THE BOND AND BOND OPTION MARKET: THE CASE OF SOUTH AFRICA 1984–2014

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Abstract

Bond option transactions from a hedging perspective are currently almost non-existent in the South African bond and bond option market. As a result of comments and suggestions made by academics and independent observers a study was conducted in the South African bond options market amongst former and current bond option traders. The goals of the present study was to establish if bond options can be an effective hedging tool in the South African bond market, to conduct empirical tests on the basic option hedging strategies to ascertain these particular strategies' suitability as hedges against investment risk by using actual market movements in the South African bond market, and to formulate recommendations that could be implemented to re-establish bond options as a viable hedging instruments in South Africa and also introduce it to Africa.

Keywords: Bond, Bond Option Transactions, South Africa

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1 Introduction

Bond option activity and liquidity in the South African bond market declined in the period 1994 to 2014 to the extent that it is currently almost non-existent (Erasmus 2014). In addition, Ndung'u, (2014) mentioned that in most eastern and western African countries there is a total absence of a liquid bond option markets even though some of these countries are trading in government bonds and have implemented the Basel II Accord.

In Africa, the use of bond options started in the early 1980s in South Africa. The initiative was taken by a number of banks, and one of the public utility companies, called ESCOM at the time. The bond option market that was established in South Africa was an over the counter market where predominately American bond options with a fixed strike rate, expiry date and underlying bond were traded. The main reason for using bond options in South Africa was to enhance the marketability of bonds issued as funding instruments and to establish a mechanism where investments in bonds and bond options could be hedged against investment risk (Bullard, 1987; Davey, 1992).

The South African bond option market grew substantially in terms of nominal value and turnover but Stals (1988) found that the bond option transactions in South Africa were mainly concluded by market participants with a speculative purpose instead of a hedging purpose in mind. Erasmus (2014) recommended that new research should be conducted to assess the effectiveness, efficiency and appropriateness of bond options as hedging instruments to mitigate the investment risk of bonds.

The importance of a capital market is stressed by Du Plessis, (2001) when this particular market is described as a place where the supply and demand of funds with a maturity of more than twelve months meet. The funds that change hands in this market take the form of amongst other fixed interest securities (bonds). Faulkner (2007) defines bonds as marketable certificates issued by amongst other central governments, statuary bodies, local governments and corporate companies with the purpose of funding operations.

Hewittunnisknup (2014) estimates that the size of the global invested capital market grew from USD$61.4 trillion in 2004 to USD$101.1 trillion by the end of 2013 and it is further estimated that bonds represent 75% of the global invested capital market (QVM Group LLC, 2014).

However, investments in bonds are not risk-free and can be exposed to amongst other investment risk (Conley, 2014). Falkena (1987) defines investment risk as the decline in the price of a bond due to a change in the yield of such a bond. A capital loss can be incurred when the bond is sold before its maturity date at a higher yield than the original purchase yield.

In addition, it is also possible to invest in options on bonds (Falkena, 1987). By the same token, investments in bond options are also exposed to investment risk. A loss can be incurred by selling the option before its expiry date at a lower price than the original purchase price due to movements in the yield of the underlying bond.

McFarlin (2013) is of the opinion that hedging strategies using options can be used to mitigate investment risk to which investments in bonds and bond options are exposed. The earliest use of options as a financial instrument appeared during the Middle Ages, when it was used in trading of goods. In the 17th century, the Dutch tulip producers started using options to guarantee minimum prices for the tulips but this practice collapsed because the contracts were not honoured. During the 18th century, options were commonly used in London and the United States but the market was chaotic due to the misbehaviour of participants. It was only during 1973, when the Chicago Board Options Exchange was established, that options were traded on an organised basis (Chance, 2008; Poitras, 2008).

In view of the comments made by Ndung'u (2014), Stals (1988) and Erasmus (2014), a study was conducted to ascertain the use of bond options as a tool to mitigate investment risk to which investments in bonds and bond options are exposed to. The goal of the present study was firstly to establish if bond options can be an effective hedging tool in the South African bond market by research amongst past and current bond market option traders. Secondly, to conduct empirical tests on the identified basic option hedging strategies to ascertain these particular strategies' suitability as hedges by using actual market movements in the South African bond market. Thirdly, to formulate recommendations that could be implemented to re-establish bond options as a viable hedging instruments in South Africa and also introduce it to Africa.

In reaching these goals, a specific methodology was followed. This specific methodology consisted of interviewing past and current bond option traders in South Africa to identify basic investment positions in bonds and bond options, identify appropriate option hedging strategies, empirically testing the effectiveness of these particular strategies based on profitability, and then providing specific recommendations.

The empirical testing of the effectiveness of the strategies was based on actual market movements (closing yields) as recorded by the Bond Exchange of South Africa for the period 6 January 1989 to 28 December 1990. The reason for choosing this specific period was that the bond market was liquid during that period and it incorporated an upward cycle as well as a downward cycle of bond yields in the South African bond market.

In ascertaining the profitability of the hedging strategies, bonds were priced using the South African bond pricing formula (Johannesburg Stock Exchange [JSE], 2005) and bond options priced using the Black and Scholes option pricing model (Bradley, 2004).

The present study contributes to the existing body of knowledge by offering specific recommendations on how to re-establish the bond option market as a viable hedging instrument in South Africa. In addition, these recommendations can also be applicable to other developing African countries where bond option markets are non-existent or not fully utilised yet.

2 Research methodology

As stated above, a specific research methodology was followed to achieve the goals of the present study. The figure below details this methodology.

Figure 1. Research methodology

Research on bond options as hedging instruments amongst former and current bond option traders

Empirical testing of identified hedging strategies to ascertain effectiveness

Recommendations on the re-establishment as options as hedging instruments

Source: Author's own compilation

The research was firstly aimed at obtaining information on hedging strategies that was used by bond option traders during the early years of bond option trading in South Africa. The bond option traders, past and current, were selected on the basis of involvement in the South African bond option market. Semi-structured interviews were used based on relevant aspects regarding bond option trading. The interviews conducted were strictly confidential and, at their explicit request, none of the traders interviewed were named.

