance of the previous tranche. Consequently, there are slight differences in the relative transaction costs, premiums and dividend flows.

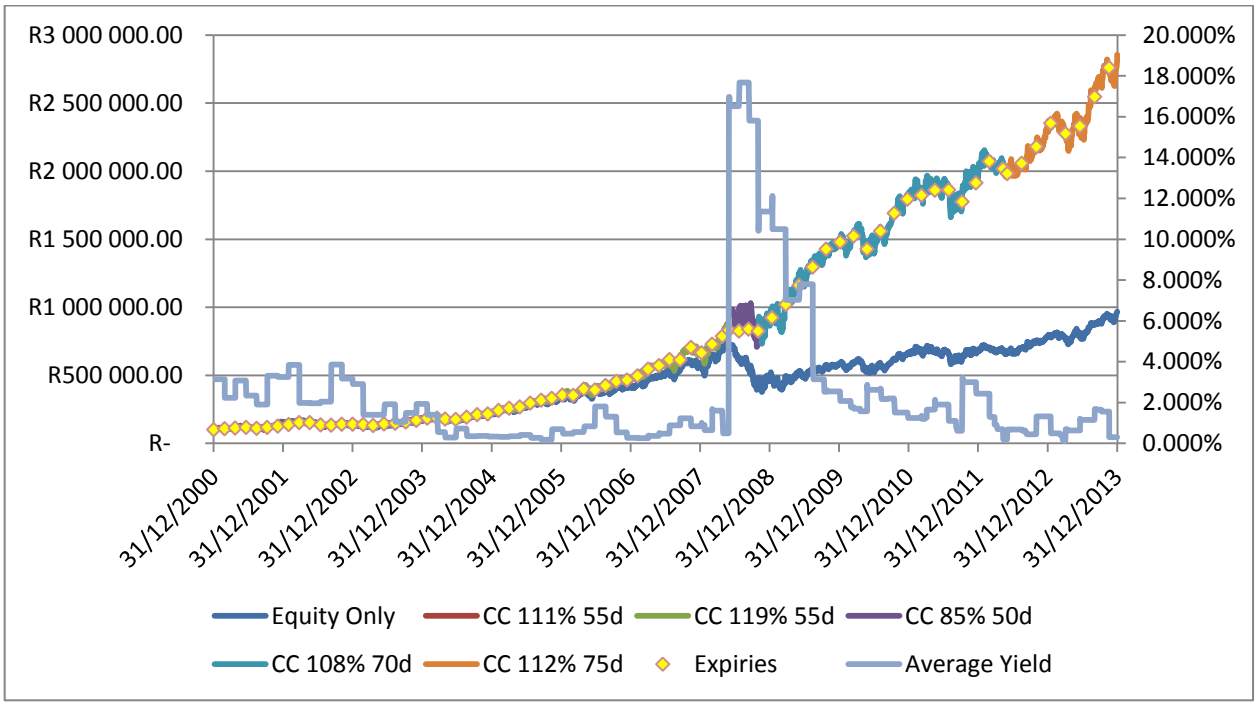


Figure 34: Optimal Covered Call performance for the entire period

Trend	Sideways	Bull 1	Bear	Slow Bull	Bull 2	All
Start	31/12/2000	30/04/2004	30/05/2008	31/10/2008	31/05/2012	31/12/2000
End	30/04/2004	30/05/2008	31/10/2008	31/05/2012	31/12/2013	31/12/2013
Time frame (yrs)	3.3	4.1	0.4	3.6	1.6	13.0
Moneyness	111%	119%	85%	108%	112%	-------
Expiry Range	55	55	50	70	75	-------
CC Start	R 100 000	R 179 573	R 831 659	R 825 222	R 1 982 284	R 100 000
CC terminal value	R 179 573	R 831 659	R 825 222	R 1 982 284	R 2 856 171	R 2 856 171
Equity Terminal value	R 172 527	R 722 996	R 469 540	R 661 681	R 967 036	R 967 036
CC Outperformance (relative)	4.1%	7.9%	33.9%	72.3%	5.7%	195.4%
CC Compound Annual Return	19.2%	45.6%	-1.8%	27.7%	25.9%	29.4%
Equity Compound Return	17.8%	42.0%	-64.5%	10.0%	27.1%	19.1%
Equity Arithmetic Return	21.8%	78.1%	-84.1%	11.4%	29.1%	66.7%

Table 22: Optimal Covered Call portoflio performance for the entire period

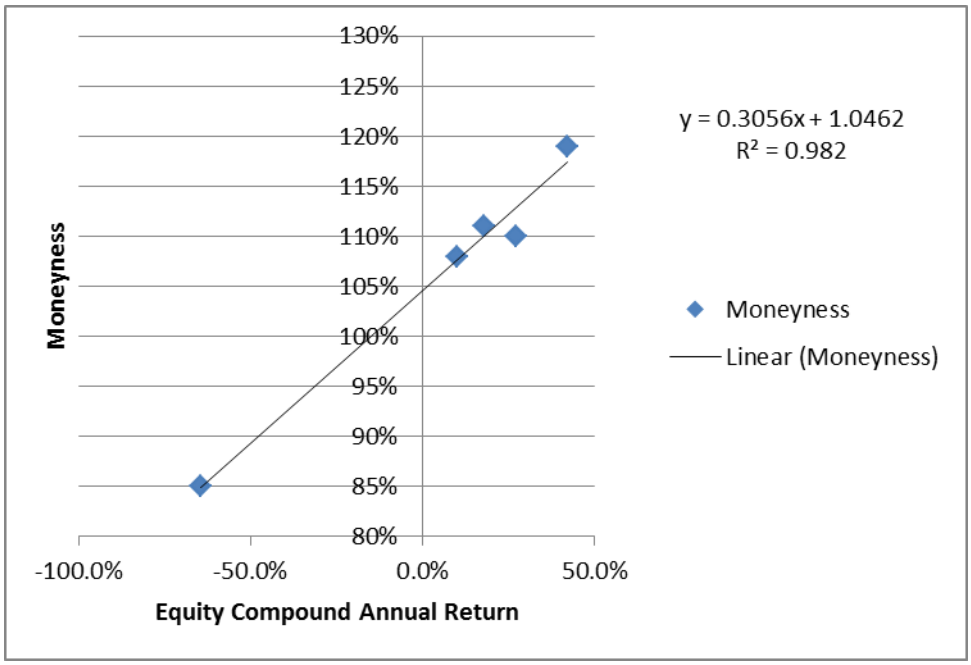


Figure 35: Choosing optimal moneyness

4.9 Impact of other factors

Various other insights and factors were uncovered in the process of building the model and measuring the output. A selection of these is discussed below.

4.9.1 *Average Premium Yield*

As the average premium yield has featured in discussion as a key element of portfolios which outperform, one might be drawn to conclude that achieving a high premium yield is a sure way of attaining outperformance.

As can be seen in Figure 36 (which is drawn across all 10,580 model iterations), premium yield has a natural and simple relationship to combinations of moneyness and expiry range (irrespective of market phase). The highest yields are attained for low moneyness (deep ITM), long-dated options, this makes sense as the low moneyness implies a high probability of exercise and the higher expiry range implies a greater time value in the option. However, as can be seen in the regression in Figure 37, there is no direct relationship between outperformance and premium yield, and so the relationship is not as simple as postulated above.

Once the market phase is taken into consideration, as shown in Figure 38, Figure 39, Figure 40, Figure 41 and Figure 42, a stronger relationship becomes visible, particularly in the Bull One and Bear phases, which achieve relatively high correlation coefficients. Notably, during the Sideways and Slow Bull phases there is in fact no relationship.

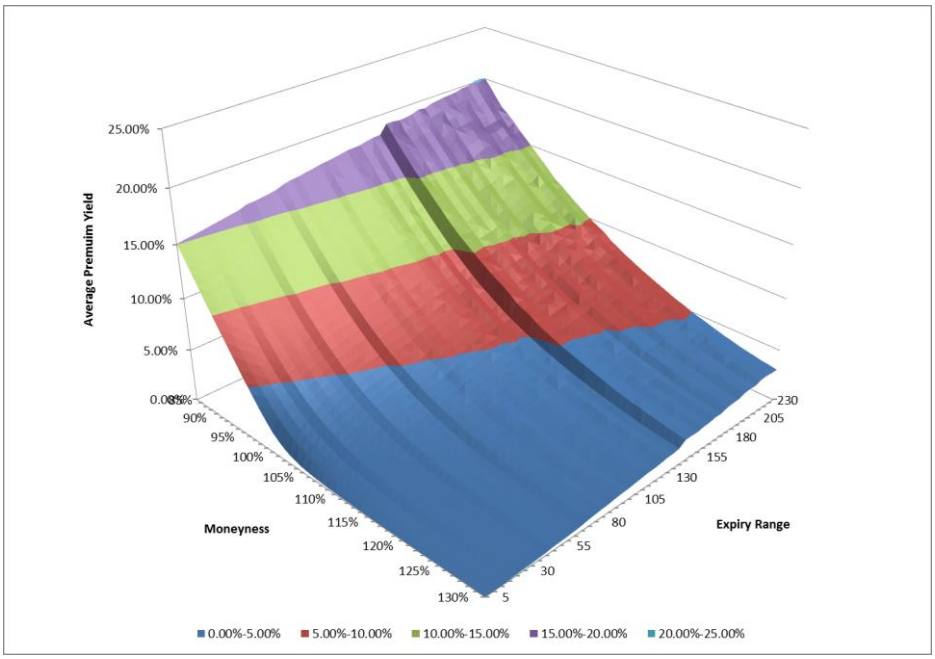


Figure 36: Average premium yield by moneyness and expiry range for the entire period

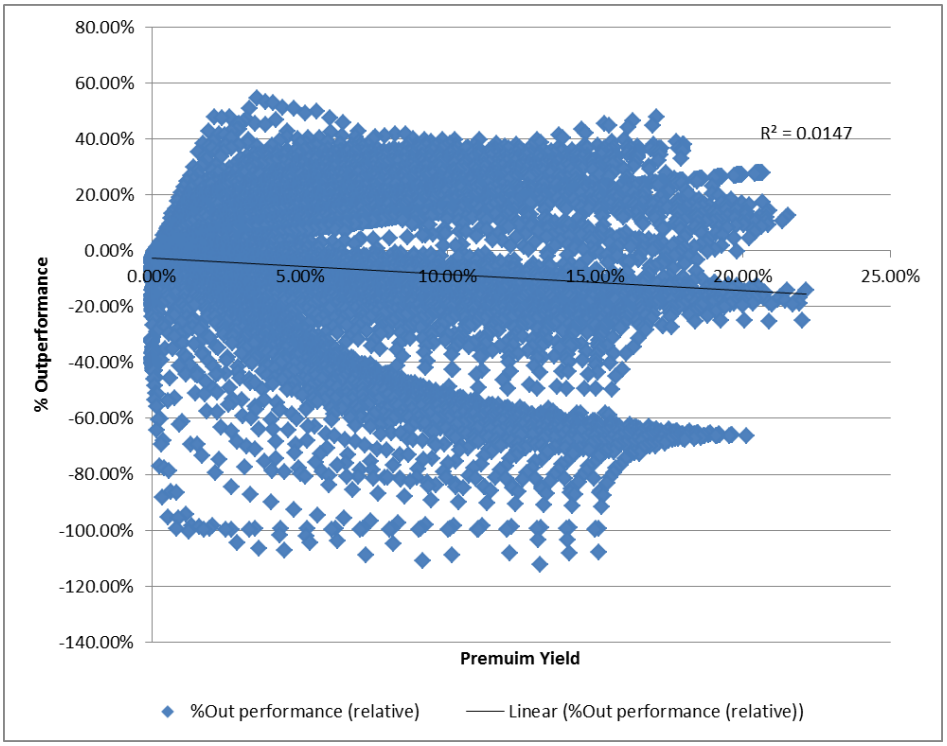


Figure 37: Regression of outperformance % and premium yield for the entire period

