# Non-Discretionary S&P 500 Options Trading Systems Backtest

# PART 2
# Model Calibration and Evaluation of Credit Spread Option Combinations

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## SUMMARY

The Theoretical Options Model using the Black-Scholes Model for American Calls and the Bjerksund and Stensland approximation model for American Puts was calibrated against an actual options data-base provided by IVolatility. Further studies were then conducted evaluating several options trading approaches including Credit Spreads. The results showed that Credit Spreads are an excellent Options combination with reduced risk when compared to the Short Only Option approach. The comparison of the results using the Theoretical Model versus using the actual options database for both the Short Only Options case and the Credit Spreads Options case are presented in Appendix 1. The summary of the results for the Short Only and the Credit Spread Options are presented in Appendix 2. The results of the Credit Spread Strategy for the S&P 500 futures options using the SPX options data as a proxy and assuming a 250 point multiplier is presented in Appendix 3. This test offers a reasonable estimate of the profitability of a Credit Spread Strategy applied to the S&P 500 futures options. Trade by Trade and a Summary report for the SPX Credit Spread options Strategy is presented in Appendix 4.

## ANALYSIS

As a review, you might remember from the first report on this project that we are using a non-discretionary adaptive mechanical trading system to trade options as Long Only, Short Only or some other Options Combination such as Credit Spreads, Ratio Backspreads, Dynamic ReHedging, etc. The Options Testing Engine is used to produce an equity stream of these options trades and summary reports are created showing important criteria. Both Theoretical Options Models and Actual Options Price Data are used as options pricing generators and significant time has been spent on calibrating the Theoretical Model for use within the testing engine.

This report will concentrate on Credit Spreads since they offer a realistic compromise between the potential for reward in option trading while protecting the downside risk and reducing drawdown.

Credit Spreads consist of an In-The-Money (ITM) option sold short so as to accept a premium, and an Out-Of-The-Money (OTM) option purchased, to limit the downside risk. The overall combination takes in a premium, hence the name “Credit Spread”. The downside risk is limited by the OTM option’s strike location relative to the ITM strike location. The Credit Spread is either fully or partially unwound, or held to expiration. Credit Spreads are not as profitable as Short Only Options due to the insurance purchased with the OTM options, but offer more peace of mind knowing that downside risk is somewhat limited. Of course, should a position move against the spread in such a manner that Deltas of the OTM options do not completely hedge the losses incurred by the ITM options, losses may exceed the theoretical maximum loss for Credit Spreads of the difference of the strike prices minus the credit taken in.