Specific information was obtained from the traders by way of the following research questions:

- What are the basic investment positions, in bonds and bond options, available in South Africa?
- Do you think that market participants regard the current South African bond formula as sufficient and understand it?
- Do you think that the Black and Scholes option pricing model is still applicable to South Africa?
- What basic option hedging techniques can be used?
- Should the South African bond option market be an "over-the-counter" or an exchange traded market?
- What role do you think the Government and other bond issuers can play in the revival of the bond option market from a hedging perspective?

A total number of 22 bond option traders were interviewed from a total of 25 bond option traders who were invited to participate.

Secondly, the identified bond option hedging strategies were empirically tested to ascertain its effectiveness as hedging instruments by using actual bond data in South Africa.

Lastly, a set of recommendations were formulated to contribute to the re-establishment of bond options as hedging instruments.

3 Results

The following results were obtained:

3.1 Basic Investment Positions in Bonds and Bond Options

The bond option traders identified six basic positions an investor can enter into when investing in a bond or bond option, namely:

- Buying a bond
- Selling a bond
- Buying a call option
- Selling a call option
- Buying a put option
- Selling a put option

The explanations of these positions are detailed in Annexure A.

3.2 South African bond formula

The bond option traders interviewed were of the opinion that the South African bond formula (Gitman, 1994) is effective and suitable even though the formula uses the cum interest and ex-interest conventions in the pricing methodology. Cum interest means the amount of interest accrued in the time between the last coupon date and the settlement date. The investor buying the bond receives the full coupon payment and is required to pay the portion which is not due to him/her, to the seller. Ex-interest is the amount of coupon interest between settlement date and the next coupon date. The seller is required to pay

the portion of interest not due to the investor since the seller has already received the full coupon payment.

The traders were however of the opinion that foreign bond option traders do not always understand the mechanics of this particular formula as other overseas countries often have different bond pricing models.

To clarify the mechanics of this particular bond pricing formula to foreign bond traders, the South African bond formula can be written as:

$$B_0 = \frac{I}{2} \sum_{t=1}^{2n} \left[\frac{1}{(1+\frac{k_b}{2})^t} \right] + M \left[\frac{1}{(1+\frac{k_b}{2})^{2n}} \right]$$

This pricing formula can also be written as follows:

$$B_0 = \frac{I}{2} \left(PVIFA_{\frac{kb}{2},2n} \right) + M \left(PVIF_{\frac{kb}{2},2n} \right)$$

Where:
B_0 = Price of the bond
I = Coupon interest rate of the bond
n = Years to expiry
M = Nominal value of the bond
k_b = Current yield to maturity of the bond
PVIFA = Present value factor for an annuity
PVIF = Present value factor for a single amount

3.3 Black and Scholes option pricing model

All the traders interviewed were of the opinion that the Black and Scholes option pricing model as detailed by Bradley (2004) are sufficient for South African bond option pricing purposes. The traders were also of the opinion that to standardise bond option pricing in South Africa, this particular model should be used as detailed below:

Call option premium (C) $= Ue^{-rt}$ N(h) - Ee^{-rt} N(h - v$\sqrt{t}$)

Put option premium (P) $= Ue^{-rt}$ N(-h) + Ee^{-rt} N(h - v$\sqrt{t-h}$)

Where:
U = price of the bond
E = strike rate of the bond option
t = time to maturity of the option
v = volatility
ln = natural logarithm
e = basis of the natural logarithm
r = risk-free interest rate
N = cumulative normal density function
and

h $= \frac{\ln\left[\frac{U}{Ee^{-rt}}\right]}{v\sqrt{t}} + \frac{v\sqrt{t}}{2}$

The delta of an option is given by:
Call option = N(h)
Put option = -N(-h)

3.4 Bond Option Strategies

The research conducted amongst the bond option traders revealed that there are a number of possible

basic bond option strategies an investor could implement when hedging the six basic positions as mentioned above. The explanation of these strategies

is included under Annexure B. These strategies are depicted in figure 2 below.

Figure 2: Bond option hedging strategies
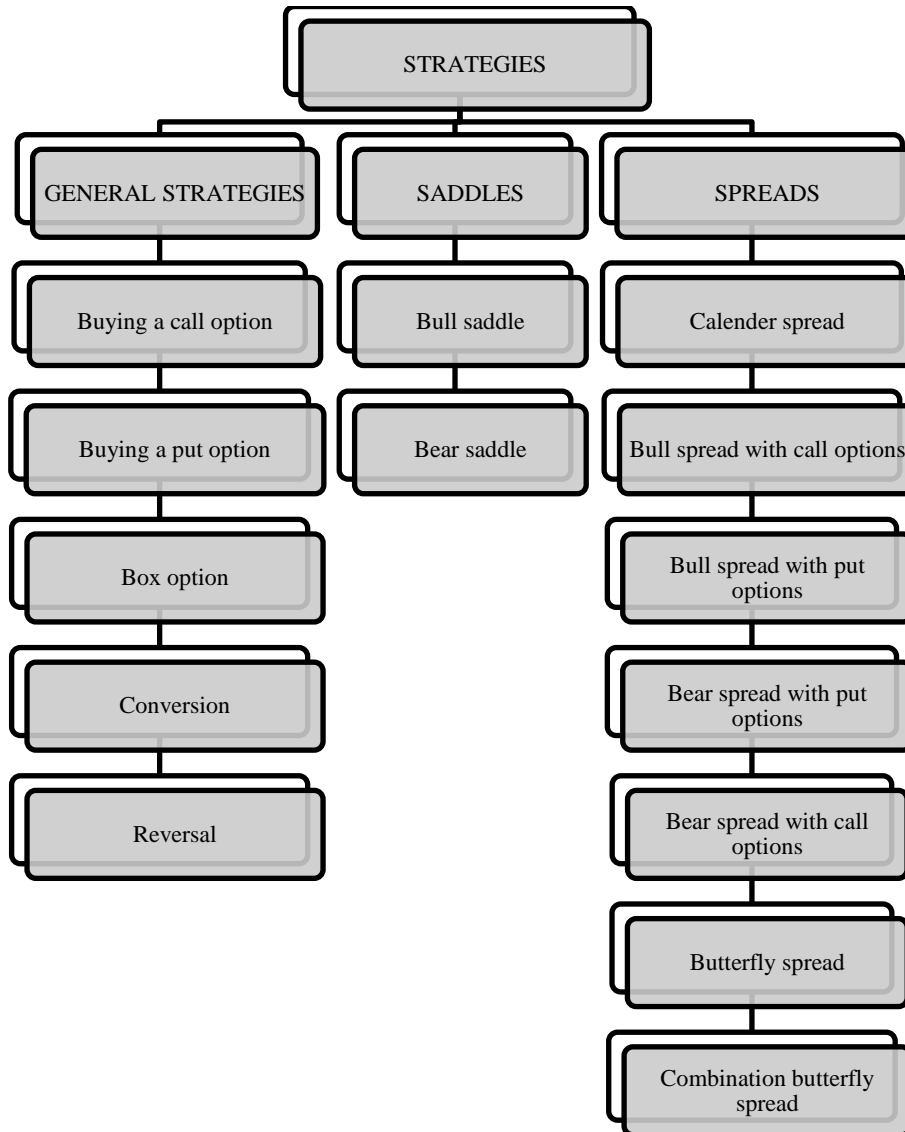
Source: Author's own compilation