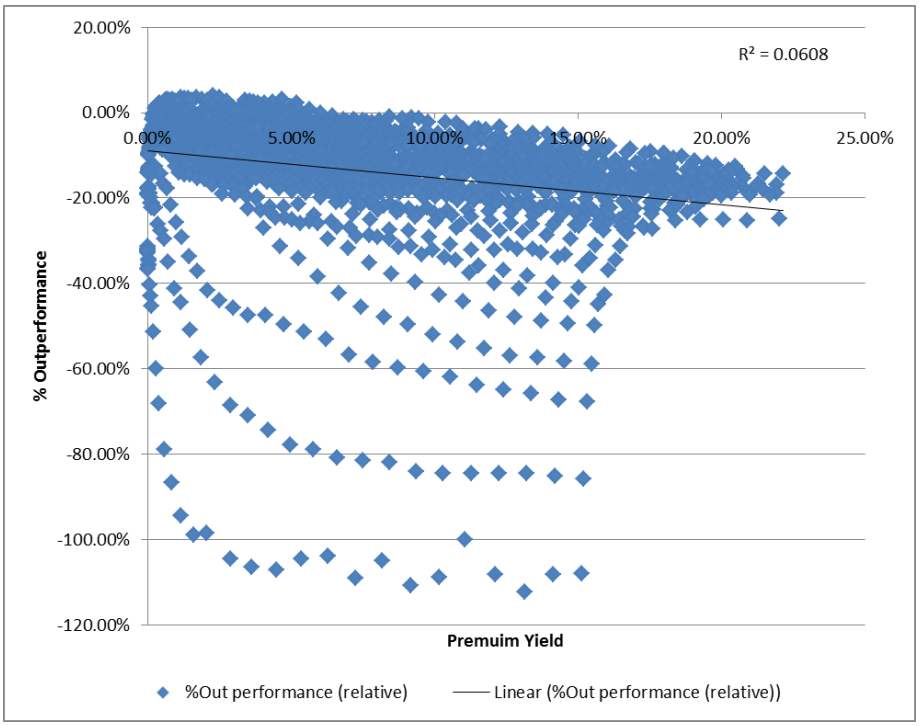


Figure 38: Regression of outperformance % and premium yield for Sideways period

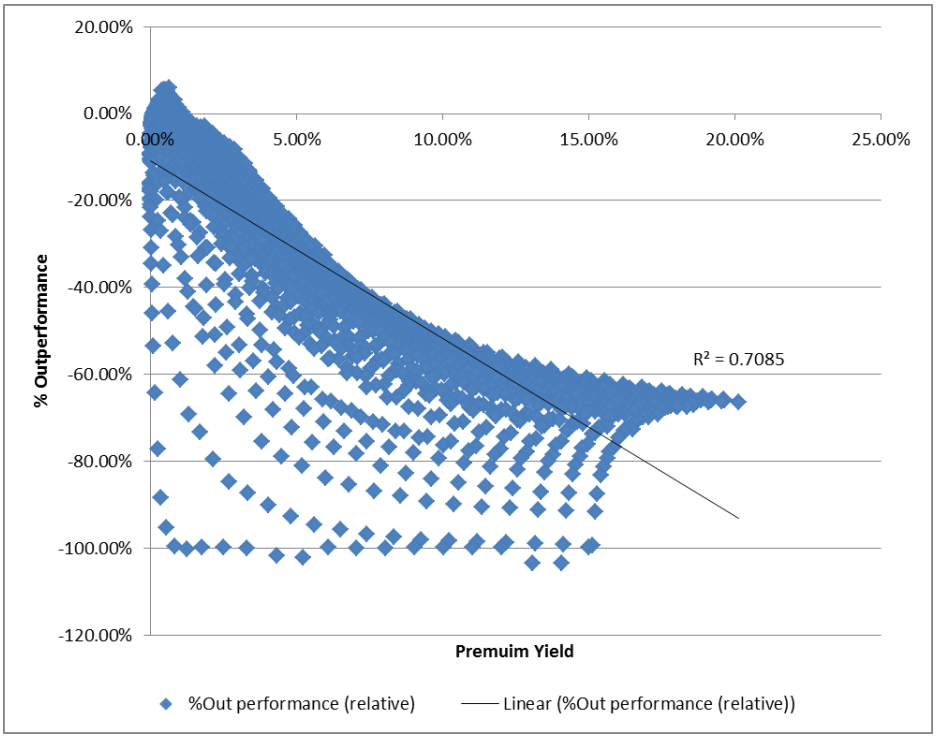


Figure 39: Regression of outperformance % and premium yield for Bull One period

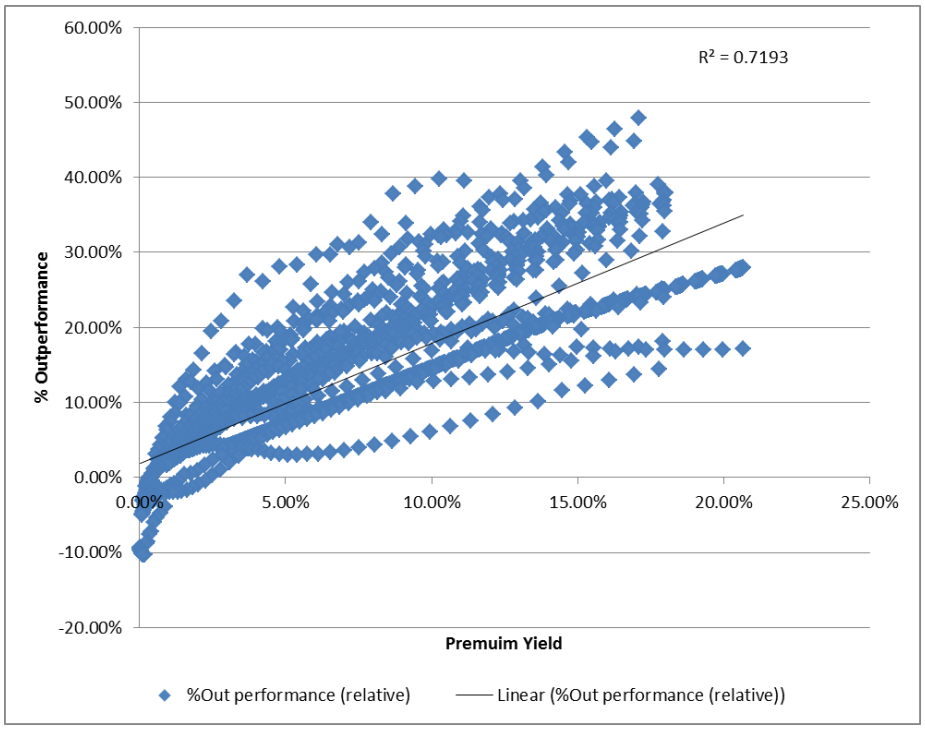


Figure 40: Regression of outperformance % and premium yield for Bear period

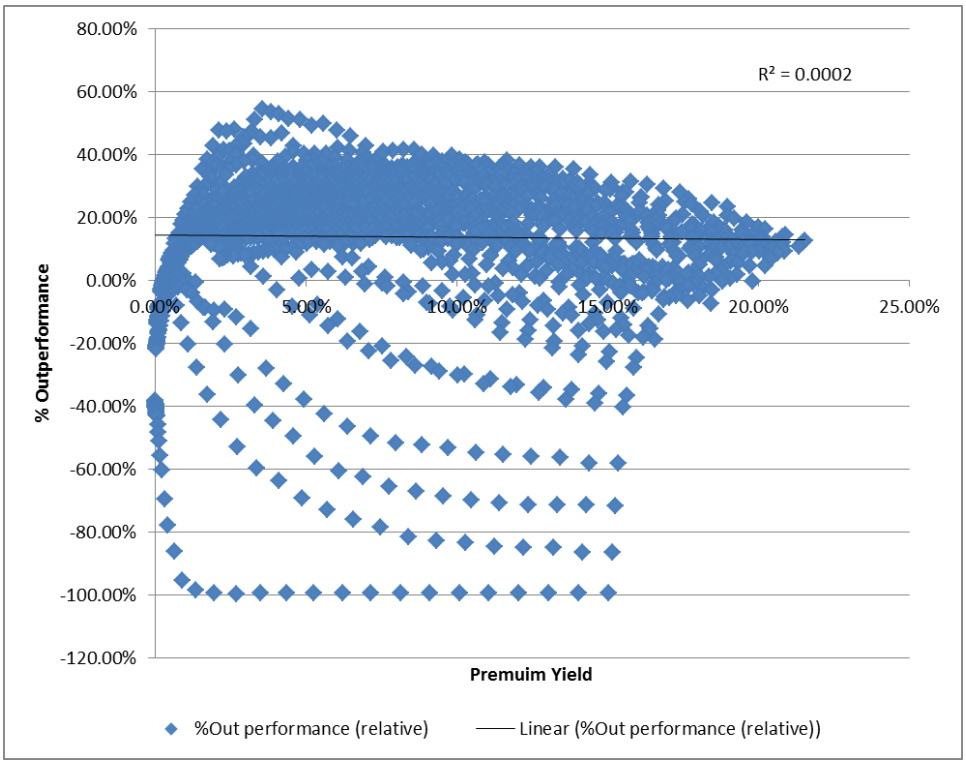


Figure 41: Regression of outperformance % and premium yield for Slow Bull period

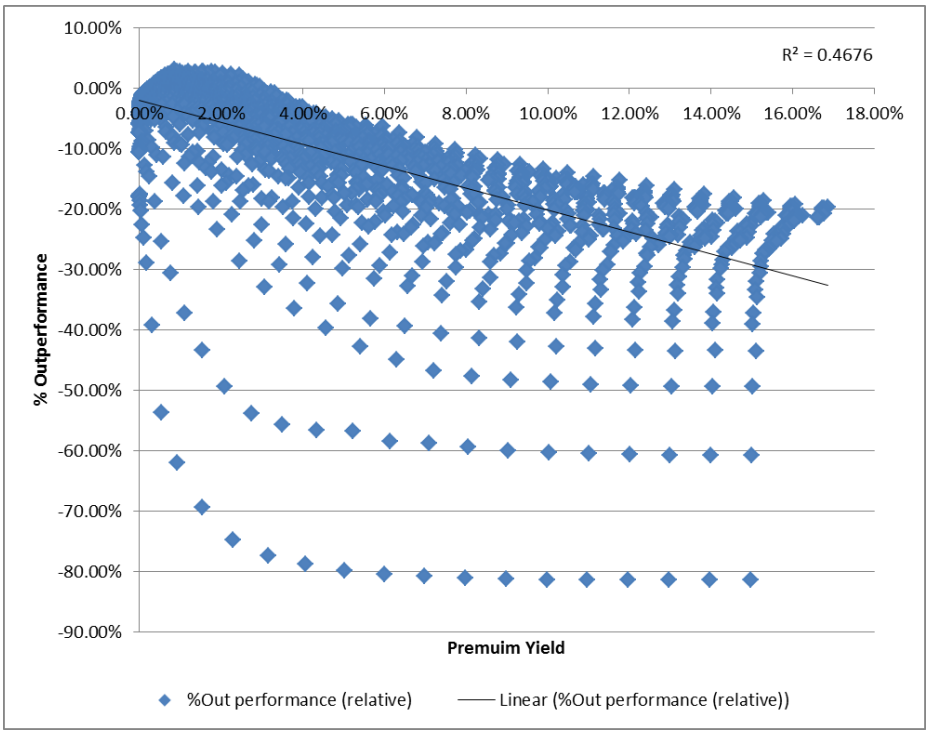


Figure 42: Regression of outperformance % and premium yield for Bull Two period

4.9.2 *Percentage of Options Exercised*

The percentage of options exercised bears a similar relationship to moneyness and expiry range to that shown above for premium yield. There is in fact a 68% correlation between them (see Table 23). As can be seen in Figure 43, options with a low expiry range and high moneyness are most likely to be exercised, this is converse to the relationship the premium yield has with expiry range, but the same for moneyness.

In a similar vein to the discussion in the preceding section and in particular because of the presence of transaction costs, one might think that there is a certain relationship between outperformance and the percentage of options that were exercised. In other words, despite large premiums earned for selling options, which will likely be exercised, the cost of rebuying the equity position continuously outweighs this benefit. This relationship is not universal across all market phases as can be seen in Figure 44. However, when drawn out into the various market phases as seen in Figure 45, Figure 46, Figure 47, Figure 48 and Figure 49 a stronger (negative) relationship materialises for the two Bull market phases, implying that for these periods the more likely an exercise the less outperformance will be achieved. Thinking back to the truncated return distribution of an options portfolio (Figure 10 and Figure 12) this is as a direct result of forgoing the upside which is lost in the bull markets. However, for the other phases there is no discernible

trend implying that the percentage of options exercised does not have a strong bearing on the outperformance (representing the normal half of the return distribution).