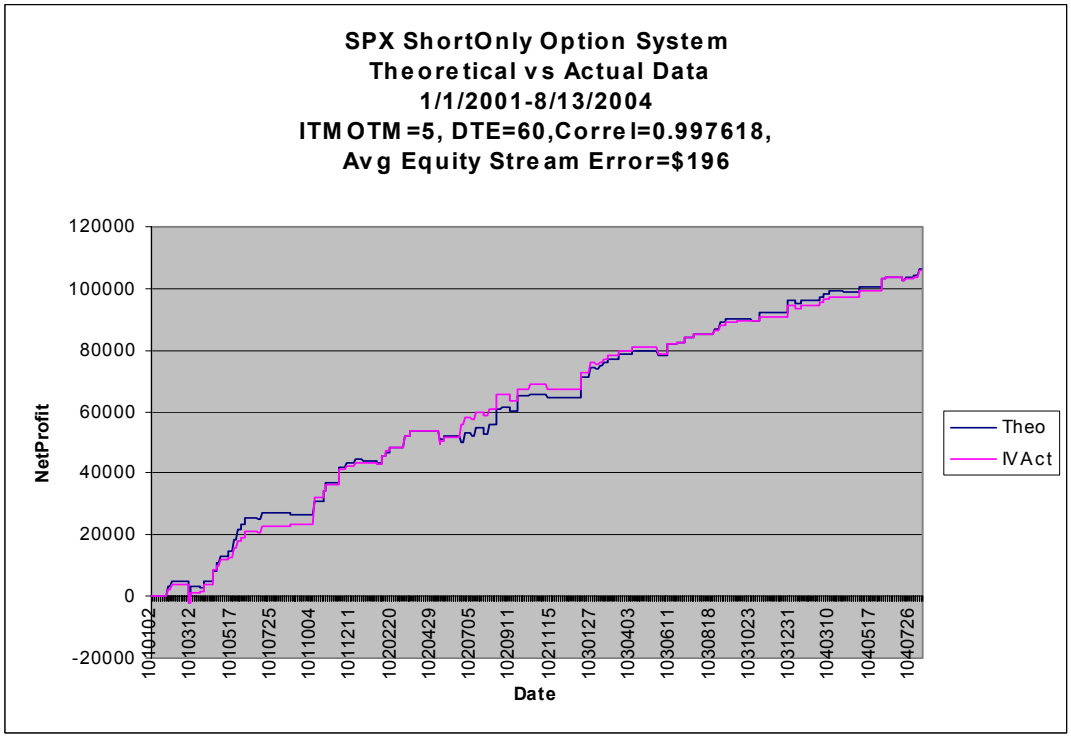
As indicated in my first report on this significant project, the most important future plan I had was to improve the Theoretical Model's accuracy. What I found was that the dividend rate I was using in the Model was underestimating the actual S&P 500 dividend. Thus the Theoretical Options Model was overestimating the options prices noticeably as we neared expiration. Once I increased the dividend amount used, the differences in net profit between the Theoretical and Actual tests for the Short Only case converged. The Credit Spreads, however, required further OTM and ITM options and thus the differences between the tests were higher due to theoretical accuracy limitations for options that are further away from their At-The Money (ATM) strike price. The net profit of the Theoretical verses Actual Credit Spread case differed by 13.8% at the end of a 3.67 year test consisting of 82 round turns. The Short Options test differed by less than 1%. It should be noted that in both cases what was important to the test was the difference between the computed entry and exit option price, and not the actual options pricing value at each trade point. Accuracy problems still exist for the Theoretical Models, however we have enough accuracy at this point to continue testing using the Theoretical Models with occasional snapshot tests using the Actual Options price data base to confirm the reasonableness of the backtests.