These strategies identified by the options traders were tested as possible option hedging strategies in the empirical testing phase below.

3.5 Over-the-counter or Traded options market

Majority of the traders interviewed were of the opinion that to re-establish the bond option market in South Africa it should be an exchange traded market and not an "over-the-counter" market. The main reason given by the traders was that an exchange traded option market provided a regulated, secure market to all participants.

3.6 Role of bond issuers

The participating bond option traders were all unanimous that the Government and other issuers of bonds for funding purposes should play a leading role in the revival of the bond option market from a hedging point of view. The traders pointed out that the future liquidity of the bond option market depends largely on the involvement of the issuers of bonds.

3. 7 Empirical Testing

In the empirical testing of the effectiveness of the hedges, the South African bond, E168, was chosen. During the period under review, 1989 to 1990, the E168 bond was the most tradable in the South African bond market and a liquid E168 bond options market existed (Bullard, 1987; Davey, 1992).

In testing the effectiveness of the hedging strategies the following procedure was followed:

- Creating an investment position using each of the mentioned six types of positions based upon the actual movements of the E168 over the period 1 January 1989 to 31 December 1990 as indicated in Figure 2 below.

- All the different types of hedging strategies were then applied as a possible hedge for each position, again based on the actual movements in the yield of the E168.
- The E168 bond was priced using the South African bond formula and the bond options using the Black and Scholes model.
- Only bond options with the E168 as underlying bond were used.
- The net cash flow was then calculated based on the premiums paid/received for the options at the initiation of the hedge.
- Lastly, the effectiveness of the hedge was calculated based on the profit/loss incurred when the options expired as per the actual movements of the E168 over the period.

Figure 3. Yield to Maturity (YTM) of the E168 over the Period 1 January 1989 to 31 December 1990
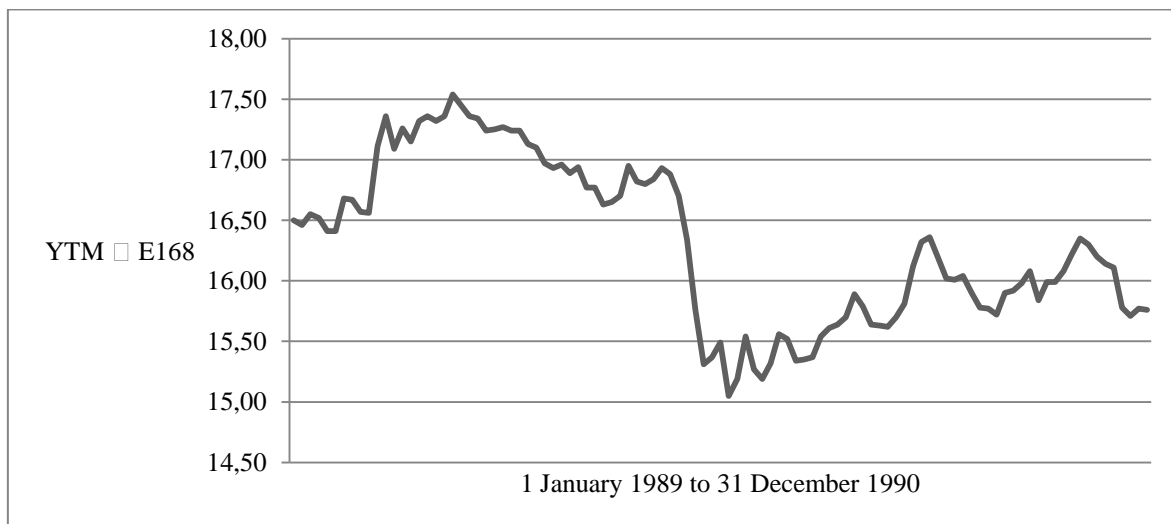
Source: Investing, 2015

The following is an example of how the testing was conducted:

- An investor short sold an E168 on 6 January 1989 at 16.50%.
- The investor hedged this position by buying an E168 call option with a strike rate of 16.50%, which expired on 13 January 1989. The premium the investor paid for the option was R2 684,49.
- On 13 January 1989 the yield of the E168 bond was 16.46%.
- The investor had to exercise the call option, and bought an E168 at 16.50%.
- The loss on the hedge was the premium paid for the call option.
- The hedge was effective as the loss was limited.

The basic investment positions were theoretically hedged using all the hedging strategies and the same methodology as above. In addition, the testing was repeated using another set of data but also in the same period as stated in Figure 2 above. The testing was conducted to identify the complete hedge(s) and partial hedge for each type of investment position where 'complete hedge' means that the profit/loss is known at the institution of the hedge. Partial hedge means that there is still an element of risk present that cannot be hedged.