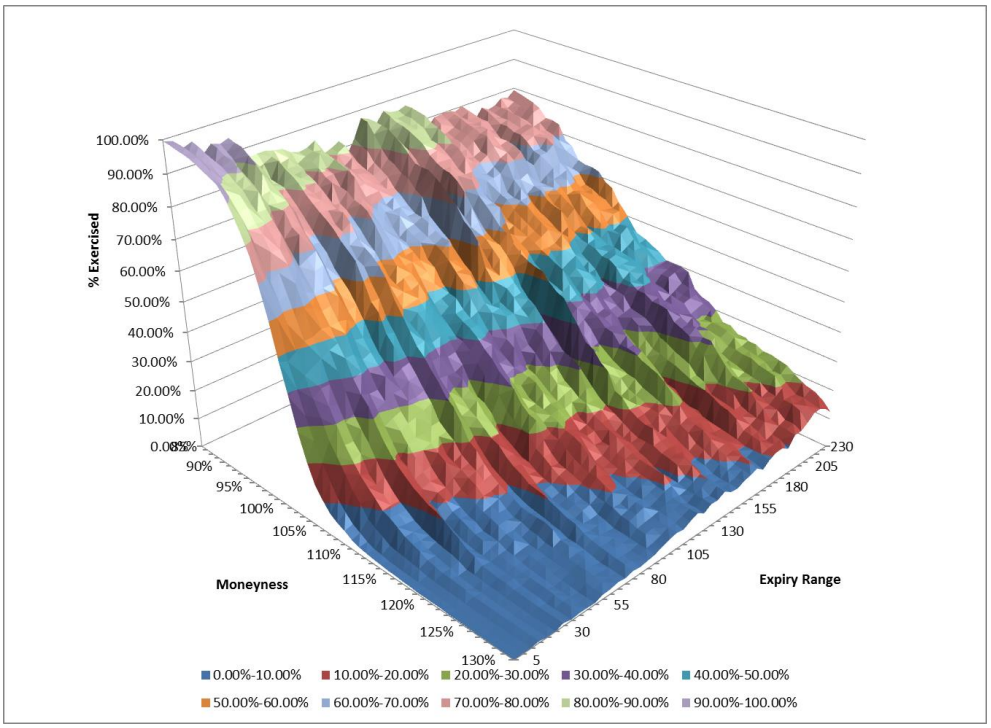


Figure 43: Percentage of options exercised by moneyness and expiry range

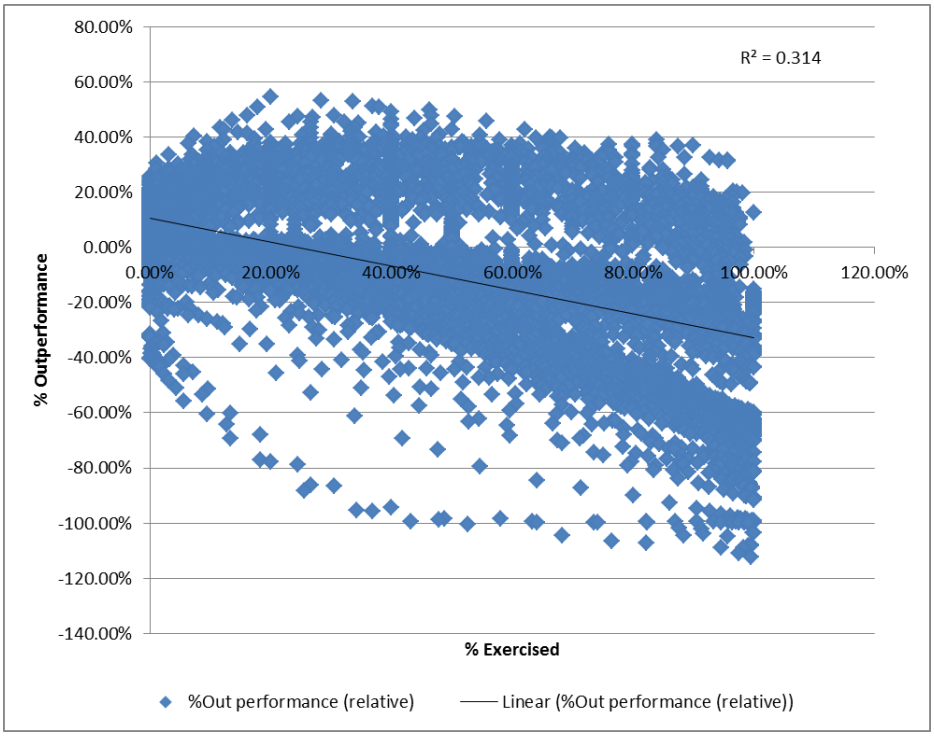


Figure 44: Regression of outperformance % and exercise % for entire period

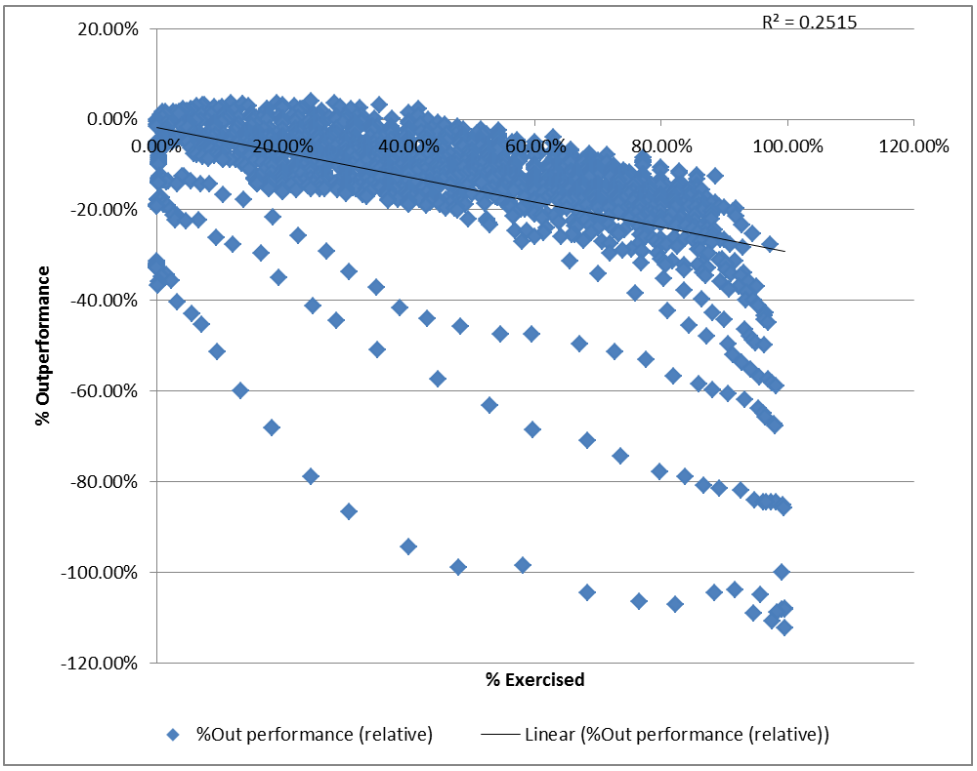


Figure 45: Regression of outperformance % and exercise % for Sideways period

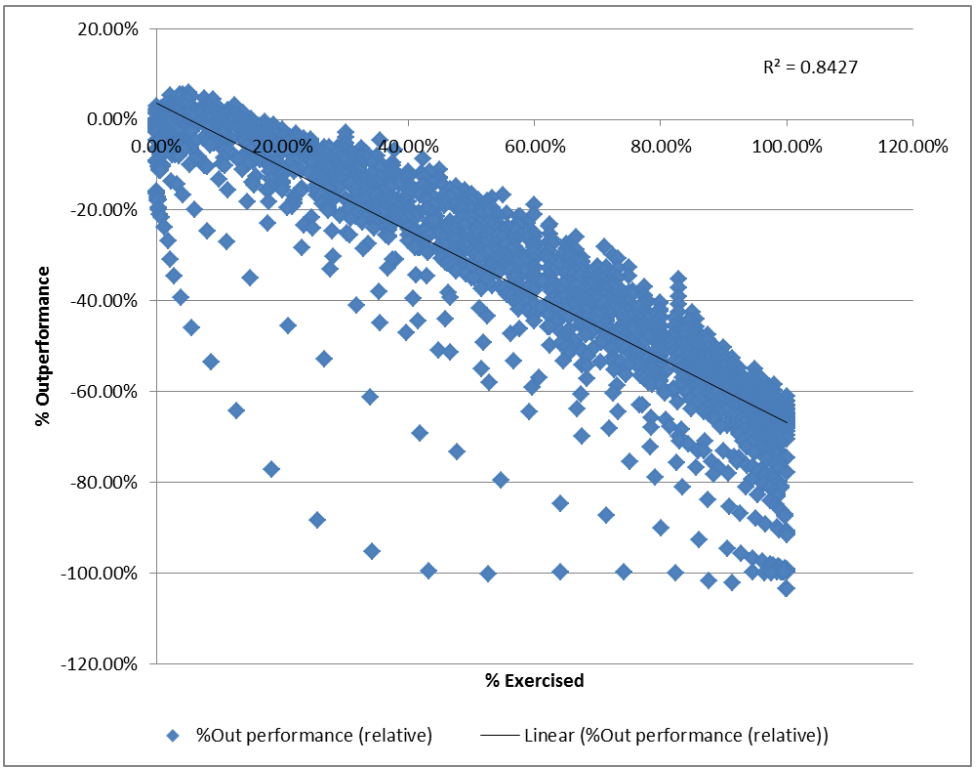


Figure 46: Regression of outperformance % and exercise % for Bull One period

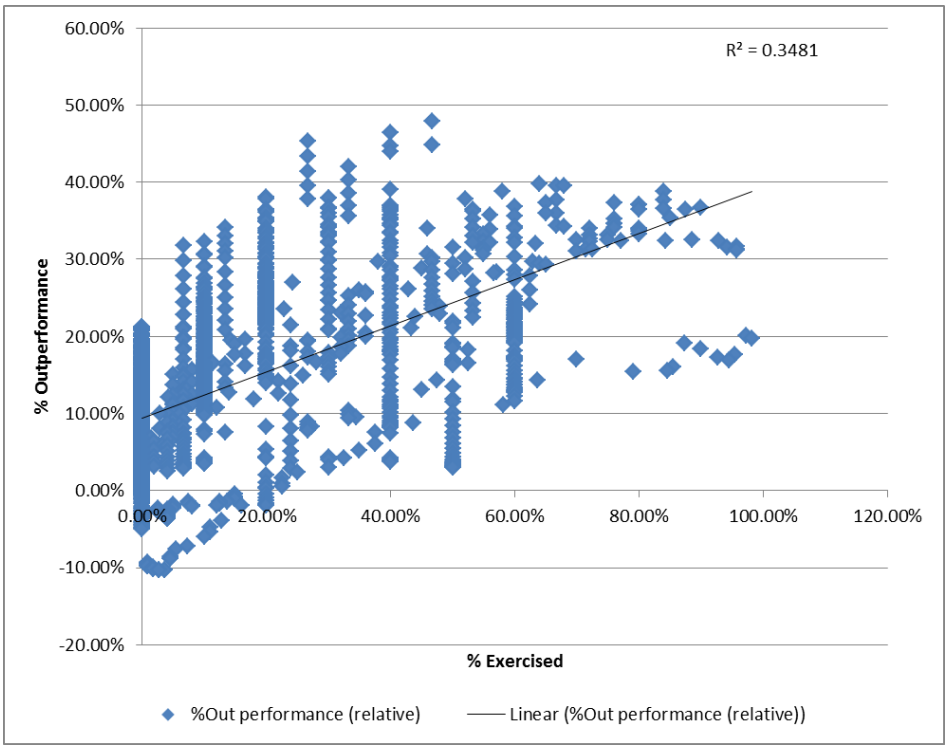


Figure 47: Regression of outperformance % and exercise % for Bear period

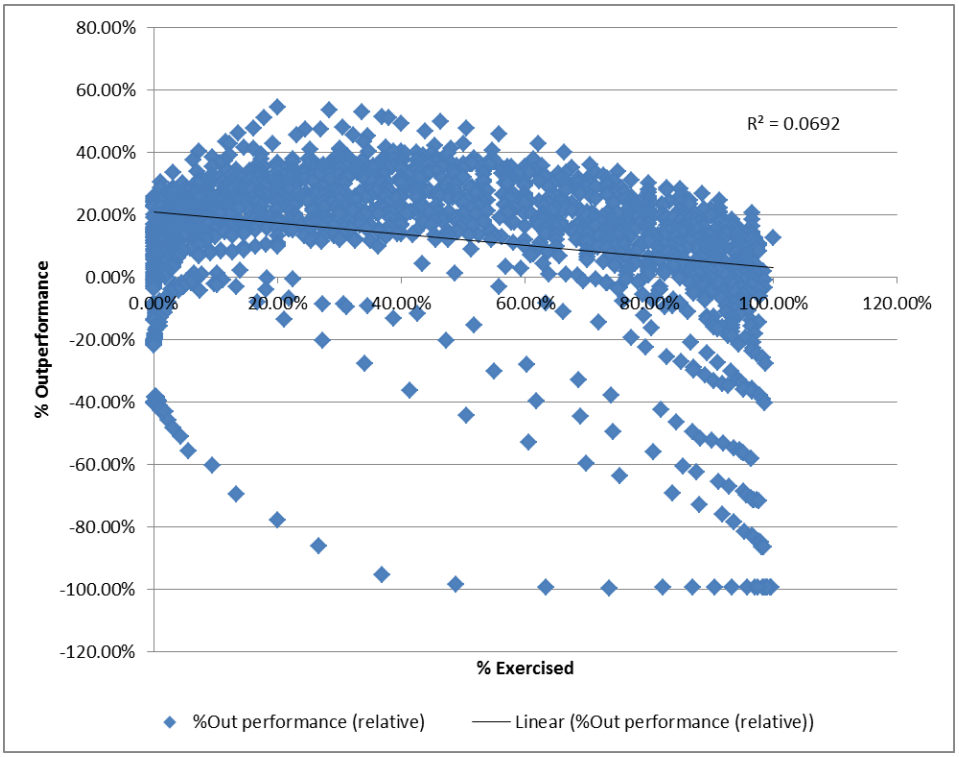


Figure 48: Regression of outperformance % and exercise % for Slow Bull period

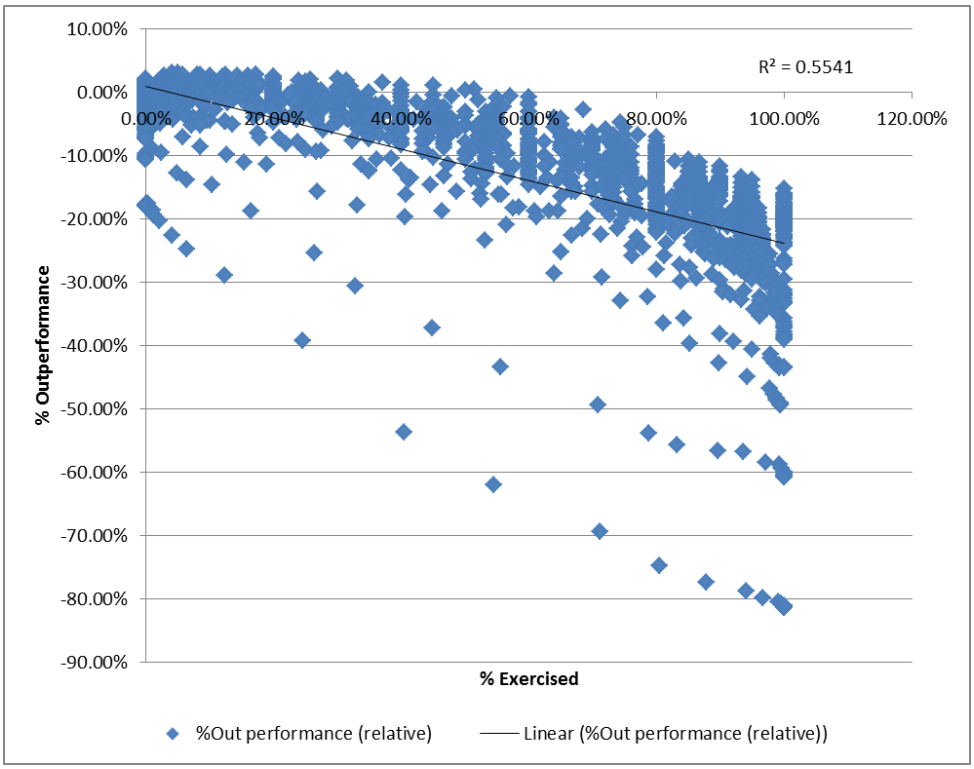


Figure 49: Regression of outperformance % and exercise % for Bull Two period

4.9.3 *Average Share Differential at Termination*

Examining Figure 50, one can see that moneyness more than expiry range appears to impact the ratio of shares which the Covered Call portfolio held at termination compared to its equity-only competitor. This is not surprising, as ITM, ATM and low OTM options have a relatively high probability of being called away, thereby requiring the Covered Calls portfolio to rebuy the shares both at a higher price than they were sold for and to incur these transaction