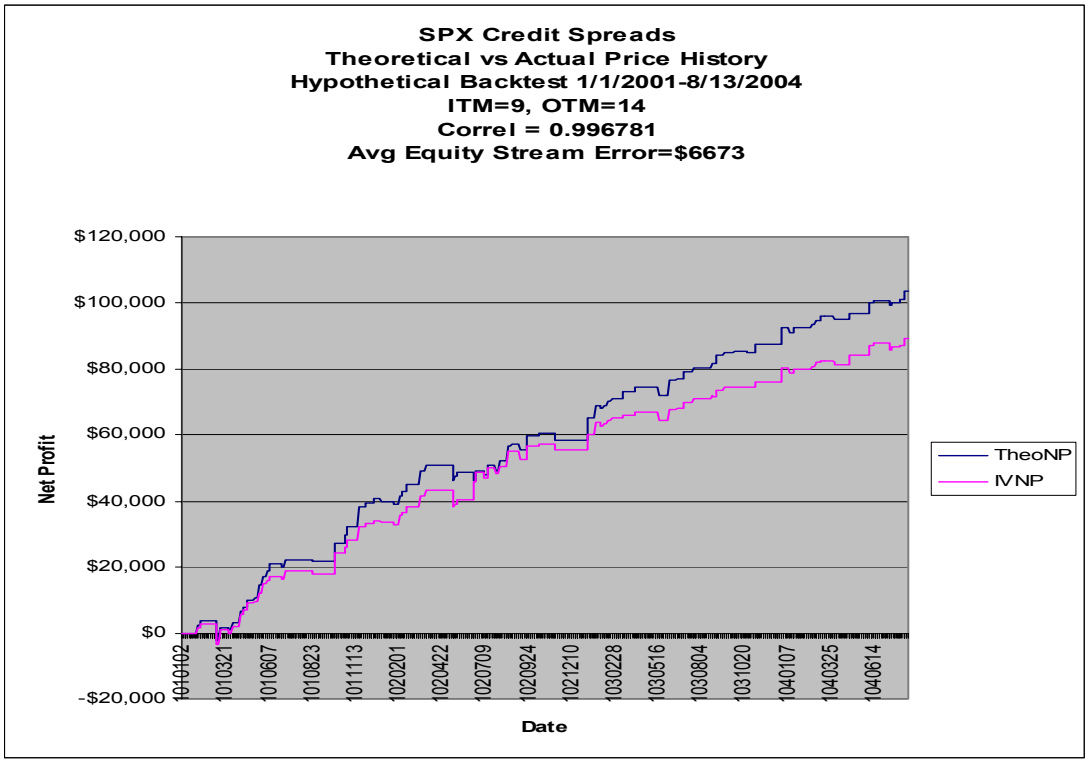
## CONCLUSION

Why are we so interested in the Theoretical Model accuracy? Why don't we just use the Actual Options Price database for all our tests? The main reason why we are interested in calibrating the Theoretical Options Model is due to computational speed and available bid/ask options data. Once the Theoretical Model has been calibrated adequately, we can run many optimization routines and trading system implementations very fast. The following questions may be addressed: For example, can Greeks on the options be used to modulate a trading system on the underlying index? Can put/call volume ratios be used as a sentiment guide to bias a directional trading strategy? Can an intraday index trading system be merged with an intermediate term index options trading system? With a well-calibrated Theoretical model we can research many different strategies quickly.