3.7.1 Results from empirical testing

The results below indicate the profit or loss attained with the hedge. The profit or loss attained includes actual capital profits and losses as well as the premiums paid or received on the different options. The premiums were actual calculated premiums and not negotiated premiums which could differ in a real-life market situation. During the first and the second test, the yield of the E168 went through periods of rising and declining interest rates.

The following sections detail the results of the two empirical tests to find the complete hedge:
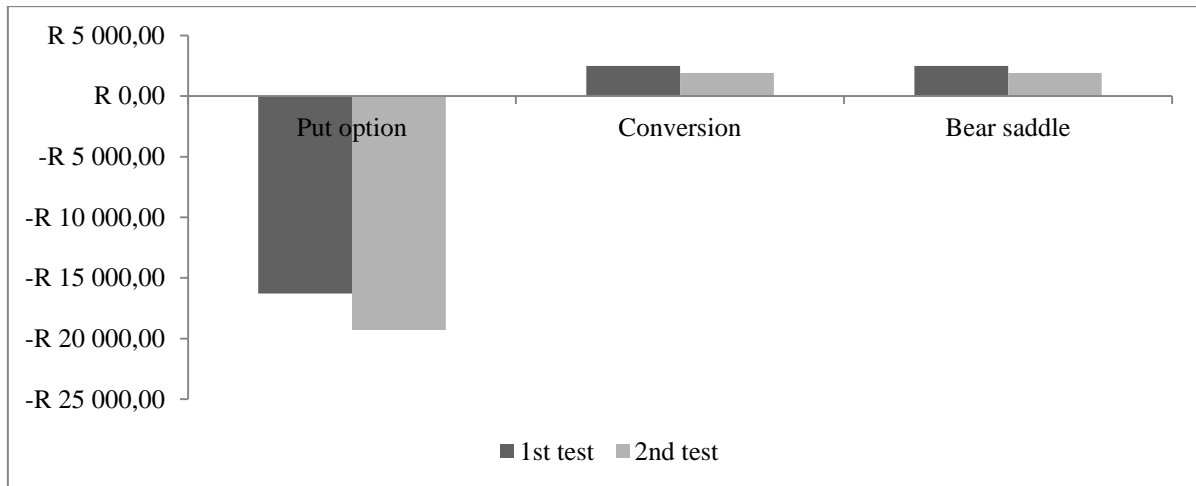
3.7.2 Long position in a bond

Figure 4 below reflects the results from the two tests and indicates the profit or loss attained with the hedges.

Buying a put option, buying a bear saddle and instituting a conversion provided a complete hedge.

The profit/loss was known at the implementation of the hedge even though the hedge with the put option produced a loss. Instituting a bear spread with put options or a calendar spread provided only a partial hedge.

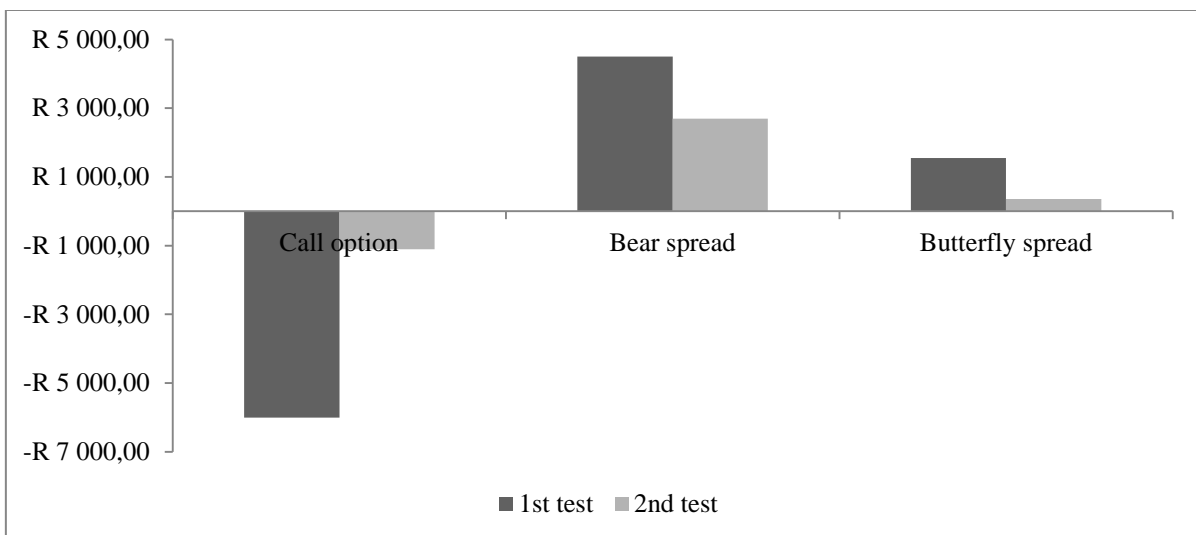**Figure 4.** Profit and loss results of hedging a long position in a bond

Source: Author, 2015

3.7.3 Short position in a bond

Figure 5 below reflects the results from the two tests and indicates the profit or loss attained with the hedges.