fees. There is a peak in the 110%-120% range which also corresponds to the moneyness range which gave the best possibility of an outperformance. The fact that outperformance tended to occur where the share differential was in favour of the Covered Calls portfolio is backed up by Figure 51, which shows reasonable correlation between positive (>100%) outperformance and the share differential. If this is isolated to outperformance above 110%, as seen in Figure 52, then the relationship becomes even stronger. This provides clear evidence that acquiring more shares (by reinvesting the premium flows and additional dividend flows) is an important factor in achieving outperformance. Conversely, for negative outperformance (underperformance), as can be seen in Figure 53, the relationship is very weak. Therefore, simply attaining a favourable share differential ratio will not necessarily result in outperformance, but outperformance is unlikely to occur without it.

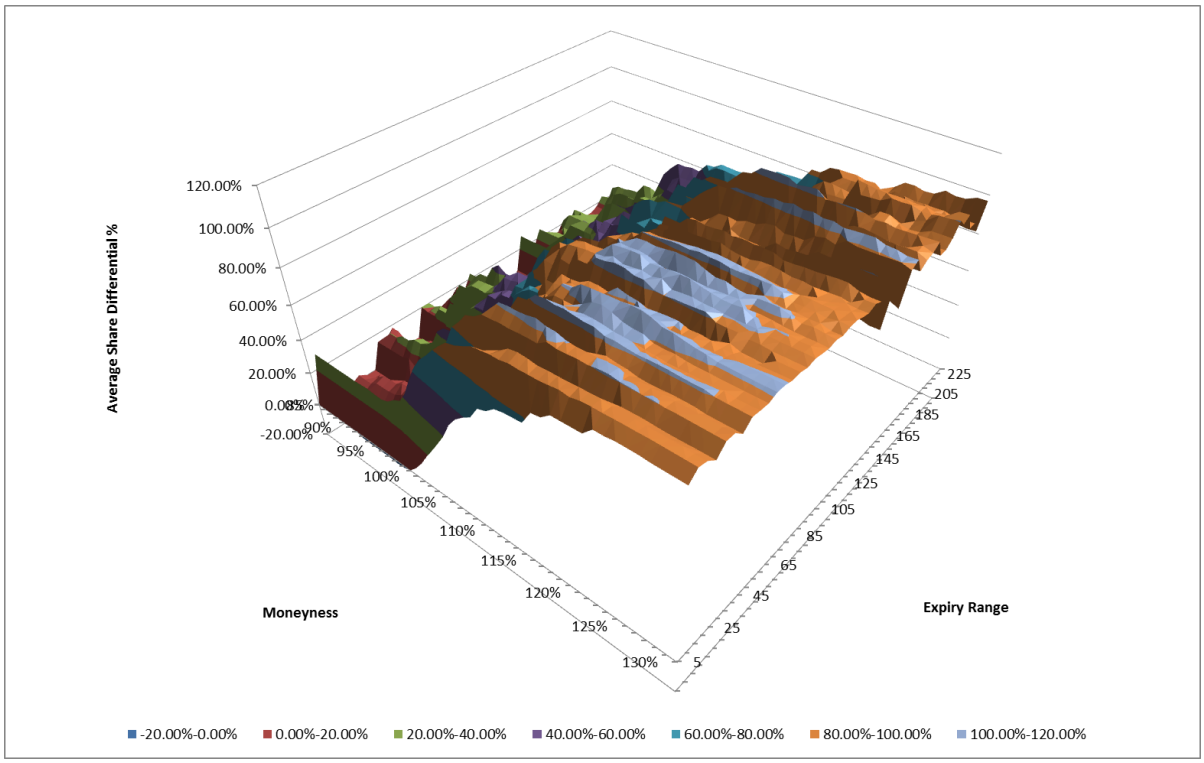


Figure 50: Average share differential % by moneyness and expiry range

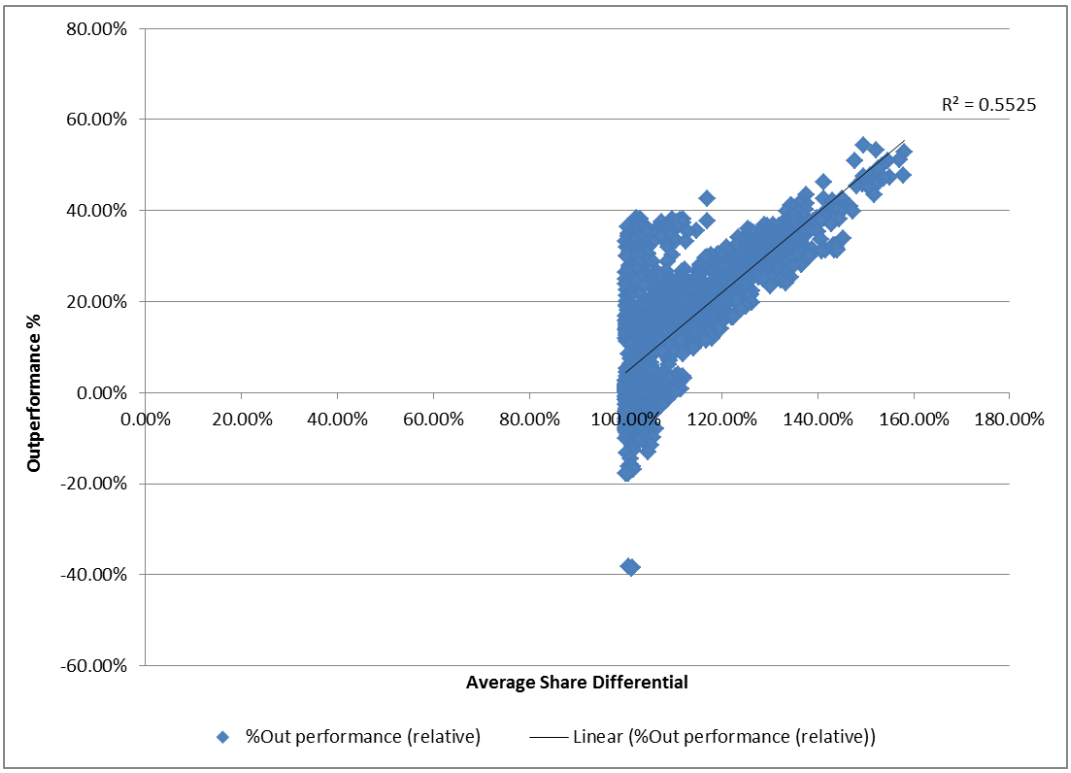


Figure 51: Regression of outperformance % and average share differential % (>100%)

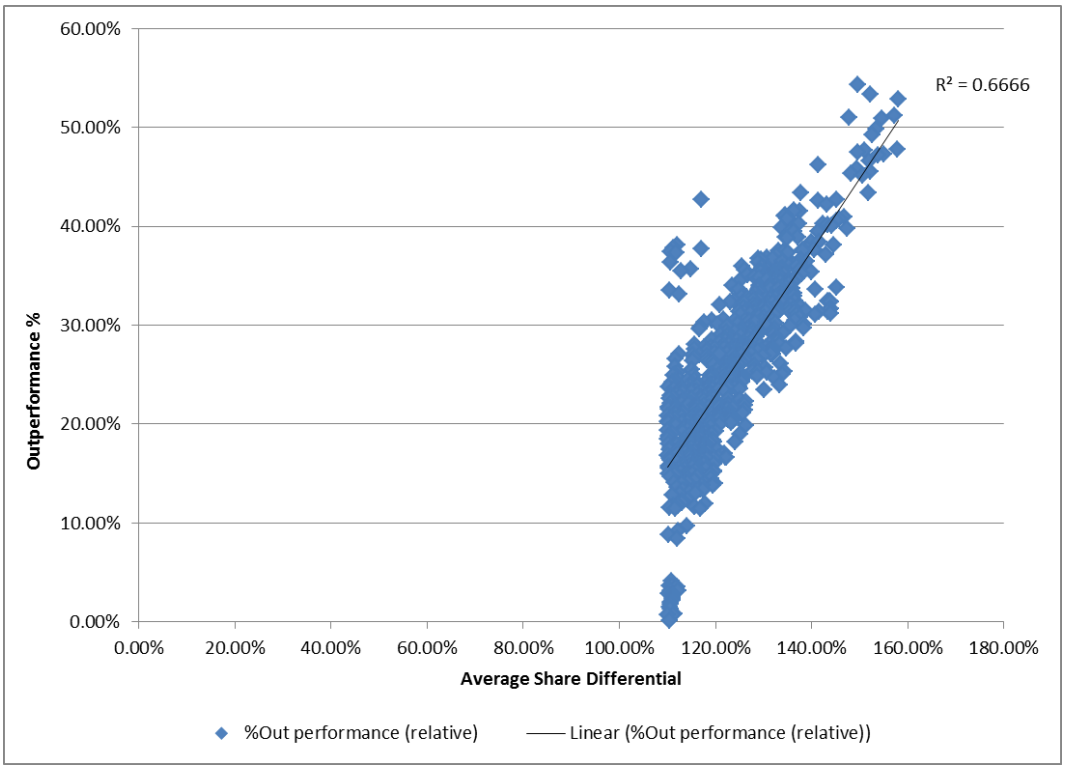


Figure 52: Regression of outperformance % and average share differential % (>110%)