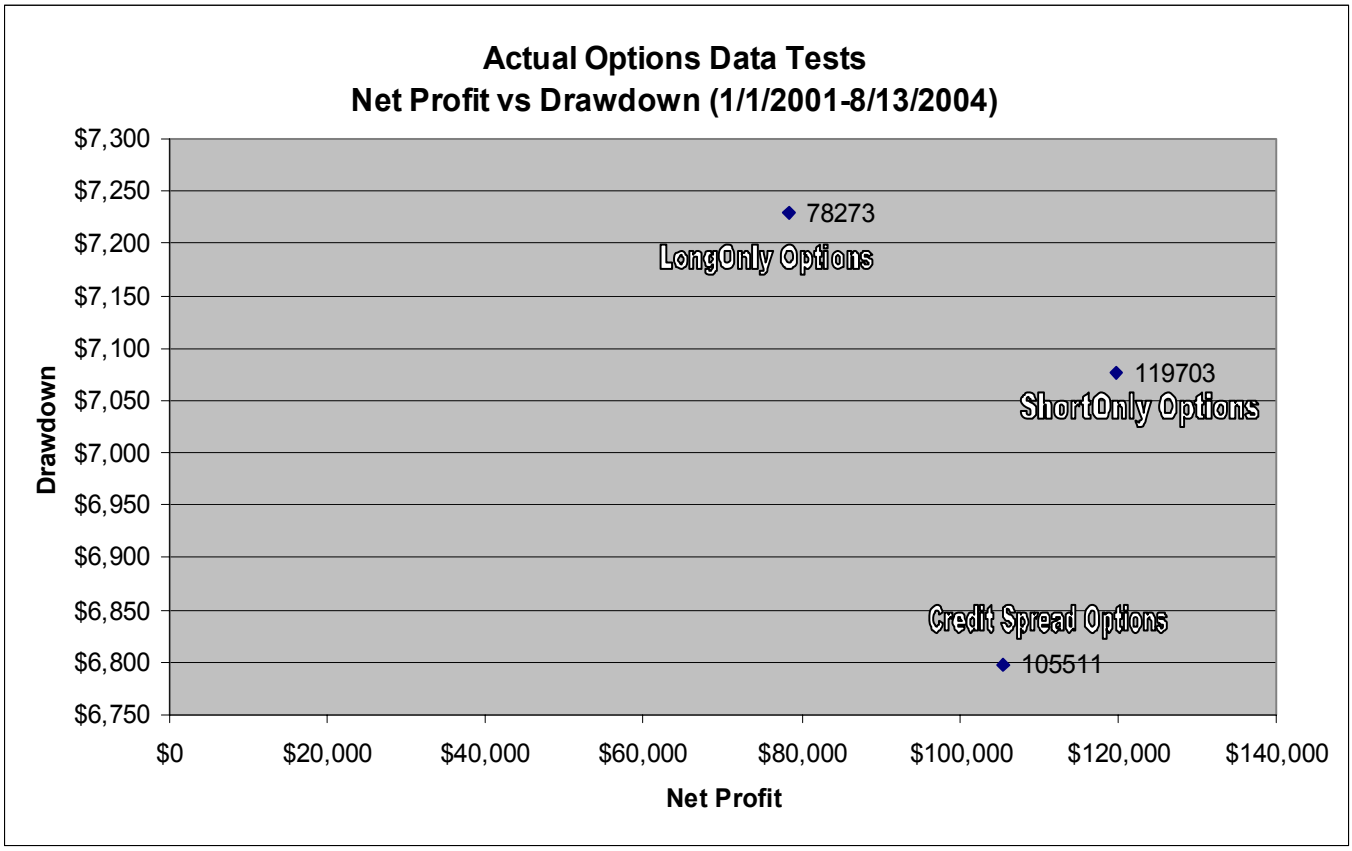
The Credit Spread Options Strategy offers a good trade-off between the Short Only Options Strategy and Long Only Strategy. As can be seen in Appendix 2, Credit Spreads offer a slightly lower net return and a lowered drawdown over the Short only Options case. The lowered drawdown for the Credit Spreads is due to the fact that the Short Only Options case has a much higher exposed downside drawdown and the Long Only Options case has a higher dimension decay effect (Theta primarily) and consequently lower percent accuracy.

Appendix 1. Theoretical Model verses Actual Options Prices for Short Only Options and Credit Spreads