Figure 5. Profit and loss results of hedging a short position in a bond
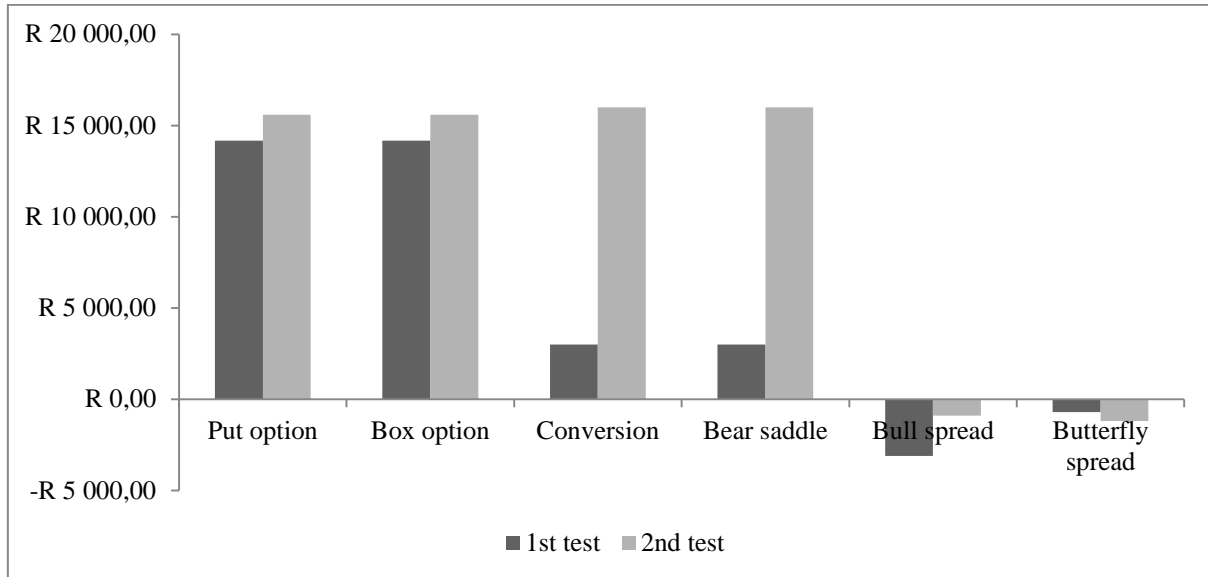

Source: Author, 2015

Buying a call option, instituting a reversal, and buying a bear saddle provided a complete hedge. The profit/loss was known at the implementation of the hedge even though the hedges all produced losses. The losses produced by the reversal and bear saddle were however consistently smaller than the hedge with the call. Instituting a bear spread with call options or a calendar spread provided only a partial hedge.

3.7.4 Long position in a call option

Figure 6 below reflects the results from the two tests and indicates the profit or loss attained with the hedges.

Figure 6. Profit and loss results of hedging a long position in a call option
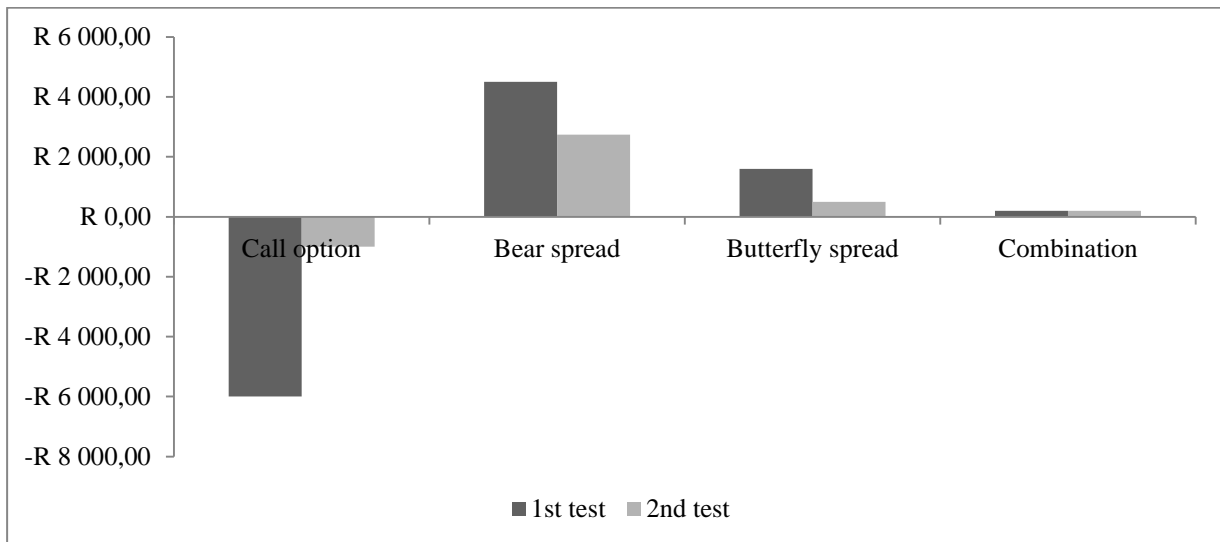

Source: Author, 2015

Buying a put option, instituting a box option, instituting a conversion, buying a bear saddle, instituting a bull spread and instituting a butterfly spread provided a complete hedge. The results indicated that a hedge using either a put option or a box option provided the largest profit consistently.

Selling a covered saddle, instituting a calendar spread or a roll over provided only a partial hedge.

3.7.5 Short position in a call option

Figure 7 reflects the results from the two tests and indicates the profit or loss attained with the hedges.

Figure 7. Profit and loss results of hedging a short position in a call option

Source: Author, 2015

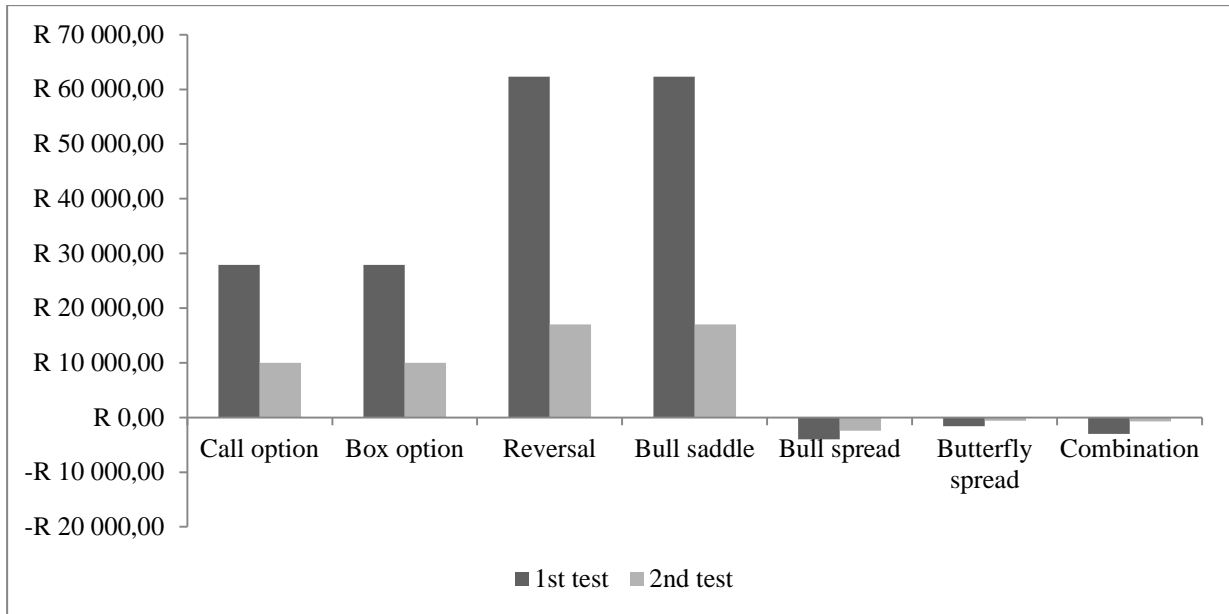Buying a call option, instituting a bear spread, instituting a butterfly spread or a combination