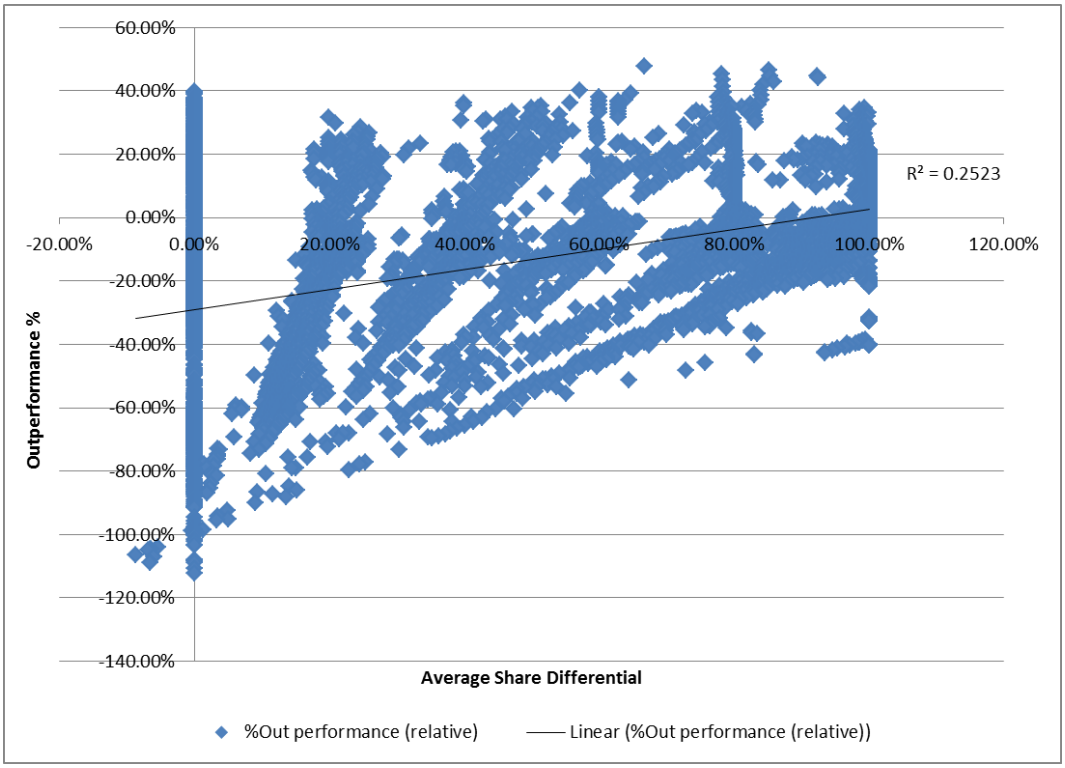


Figure 53: Regression of outperformance % and average share differential % (<=100%)

4.9.4 *Percentage of Premium Earned Spent on Transaction Costs*

For the great majority of option combinations the percentage of premium income later spent on transaction costs is not significant. However, combinations of high moneyness (low premium) and low expiry range (also low premium) result in exponential ratios as can be seen below in Figure 54. This chart on its own is rather meaningless, but it gives context to Figure 55 in which only values less than 600% are shown. The shape is similar which implies, as suggested by Figure 54, that for the great majority of option combinations the transaction costs are only a small fraction of the premium earned (here transaction costs are all of those in the Covered Call portfolio, both on equity and option transactions), hence the large flat surface, which is visible in both figures. It should be noted, however, that no time value of money adjustments were made to these figures, as premium earned was spent immediately and as such premium and transaction costs are subject to the same valuation constraints.

In terms of factors which are key to achieving outperformance, as can be seen in Figure 56, there is very little correlation between outperformance and the percentage of premium earned that was spent on transaction costs (again limited to values below 600%).

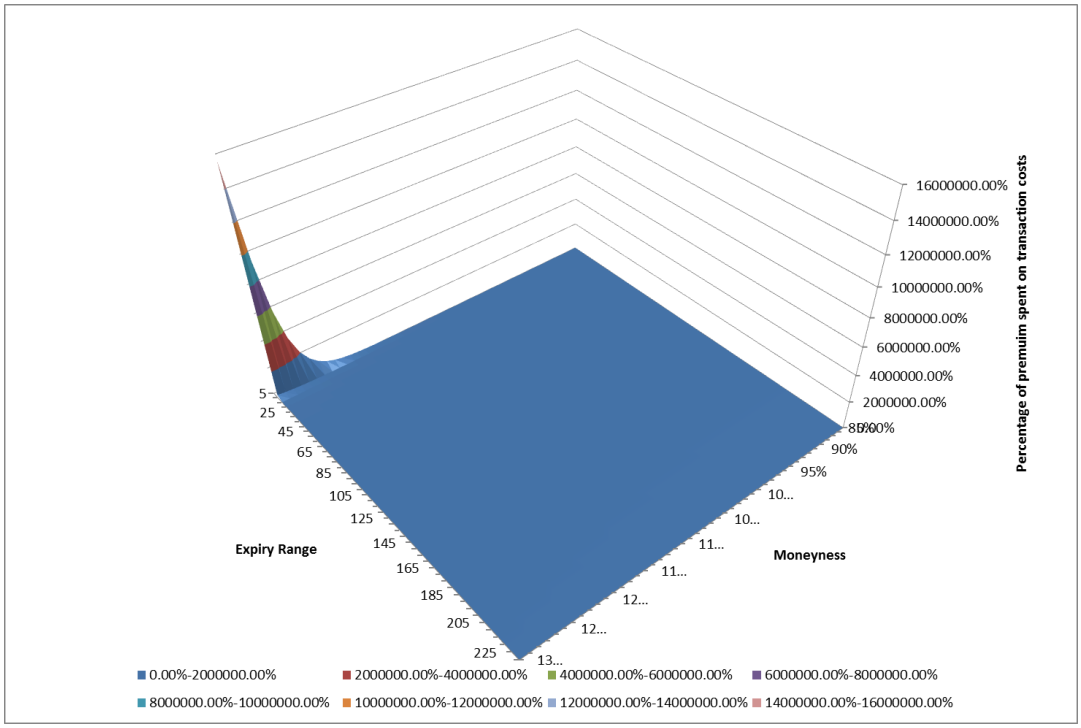


Figure 54: Percentage of premium spent on transaction costs by moneyness and expiry range

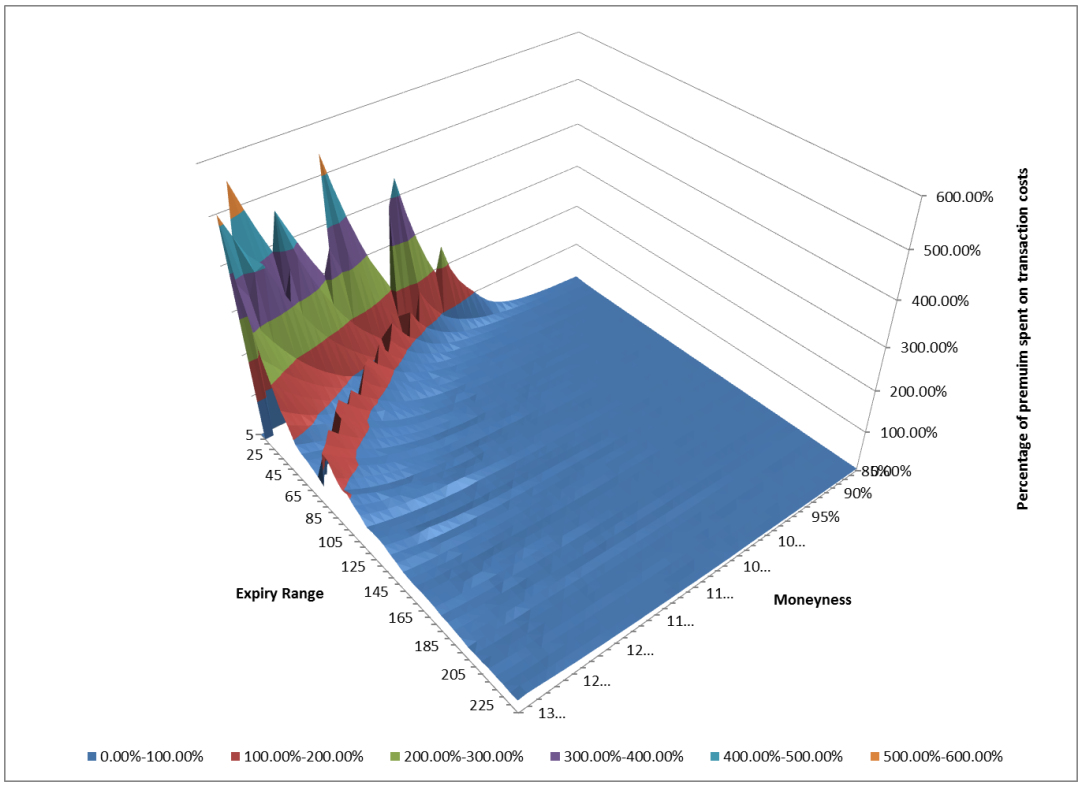


Figure 55: Percentage of premium spent on transaction costs by moneyness and expiry range, excluding values above 600%

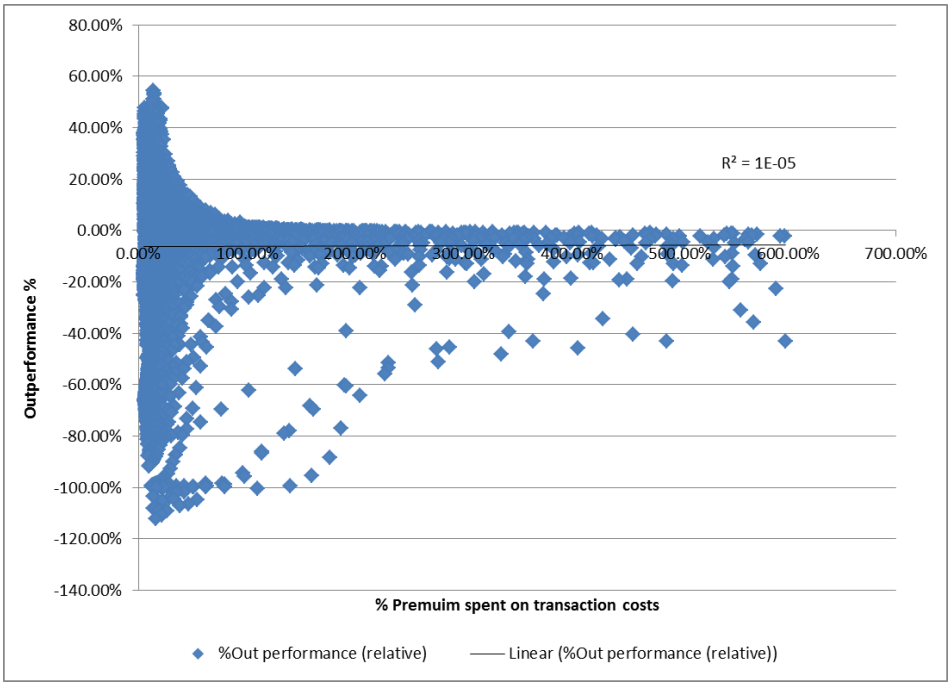


Figure 56: Regression of outperformance % and % premium spent on transaction costs

4.9.5 *The Effect on Return of The Starting Balance*

Considering a 110% OTM 45-day Covered Call portfolio (chosen because it managed an outperformance across the entire 13-year period), it was interesting to note the effect on the final outperformance percentage of the starting balance. Obviously, at lower balances the transaction costs provide a high degree of friction, and the R10,000 reinvestment threshold creates relatively longer periods between purchasing of more shares, thereby limiting market participation; hence it is no surprise that higher starting balances achieve proportionately higher returns. This relationship turns out to have logarithmic growth (see Figure 57), with incremental increases in the starting balance from R50,000 (R10,000 to each share in the portfolio) seeing significant improvements in outperformance up to around R1,000,000, where after each additional rand in the starting balance does not garner much of an improvement in outperformance. As can be seen in Figure 58, a similar but less pronounced relationship is also found in the Sortino differential.