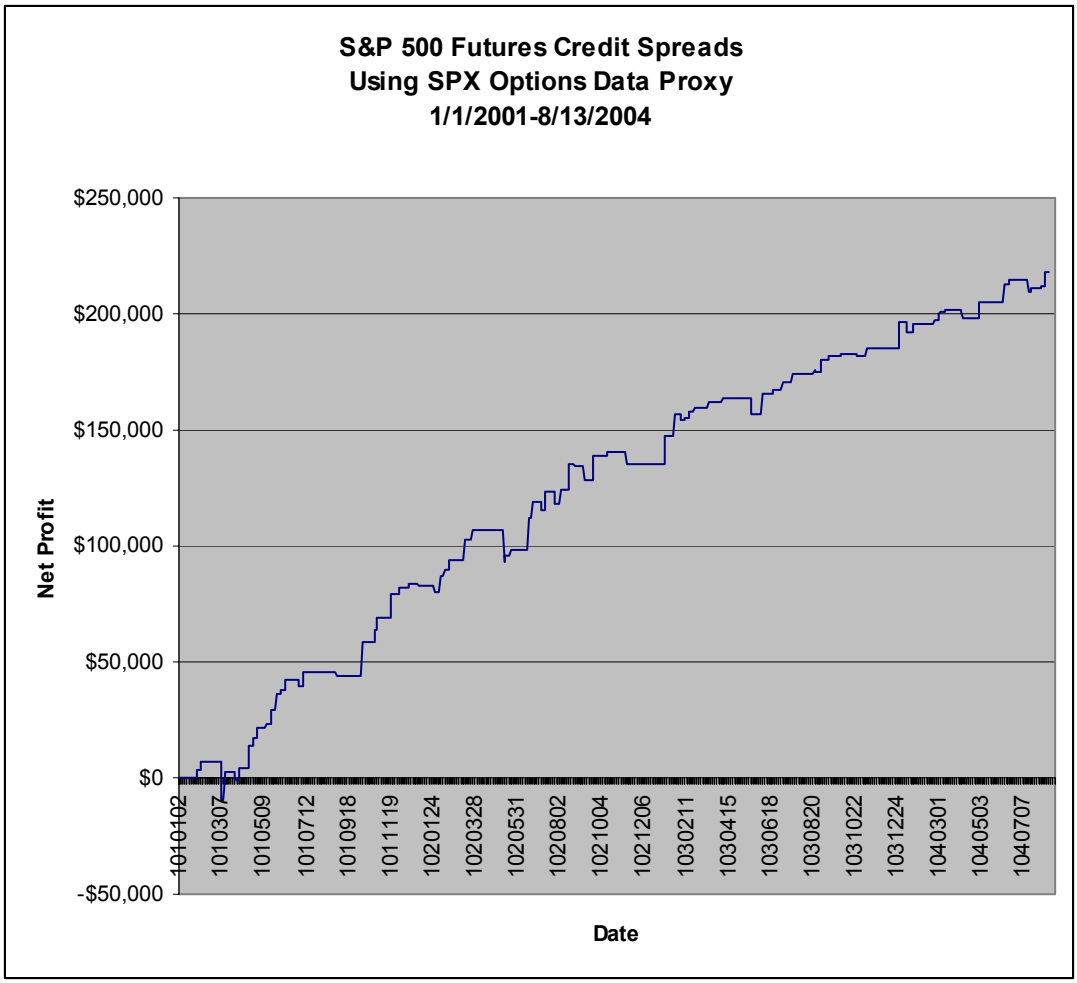
Appendix 2. Net Profit and Maximum Closed Trade Drawdown for 3 SPX Options Strategies using Actual Options (Best test result-Highest reasonable Strike Price ITM/OTM used)




| IVData | ShortOnly | LongOnly | CreditSpreads |
|---|---|---|---|
| **NP** | 119703 | 78273 | 105511 |
| **DD** | 7076 | 7230 | 6798 |
| Settings | 10,60 | 10,60 | 9,22,60 |

Appendix 3. S&P 500 Futures options Credit Spread using SPX options data as a proxy
Summary Report. 1/1/2001 to 8/13/2004

| | | |
|---|---|---|
| Last Date | = | 20040813 |
| Symbol | = | SP500 |
| (SPX as proxy using $250 per point to simulate S&P 500 Options trading) | | |
| Net$ | = | $218,123.00 |
| TotTrades | = | 86 |
| AvgTrade | = | 2536.31 |
| NetPuts | = | 92674.10 |
| NetCalls | = | 130609.00 |
| MaxDrawdown | = | 15715.00 |
| Net/DD | = | 13.88 |
| %Correct | = | 73.26 |
| MaxLoss | = | -15655.00 |
| Commission | = | 30.00 |
| YearsInTest | = | 3.67 |
| %NP/yr/3*DD | = | 126.18 |
| SR | = | 0.28 |
| Avg mo Return | = | 17.15 |
| StdDev of Returns | = | 61.85 |



Appendix 4. Trade by Trade and Summary for SPX Credit Spread Options Strategy using Actual Options Data from 1/1/2001 to 8/13/2004. Mid-Range Test using reasonable ITM/OTM criteria.