provided a complete hedge. Instituting a box option, instituting a reversal, buying a bull spread or

instituting a calendar spread provided only a partial hedge.

3.7.6 Long position in a put option

Figure 8 below reflects the results from the two tests and indicates the profit or loss attained with the hedges.

Figure 8. Profit and loss results of hedging a long position in a put option
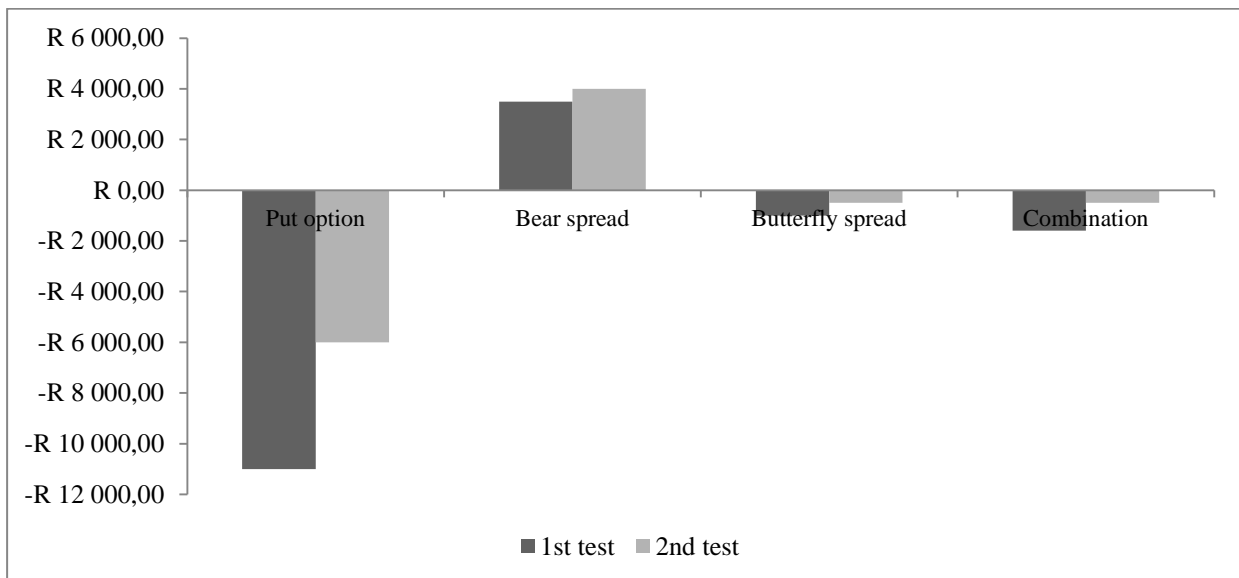

Source: Author, 2015

Buying a call option, instituting a box option, instituting a reversal, instituting a bull spread, instituting a butterfly spread, instituting a combination or buying a bull saddle provided a complete hedge. Selling a bear saddle, instituting a calendar spread or instituting a roll over provided only a partial hedge.

3.7.7 Short position in a put option

Figure 9 below reflects the results from the two tests and indicates the profit or loss attained with the hedges.

**Figure 9.** Profit and loss results of hedging a short position in a put option

Source: Author, 2015

Buying a put option, instituting a bear spread or a butterfly spread or a combination provided a complete hedge. Buying a bear saddle, instituting a box option or a reversal or a calendar spread or a roll over provided only a partial hedge.

4 Recommendations

In view of the results obtained and described above, the following are the recommendations that could contribute to the re-establishment of the bond option market as a hedging alternative in the South African bond options market. The recommendations are depicted in figure 10 below.

Figure 10. Recommendations
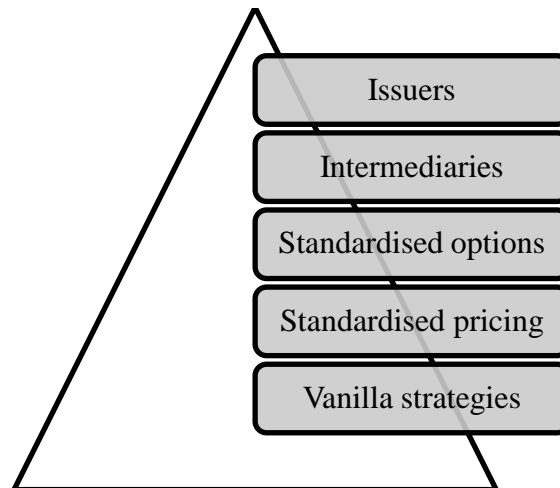
Source: Author, 2015

4.1 Recommendation 1: Issuers

The issuers of bonds should use bond options as vehicles to obtain funding from the capital market. These bond issuers should include the Government, semi-government organisations and other commercial companies. The issuer can for example use call options to obtain the necessary funding when the call options are exercised. The issuer does not have to have an expensive in-house trading operation. The trading of the options can be outsourced to other financial intermediaries that can trade on their behalf. The intermediary can be used to make an active market in the issuer's options to enhance the hedging capabilities if bond options.