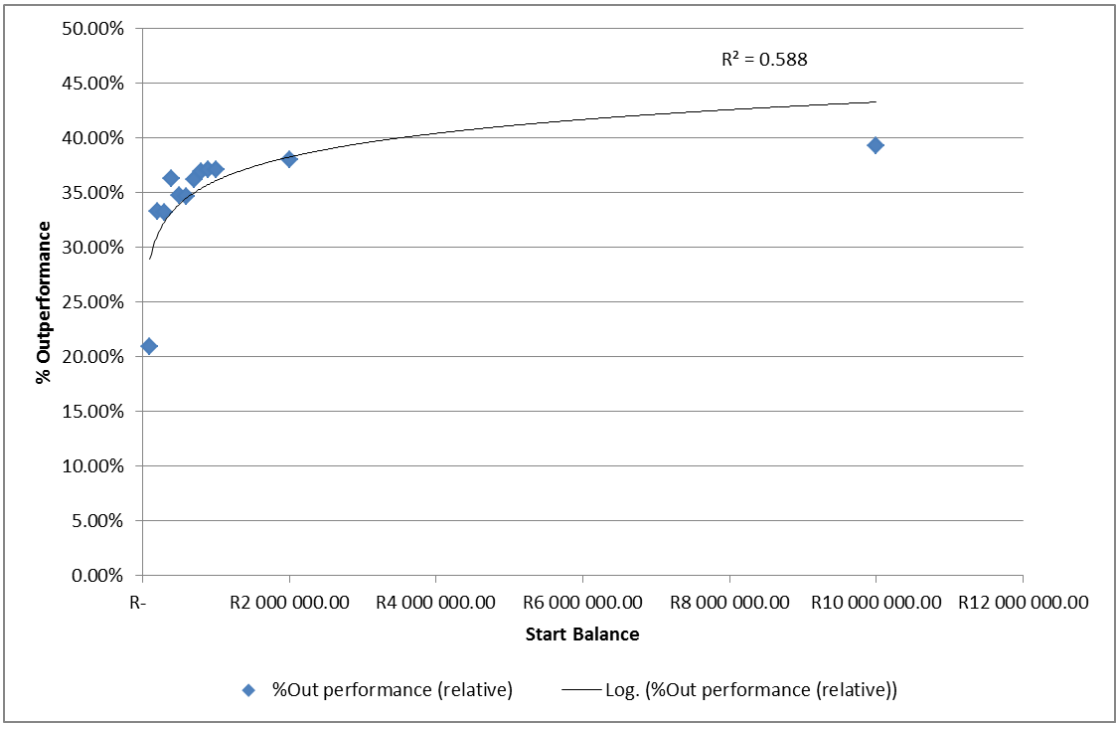


Figure 57: Regression of % outperformance and start balance (for 45-day 110% Covered Call)

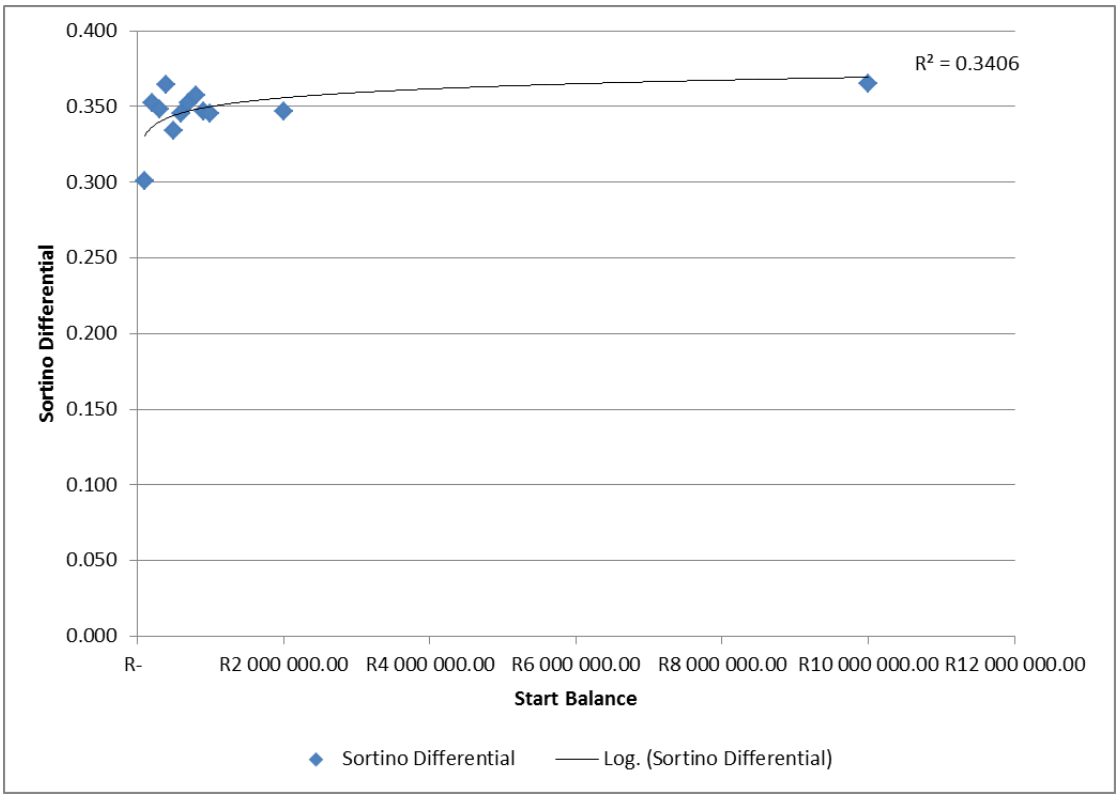


Figure 58: Regression of Sortino differential and start balance (for 45-day 110% Covered Call)

4.9.6 *The Effect of the Reinvestment Threshold*

The reinvestment threshold used throughout this study of R10,000 was chosen because it maximises the economy of scale on the brokerage rate available on share transactions. That being that a minimum brokerage of R50 would be levied irrespective of the size of the transaction. Only transactions above R10,000 attract a fixed percentage of 0.5%. However, in retrospect it turns out that even though the proportional cost per transaction is higher, this negative effect is offset by getting into a generally rising market sooner (the overall trend for the entire 13-year period is up). Having again run the model on a 110% OTM 45-day Covered Call portfolio (for the same reasons given previously) with various reinvestment thresholds it can be seen below in Figure 59 that the ideal threshold lies in the vicinity of R5,000 – R7,500, while R10,000 (in yellow) lies a little higher up the curve. Costs as a percentage of premium earned was chosen as a measure as it would be directly affected by the greater number of transactions at proportionately higher costs as the threshold was lowered.

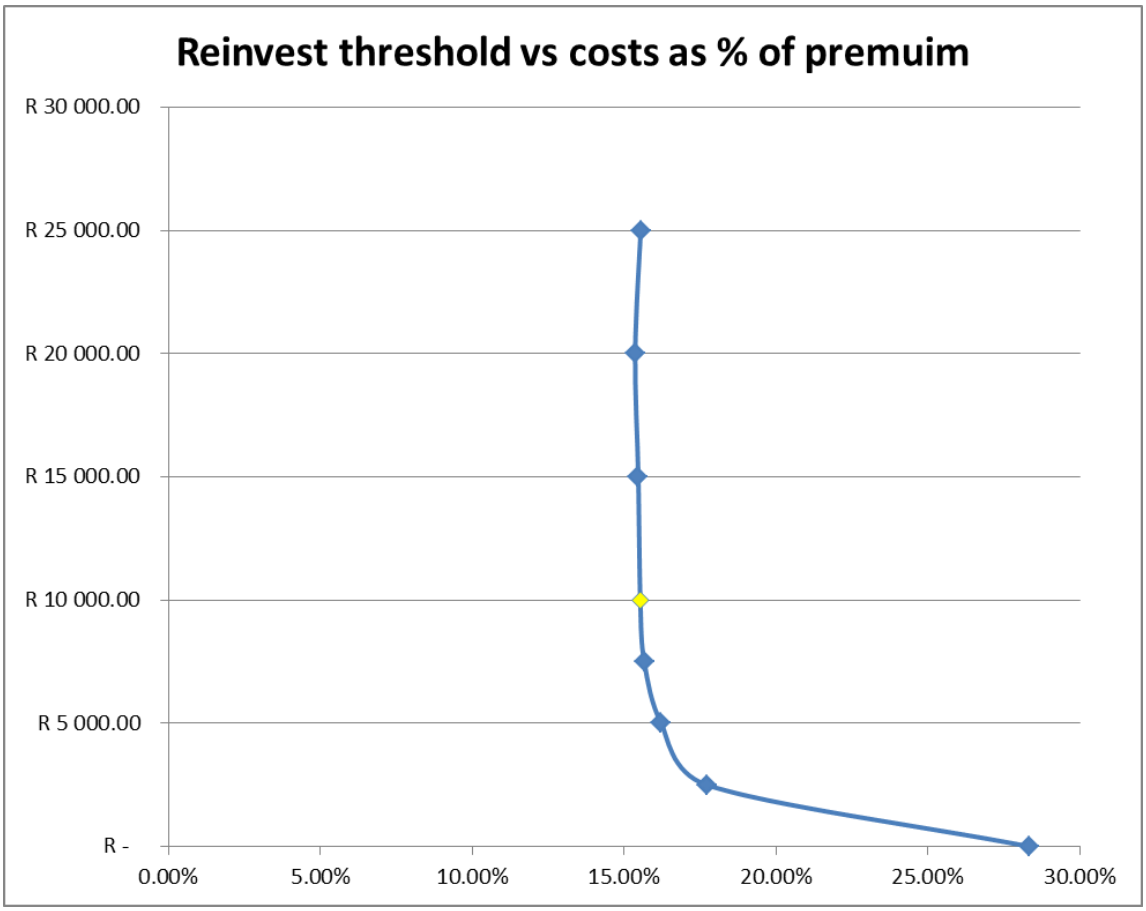


Figure 59: Reinvestment threshold vs. costs as % of premium earned

4.9.7 *The Effect of Transaction Costs*

In order to compute the effect of transaction costs the entire model was re-run for all 10,580 combinations, with all transaction costs zeroed. This data was then directly compared to the output of the model with transaction costs to arrive at an outperformance difference for each combination. In comparing this outperformance difference across all market phases, moneyness and expiry range combinations (see Figure 60), it is interesting to note that there are only significant performance gains where the frictions of transaction costs are removed for those options with short expiries and low moneyness. This is because these options are regularly called away, and the costs of having to reinstate the position become significant. However, in comparing Figure 61 and Figure 62, which show the outperformance in ZAR across all market phases for all option combinations, one can see that the area which gained most from the removal of transaction costs (the spike in Figure 60) is not aided much by this as it was already underperforming quite considerably; other than this, the entire graph simply shifts slightly on the *z* (outperformance) axis, implying that transaction costs are relevant but that they hamper the

performance in a very predictable fashion. In both simulations, outperformance still takes place at approximately the same combinations of moneyness and expiry range.