The advantage to issuers using bond options as funding vehicles in the bond market and making an active market is that required funding can be planned well ahead by issuing options in certain time bands thus mitigating investment risk. The cost of funding to the issuer can also be reduced by selling call options and thus earning an option premium. An added advantage to the issuer is that the active trading of the issuer's options enhances its marketability and thus making future options issues and hedging easier.

4.2 Recommendation 2: Intermediaries

The re-establishment of financial intermediary firms in the bond option market is recommended. These intermediaries can be any capable organisation from a bank to a broker firm. There could be a cost attached to using an intermediary firm but these firms are important components in providing liquidity and hedging opportunities to the bond option market.

Liquidity in the bond option market means that a market participant has counterparties available to trade with. Liquidity could enhance the use of options from a hedging point of view.

4.3 Recommendation 3: Standardised options

The use of standardised options is recommended for South Africa. In contrast to over-the-counter options standardised options means options with a fixed maturity date, fixed strike rate and specific underlying bond. These bond options should also be listed and traded on an official exchange under regulated conditions.

Funding and hedging with bond options should benefit from this structure as the credit risk component of options - settlement of the premiums and delivery of the underlying bond on exercise date - could be largely eliminated.

The use of limited over-the-counter options is still recommended but only for short-term hedging purposes. In this context short-term means a bond option that expires within one week of the transaction date of the option. It also means a bond option without a fixed maturity date or fixed strike rate, all of which are negotiated between the buyer and seller of the option.

4.4 Recommendation 4: Standardised pricing

As discussed above, the South African bond pricing formula and the Black and Scholes option pricing model is recommended for pricing bonds and bond options. The advantages are that all market participants can price bonds and bond options without the risk of arbitrage or mismatched pricing. It also means that a standardised method is used by all market participants for mark-to-market purposes.

4.5 Recommendation 5: Vanilla strategies

The use of plain vanilla option hedging strategies as detailed above is recommended for South Africa. The research, empirical testing, in this study has revealed that these identified strategies can be effective for hedging purposes.

There are more technical hedging techniques available but these are not recommended as liquidity in the bond options market, as explained above, could be problematic. In addition, these highly technical bond option strategies could not fit into the suggested framework detailed in recommendation three above.
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5 Conclusion

Suggestions that the activity and liquidity in the South African bond options market had declined to such an extent that it is currently non-existent were investigated. Various reasons for this decline were identified amongst other that bond options were used for speculative instead of hedging purposes.

Research in this study has found that there are hedging techniques available that can be effective. These identified techniques were empirically tested against actual market movements in the South African bond market and the current study found that these techniques can be used as effective hedging instruments in the South African bond option market.

Specific recommendations were formulated to enhance the use of bond options for hedging positions in South African bond market. These recommendations included the enhanced role of the issuers of bonds, the re-introduction of intermediary organisations in the bond option market, trading in standardised bond options instead of over-the-counter options, the use of the South African bond pricing formula and the standard Black and Scholes bond option pricing formula and the use of plain vanilla hedging techniques.

The above recommendations can also be implemented in other African countries to enhance their particular financial systems.

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Appendices

Annexure A. Basic investment positions

Positions	Explanation
Buying a bond	Pascalroussel (2008) describes the buying of a bond as a so-called 'long position' where an investor purchases the bond and owns it with the intent to sell it later at a profit or keep it until the maturity date of the bond. The risk involved in taking this position is that the investor might incur a capital loss when selling the bond at a higher yield than the original purchase yield and this loss is unlimited. Even in the event that the investor keeps the bond until maturity, a loss is still possible. The investment could have been switched to another investment in a bond with a resultant lower loss or even a profit, which is often referred to as an 'opportunity cost/loss'.
Selling a bond	Grant (2003) explains the selling of a bond as a so-called 'short position' where the investor sells the bond, which is not owned, and the transaction is done with the intent to purchase the bond later and making a profit in the process. Should the market yield on the bond not rise, the investor might incur a capital loss when buying the bond at a lower market yield than the original selling yield. The investor, however, needs to deliver the bond to the buyer thereof on the settlement date of the transaction. In the event that the bond is not purchased for a particular settlement date a carry transaction (borrowing the bond) will have to be concluded. The carry transaction consists of buying a bond (the same bond as the short position) for the current settlement date and selling the same bond for the next settlement date. Additional costs can be incurred in this carry transaction, especially if the short position is carried for prolonged periods of time. The shortening of a bond can thus be seen as a short-term investment strategy.
Buying a bond call option	Buying a call is for investors who expect the underlying bond's market yield to decline during the term of the option, and is an alternative to buying the bond outright. If the underlying bond's market yield does in fact decline, the investor will be able to sell the call option at a profit at some point before expiration (Rosenburg, 2014). The risk in this strategy is limited and the maximum loss that the investor can incur is equal to the premium paid for the call option. The profit on this strategy is the monetary value of exercising the option (based on strike yield of the bond minus market yield of the bond) minus the premium paid for the option.
Selling a bond call option	Riddix (2012) explains that the seller of a call option expects the underlying bond's market yield to increase during the term of the option. This is an alternative to buying the bond outright. If the underlying bond's market yield does in fact increase, the investor will be able to sell the call option at a profit at some point before expiration. For the seller, the profit is the premium received for the option if the yield for the bond does in fact increase. The risk for the seller of the call option is unlimited and the maximum loss is unlimited. The reason for this is that the yield of the underlying bond can decline over the lifetime of the option resulting in the value of the call option increasing.
Buying a put option	When an investor buys a put option, he/she has the right to sell the underlying bond at a pre-determined yield, also called a strike yield. The investor expects the yield of the underlying bond to increase over the lifetime of the put option. The risk in this strategy is limited and the maximum loss that the investor can incur is equal to the premium paid for the put option. (Rahemtulla, 2010). The profit on this strategy is the monetary value of exercising the put option (based on strike yield of the bond minus market yield of the bond) minus the premium paid for the put option.
Selling a put option	When an investor sells a put option, he/she obligates to buy the underlying bond at a pre-determined yield also called the strike yield. The investor expects the yield of the underlying bond to decrease over the lifetime of the put option. The risk in this strategy is unlimited and the maximum loss is also unlimited (Rahemtulla, 2010). The maximum profit on this strategy for the seller is the monetary value of the premium received for the sale of the option.