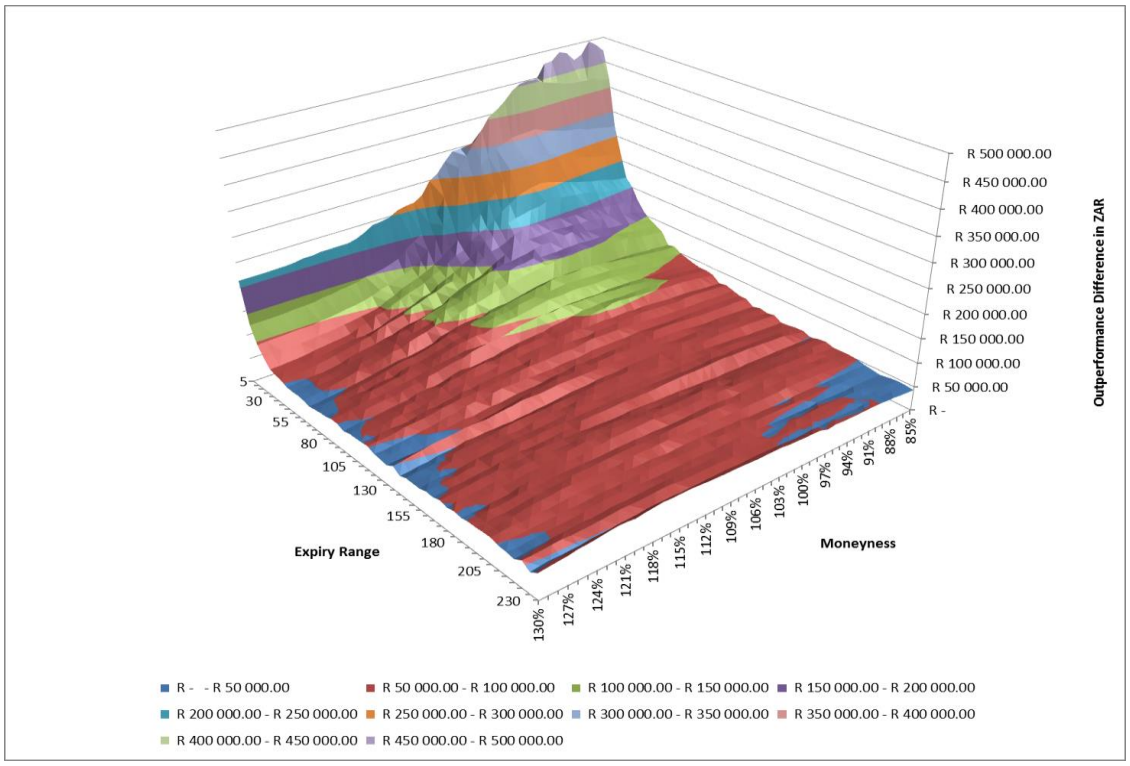


Figure 60: Outperformance difference (for no transaction costs) in ZAR by moneyness and expiry range

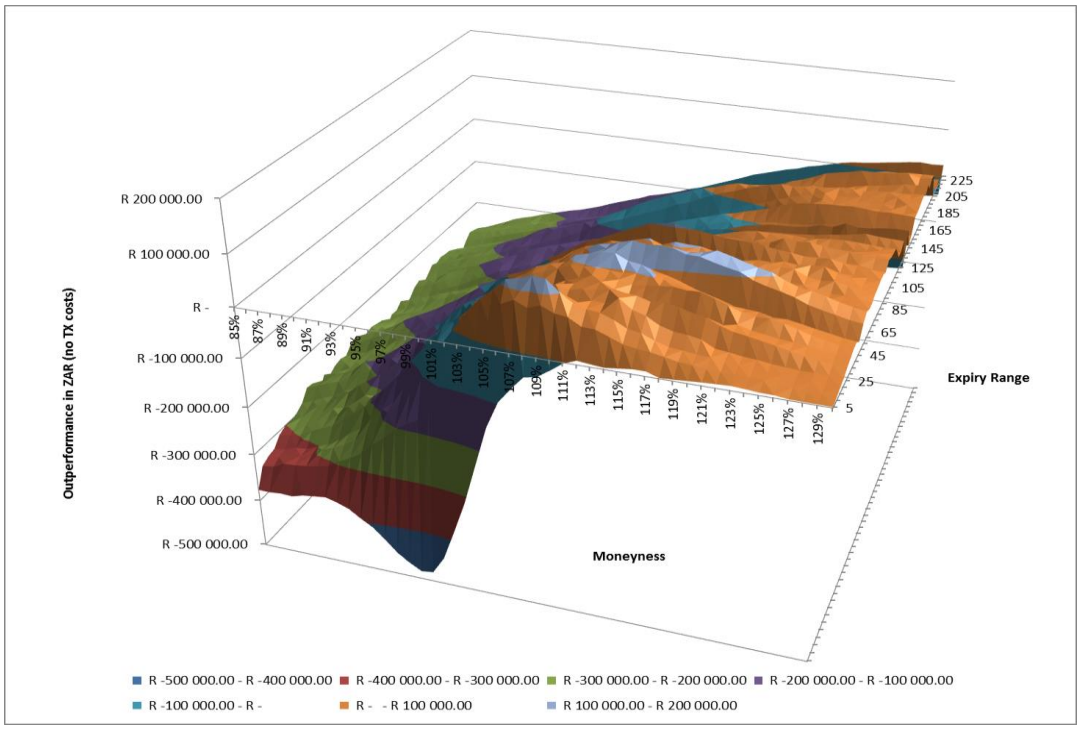


Figure 61: Total outperformance with no transaction costs present (in ZAR) by moneyness and expiry range across all market phases

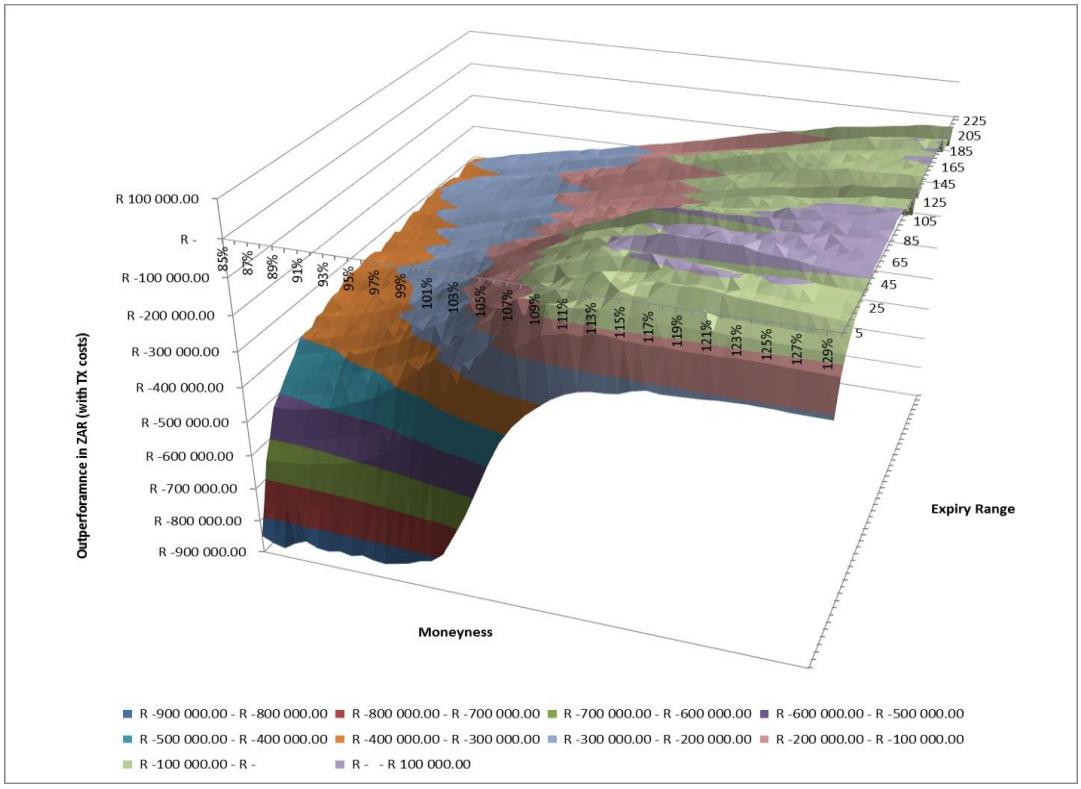


Figure 62: Total outperformance with transaction costs present (in ZAR) by moneyness and expiry range across all market phases

4.9.8 *Error tracking*

As discussed in the model design in section “3.2.4h Sanity Checks”, while every effort was made to retain real-world conditions in the model; certain compromises were unavoidable in the interests of retaining usability. In order to ensure that none of these quirks had any undue effect on the results attained above, as can be seen in Figure 63 and Figure 64, there is no relationship between the outperformance percentage and the error count or between the Sortino differential and the error count. As the majority of “errors” occurred when an option transaction was concluded even when the premium earned was less than the transaction cost of doing so, the only meaningful relationship of all the datum to the error count was the tendency for a high percentage of premium to be spent on transaction costs when the error count was high, which can be observed below in Figure 65.

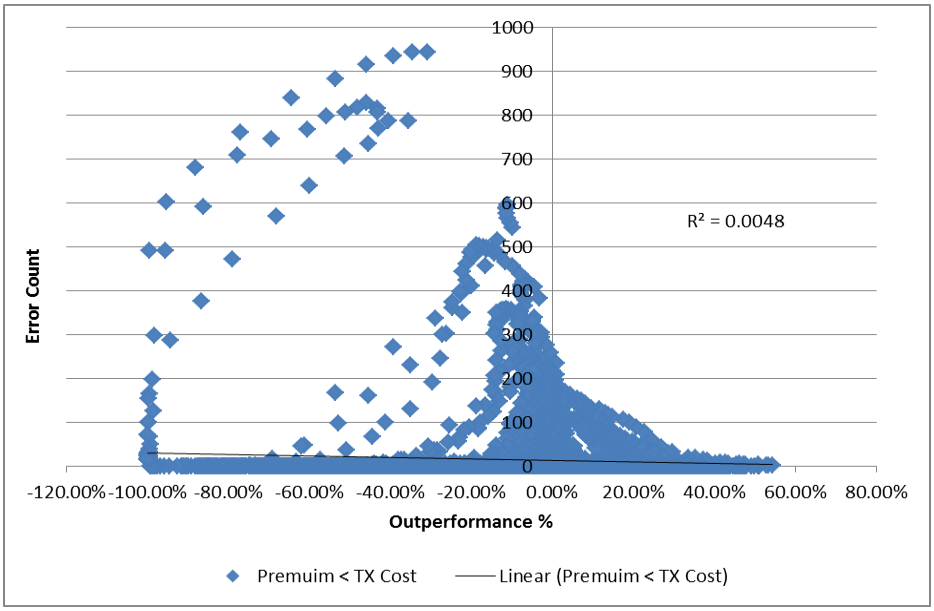


Figure 63: Error count vs. outperformance %

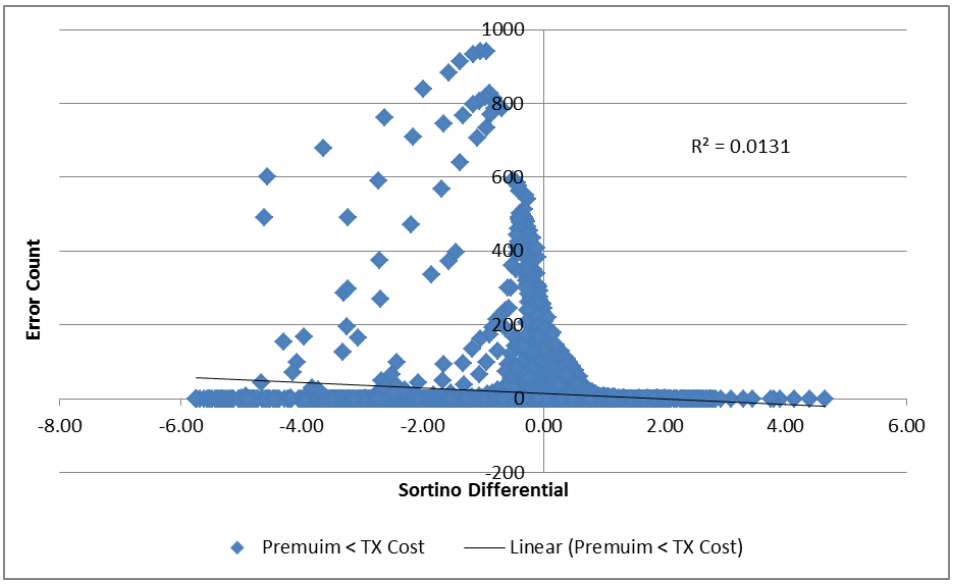


Figure 64: Error count vs. Sortino differential

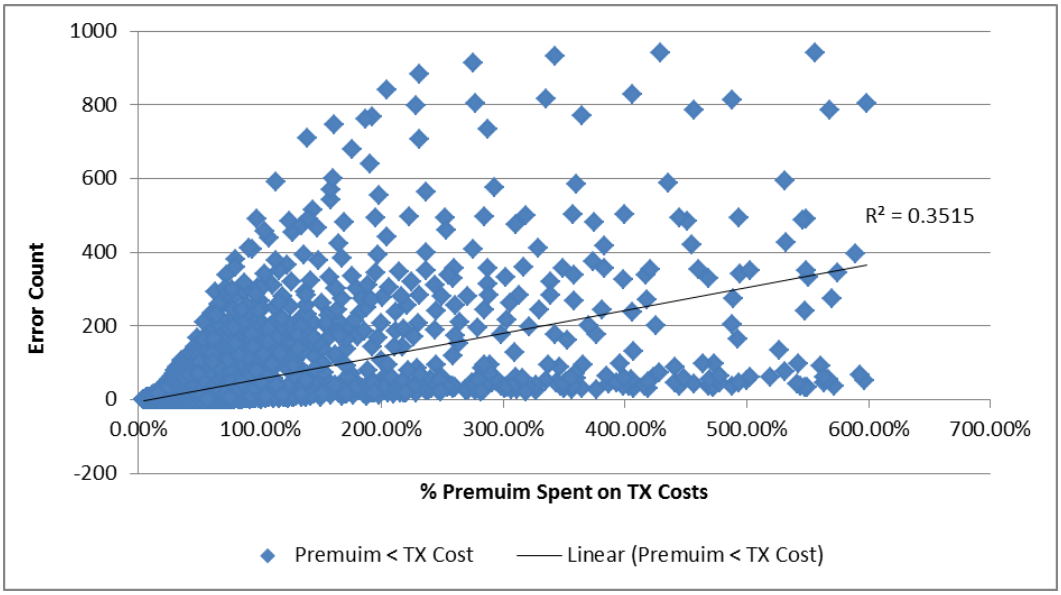


Figure 65: Error count vs. % premium spent on transaction costs

4.9.9 *Correlation Across all Variables Tracked*

In addition to the relationships commented on in the preceding sections, for the sake of completeness, Table 23 below provides a full variable correlation map across all market phases, for all combinations of moneyness and expiry range. The data were extracted under the general conditions applied throughout the model, with normal transaction costs and reinvestment thresholds.