Annexure B. Basic hedging strategies

Strategy	Explanation
Buying a call option	Ianieri (2010) describes buying a call option as a possible strategy to hedge a short position in a bond against declining yields of the bond. Buying a call results in a known cost as the maximum loss is known at the initiation of the strategy, the premium paid for the call option.
Buying a put option	This hedging strategy is traditionally used for hedging a long position in a bond against rising yields of the bond (Ianieri, 2010). Buying a put option results in a known cost as the maximum loss is known at the initiation of the strategy, the premium paid for the put option.
Box option	Thomsett (2011) describes a box option as a fairly complex option strategy that can hedge against risk and generate returns. In its most basic form, a box option can be instituted, for example by hedging a long position in an option (for example a call option) by buying an opposite option (for example a put option). By instituting a box option strategy, the cost is known (premiums paid for the options) but the profit can be unlimited provided the yield of the underlying bond moved substantially.
Conversion	An investor can use a conversion to hedge a long position in a bond by buying a put option and selling a call option and thus creating an equivalent synthetic short stock (long put + short call) position (Optionshouse, 2012a). The cost of the conversion is known when instituted (premiums paid for the options) but the profit/loss is limited to either the difference between the yield of the bond and the strike rates of the options. Which option (call or put) will be exercised depends on whether the market yields have increased or decreased.
Reversal	According to Optionshouse (2012b), an investor can use a reversal to hedge a short position in a bond by buying a call option and selling a put option and thus creating an equivalent synthetic long stock (long call + short put) position. The cost of the reversal is known when instituted (premiums paid for the options) but the profit/loss is limited to either the difference between the yield of the bond and the strike rates of the options. Which option (call or put) will be exercised depends on whether the market yields have increased or decreased.
Bull saddles	A bull saddle can be regarded as the same as a reversal by buying a call option and selling a put option with the view that market yields will decline. No short position in the underlying stock is instituted. This strategy can be regarded as a bullish strategy (Tradeking, 2012). The cost of the bull saddle is known when instituted (premiums paid and received for the options) but the profit/loss is unlimited depending on where the market yield of the underlying bond is at the expiry date of the options. Which option (call or put) will be exercised depends on whether the market yields have increased or decreased.
Bear saddles	A bear saddle can be regarded as the same as a conversion by buying a put option and selling a call option with the view that market yields will increase. No long position in the underlying stock is instituted. This strategy can be regarded as a bearish strategy (Tradeking, 2012). The cost of the bear saddle is known when instituted (premiums paid and received for the options) but the profit/loss is unlimited depending on where the market yield of the underlying bond is at the expiry date of the options. Which option (call or put) will be exercised depends on whether the market yields have increased or decreased.
Calendar spread	Smith (2012) explains a calendar spread as selling an option that expires in the near future and buying an exact similar option with a later expiry date. This combination creates a fairly neutral position that benefits from the accelerated time decay of the near future option sold short. A calendar spread is one of the most useful options strategies out there because it allows investors to make directionally biased trades at a lower cost basis than with outright purchases of puts or calls. The cost of the calendar spread is known when instituted (premiums paid and received for the options) but the profit/loss is unlimited depending on where the market yield of the underlying bond is at the expiry date of the near option.
Bull spread with call options	Fidelity (2013a) explains a bull spread with call options as a strategy of buying a call option with a higher strike rate and selling a call option with a lower strike rate, both with the same expiry date. The advantage of a bull spread with call options is that the risk is limited because the short position in the one call is covered by the long position in the other call. Profit is also limited to the nett option premium paid or received as well as the profit locked in between the strike rates of the options on condition that the market yield of the underlying bond is below the strike rate of the short position when the options expire.
Bull spread with put options	A bull spread with put options is instituted by selling a put option with a lower strike rate and buying a put option with a higher strike rate, both with the same expiry date (Fidelity, 2013b). The advantage of a bull spread with put options is that the risk is limited because the short position in the one put option is covered by the long position in the other put option. Profit is also limited to the nett option premium paid or received on condition that the market yield of the underlying bond is below the strike rate of the short position when the options expire.
Bear spread with put options	Options Industry Council (OIC) (2012a) describes a bear spread with put options as a strategy of selling a put option with a higher strike rate and buying a put option with a lower strike rate, both with the same expiry date. Because of the way the strike prices are selected, this strategy requires a net cash outlay (premium) at the introduction of the strategy. Profit is also limited to the net option premium paid or received as well as the profit locked in between the strike rates of the options on condition that the market yield of the underlying bond is above the strike rate of the short position when the options expires.
Bear spread with call options	Options Industry Council (OIC) (2012b) describes a bear spread with call options as a strategy of buying a call option with a lower strike rate and selling a call option with a higher strike rate, both with the same expiry date. Because of the way the strike prices are selected, this strategy normally has a net cash inflow (premium) at the introduction of the strategy. Profit is also limited to the net option premium paid or received as well as the profit locked in on condition that the market yield of the underlying bond is above the strike rate of the long position when the options expire.
Butterfly spread	A butterfly spread is a combination of a bull and a bear spread using either call options or put options by buying an option with a high strike rate, buying an option with a low strike rate and selling two options with a strike rate between the high and low strike rate. It is a neutral strategy for low volatility in the market for the underlying bond. This strategy has limited risk but also limited profit as it is non-directional (Optionspundit, 2011).
Combination butterfly spread	A combination butterfly spread consists of a butterfly spread using call options as well as a butterfly spread using put options. It is a neutral strategy for low volatility in the market for the underlying bond. This strategy has limited risk but also limited profit as it is non-directional.