	Peroid (yrs)	Moneyness	Expiry Range	CC Annual return (g)	CC Vol (stdev) (annualised)	CC Sharpe Ratio	CC Sortino Ratio	CC Total Expiries	CC Total Exercises	CC % Excersized	CC avg Premuim Yield	Eq Annual return (g)	Eq Vol (stdev) (annualised)	Eq Sharpe Ratio	Eq Sortino Ratio	%Out performance (relative)	Total CC Portfolio TX Costs vs Premuim Earned	Just CC Trade Costs vs Premuim Earned	Sortino Differential	Average Share Differential %	Phase	Hedge always >= 0	Premuim < TX Cost
Peroid (yrs)	100%																						
Moneyness	1%	100%																					
Expiry Range	0%	5%	100%																				
CC Annual return (g)	78%	10%	9%	100%																			
CC Vol (stdev) (annualised)	-16%	69%	-12%	-26%	100%																		
CC Sharpe Ratio	68%	7%	21%	85%	-18%	100%																	
CC Sortino Ratio	75%	9%	21%	92%	-27%	89%	100%																
CC Total Expiries	34%	-7%	-55%	7%	21%	1%	1%	100%															
CC Total Exercises	25%	-35%	-34%	-9%	-9%	-12%	-9%	71%	100%														
CC % Excersized	35%	-79%	7%	24%	-80%	23%	29%	8%	44%	100%													
CC avg Premuim Yield	3%	-84%	33%	-12%	-60%	-8%	-11%	-17%	17%	68%	100%												
Eq Annual return (g)	82%	-1%	2%	90%	-35%	79%	88%	27%	22%	44%	-8%	100%											
Eq Vol (stdev) (annualised)	46%	2%	-2%	12%	22%	8%	-2%	16%	7%	-1%	16%	6%	100%										
Eq Sharpe Ratio	79%	-1%	2%	90%	-35%	80%	87%	26%	21%	43%	-8%	99%	4%	100%									
Eq Sortino Ratio	76%	-1%	2%	89%	-38%	78%	88%	25%	21%	44%	-10%	99%	-7%	99%	100%								
%Out performance (relative)	-39%	28%	13%	-18%	41%	-20%	-26%	-41%	-57%	-58%	-13%	-56%	7%	-49%	-56%	100%							
Total CC Portfolio TX Costs vs Premuim Earned	-11%	37%	-32%	1%	31%	0%	-1%	29%	-10%	-37%	-43%	1%	-16%	3%	4%	0%	100%						
Just CC Trade Costs vs Premuim Earned	-6%	33%	-33%	3%	31%	1%	0%	32%	-9%	-34%	-37%	2%	-10%	4%	4%	1%	99%	100%					
Sortino Differential	10%	21%	39%	21%	16%	34%	39%	-46%	-58%	-24%	-4%	-8%	8%	-9%	-10%	52%	-9%	-8%	100%				
Average Share Differential %	-8%	68%	2%	-2%	66%	-6%	-10%	-9%	-37%	-83%	-54%	-25%	19%	-22%	-27%	61%	23%	21%	30%	100%			
Phase	-40%	-2%	2%	-7%	-12%	-3%	-2%	-13%	-9%	-4%	-11%	-12%	-72%	-1%	-2%	31%	15%	11%	-1%	2%	100%		
Hedge always >= 0	-1%	1%	4%	4%	-4%	2%	3%	-18%	-8%	1%	3%	-1%	-4%	-1%	0%	7%	-4%	-3%	7%	3%	4%	100%	
Premuim < TX Cost	12%	17%	-32%	8%	29%	5%	2%	65%	0%	-24%	-27%	9%	6%	9%	8%	-7%	59%	65%	-11%	12%	-3%	-16%	100%

Table 23: Correlation map of all variables

5 CONCLUSION

In seeking to uncover the realities faced by retail investors wanting to use a Covered Call strategy as a yield enhancer without introducing undue risk into their portfolio several key factors came to the fore.

The biggest cause of underperformance was a strong bull market, as the investor risks having their shares called away and losing out on upside beyond the call strike price. That said, underperformance in this case did not equal negative returns. In fact, it likely equals more certain (less risky) returns.

The strategies' ability to outperform comfortably, primarily comes from two factors: (a) the presence of high volatility, which enables higher premium yields; and (b) reinvesting these premium yields back into the underlying share, which ultimately leads to greater future premium and dividend yields creating compound growth.

The presence of transactional costs makes the relative success of the strategy quite sensitive to the size of the initial share portfolio, and this is of great consequence to retail investors. To this end, a portfolio of R100,000 (split evenly across five shares) was reliably found to be able to outperform an equity-only portfolio.

In terms of deciding on the option moneyness, a strong relationship was found between the optimal moneyness level and the prevailing compound rate of return for the current market phase while the ideal expiry period was typically in the 50-75 day range.

With respect to risk-adjusted returns (making use of a difference in Sortino ratios), their relationship to outperformance was in certain cases found to be quite predictable and positive. Moreover, regardless of whether there was a predictable relationship, it was only in a negligible number of cases that outperformance resulted in a negative difference (implying the equity portfolio had a superior risk metric). Thus, while it is not necessarily true that the presence of Covered Calls in the portfolio resulted in both an increase in return and a decrease in risk (and thus a violation of the efficient market hypothesis), it is true that the increase in return was not as a result of a disproportionate increase in risk, and therefore on a risk-adjusted basis the returns were superior.

The lack of a volatility risk premium in the data used has likely understated the outperformance results which might be available in the real world. This should be borne in mind when assessing the comparatively meagre outperformance achieved in the flatter market phases.

5.1 Limitations of the Study and Areas for Future Work

A key assumption in devising the strategies employed in this model was that the investor is knowledgeable about the current market phase. While this may seem like an easy aspect of the market to observe (and it certainly is with the benefit of hindsight), it is often the case that the market is some way into the next phase before it is commonly accepted by most to be the case. A further enhancement would be to devise a methodology for assessing the current market phase by examining various moving averages, and thereby set trading rules accordingly.

This study has exclusively relied on the comparison of Sortino ratios to determine whether outperformance was achieved in a risk optimal way. This is only one of many risk/return frameworks identified in the literature review as being more suitable for the analysis of portfolios containing options. Other metrics may yield differing or more insightful results than those obtained here, and this might be an area for further research.

Conducting the study over a longer time period may also have yielded further insightful results, but as the intention was to compare market phases to expiry range and moneyness this was not necessary. Future studies may want to pick up where this study has ended or start from an earlier period.

As the South African market evolves it may one day get to a stage where there is a liquid listed options market to provide a source of implied volatility data. It would be of interest at this point to run a similar study in parallel to assess the true impact of the use of dynamic historic volatility rather than implied volatility as has been favoured by many other authors.

While every effort was made to model real-world frictions as accurately as possible, one which was not considered was tax. The introduction of tax effects into the model would introduce considerable complexity into the decision-making process but might also yield interesting results. For example, an investor may prefer to pay a high premium and transaction cost to avoid the likelihood of having their shares called away in order to avoid triggering a capital gains event. Conversely, they may wish to be exercised at a low strike price, resulting in a comparatively lower capital gain, and then to pocket a higher premium which could be offset against other trading losses. The modelling of tax efficiency is quite complex and, again, this is something that could be studied further.

Following on from the tax discussion, an aspect which was not modelled is an action that a real-world investor is likely to take for tax or other reasons, that is to pay a large premium to buy back (close) their option position when it is likely that it will be exercised. This would have the effect of

avoiding the transaction costs to rebuy the equity position, but would adversely affect free cash, possibly requiring the investor to maintain a cash fund to be able to do this, the effects of which are unknown.

A single set of transaction costs were considered for this study. If these costs change significantly in the future it may again yield different outcomes and it may be of interest to conduct the study under these conditions.

Another further improvement on the model would be to calculate a dynamic moneyness and/or expiry range at the time of writing an option based on the volatility of the preceding period. It is likely that a dynamic model such as this would yield outperformance and risk results superior to those uncovered here.

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7 APPENDIX

7.1 QuantTools Black Scholes Vanilla Option Price Excel Plugin

Excerpt from the usage notes:

7.1.1 *Purpose*

Calculates the premium of an American or European-styled vanilla option.

7.1.2 *Parameters*

The function is used as follows:

```
=vanillaOption(valuationDate, maturityDate, OptionStyle, CallorPut, Spot, Strike, BorrowingCost, Dividends, Volatility, zeroCurve)
```

where the parameters are:

- `valuationDate` - The value date of the option as an Excel date.
- `maturityDate` - The maturity date of the option as an Excel date.
- `optionStyle` - The option style is either EUROPEAN (also "e") or AMERICAN (also "a").
- `CallorPut` - The option can have either a PUT or a CALL payoff.
- `Spot` - The spot value of the underlying.
- `Strike` - The strike value of the option in the same currency unit and the spot.
- `BorrowingCost` - The borrowing cost expressed as an annually compounded rate (NACA).
- `Dividends` - The table of discrete dividends estimated during the tenure of the option. This table consists of three columns, the first column is the dividend type (d = discrete dividend amount or y = discrete dividend yield), the second the ex-dividend date as an Excel date and the third column contains the corresponding dividend amount in the same currency units as the spot if dividend type is "d", otherwise a percentage yield is expected. Dividend ex-dates that occur on or before the valuation date or after the maturity date are ignored as these should not impact on the option price.
- `Volatility` - Volatility is entered as a table with two columns to represent a volatility curve. The first column is the number of days ahead (not an Excel date!) from the valuation date and the second column contains the corresponding annualised volatility percentage. If a flat volatility is required, the user can either (i) enter a volatility curve with the same volatility value at each day ahead or (ii) have only one line in the table. Note that when a curve is specified but the last day on the curve is less than the maturity date of the option, the volatility is automatically extrapolated as a flat curve from the last defined value. Linear interpolation is used to obtain volatility values between the discretely specified days ahead values.

- `zeroCurve` - The zero curve is used for discounting future cash flows. It is entered as a table with two columns to represent a zero curve. The first column is the number of days ahead (not an Excel date!) from the valuation date and the second column contains the corresponding zero rate. If a flat zero rate is required, the user can either (i) enter a zero curve with the same rate at each day ahead or (ii) have only one line in the table. Note that when a curve is specified the last day on the curve must be at least equal to the maturity date of the option. If this is not the case the curve will be extrapolated as a flat curve from the last defined value. Linear interpolation is used to obtain rates between the discretely specified days ahead values. It is assumed that all rates specified on the zero curve are annually compounded rates (NACA).

7.1.3 *Example*

Consider an American call option valued on the 21 Feb 2003 expiring two years later with a flat volatility of 40% pa. The two year zero rate is 10% NACA. The spot price on valuation date is ZAR100 and the strike is the same amount. Future dividends are estimates as ZAR2 and ZAR3 on 22 Aug 2003 and 21 Aug 2004 respectively. The option can be valued by typing the following in cell C21 shown in the figure below:

```
=vanillaOption(C4,C5,C6,C7,C8,C9,C10,C12:E13,C15:D16,C18:D19)
```

The value of the option on 21 Feb 2003 is therefore ZAR26.90.

7.1.4 *Limitations*

The following limitations are noted:

- Business days - currently no check for business days are done.