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>>>>>>>>>>>>>>>>>>>>>>>>>>>>CREDIT SPREADS OPTIONS BACKTEST SUMMARY<<<<<<<<<<<<<<<<<<<<<<<<<<<<
Last Date              =  20040813
Symbol                 =  SPX
Net$                   =  89313.10
TotTrades              =  86
AvgTrade               =  1038.52
NetPuts                =  37069.60
NetCalls               =  52243.50
MaxDrawdown            =  6262.00
Net/DD                 =  14.26
%Correct               =  73.26
MaxLoss                =  -6262.00
Commission             =  0.00
YearsInTest            =  3.67
%NP/yr/3*DD            =  129.66
SR                     =  0.29
Avg mo Return          =  16.52
StdDev of Returns      =  57.43
MaxDaystoExpiration=  60.00
Short Options ITM      =  9.00
Long Options OTM       =  14.00

>>>>>>>>>>>>>>>>>>>>>>>>>>>> SAMPLE TRADE BY TRADE REPORT<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<

20010103 OptionData StrikePr    =  1395.00 AssetPrice=  1347.55 Ask=    73.38 Bid=    71.38 OptData Yr=2001 MoOpt= 3
InterpolationCodes=     0.00
20010103 OptionData StrikePr    =  1205.00 AssetPrice=  1347.55 Ask=    15.23 Bid=    13.98 OptData Yr=2001 MoOpt= 3
InterpolationCodes=     1.00
1010103  SPX InitiateLng   StkPr=  1347.55 DaysToExp = -36893.00 EqReqd=  25000.00 ExpDate=20010316.00
1010103  SPX SellITMPut    StrPr=  1395.00 Cost    =    71.38
1010103  SPX BuyOTMPut     StrPr=  1205.00 Cost    =    15.23
20010130 OptionData StrikePr    =  1395.00 AssetPrice=  1373.75 Ask=    46.80 Bid=    45.00 OptData Yr=2001 MoOpt= 3
InterpolationCodes=     0.00
20010130 OptionData StrikePr    =  1205.00 AssetPrice=  1373.75 Ask=     4.76 Bid=     4.02 OptData Yr=2001 MoOpt= 3
InterpolationCodes=     1.00
1010130  SPX BuyBackITMPut StrPr=  1395.00 Cost    =    46.80
1010130  SPX SellOTMPut    StrPr=  1205.00 Cost    =     4.02
1010130  SPX UnwindLPos    P/LOp=  1337.00 ExpDate  =20010316.00
1010130  SPX UnwindLPos    StkPr=  1373.75 DaysToExp =    45.00 PctTrd =     0.05 Cum$=  1337.00

20010130 OptionData StrikePr    =  1325.00 AssetPrice=  1373.75 Ask=    78.00 Bid=    76.20 OptData Yr=2001 MoOpt= 3
InterpolationCodes=     0.00
20010130 OptionData StrikePr    =  1515.00 AssetPrice=  1373.75 Ask=     3.42 Bid=     2.72 OptData Yr=2001 MoOpt= 3
InterpolationCodes=     1.00
1010130  SPX InitiateSht   StkPr=  1373.75 DaysToExp =    45.00 EqReqd=  25000.00 ExpDate=20010316.00
1010130  SPX SellITMCall   StrPr=  1325.00 Cost    =    76.20
1010130  SPX BuyOTMCall    StrPr=  1515.00 Cost    =     3.42
20010205 OptionData StrikePr    =  1325.00 AssetPrice=  1354.30 Ask=    60.10 Bid=    58.10 OptData Yr=2001 MoOpt= 3
InterpolationCodes=     0.00
20010205 OptionData StrikePr    =  1515.00 AssetPrice=  1354.30 Ask=     1.11 Bid=     0.74 OptData Yr=2001 MoOpt= 3
InterpolationCodes=     1.00
1010205  SPX BuyBackITMCall StrPr=  1325.00 Cost    =    60.10
1010205  SPX SellOTMCall   StrPr=  1515.00 Cost    =     0.74
1010205  SPX UnwindSPos    P/LOp=  1342.00 ExpDate  =20010316.00
1010205  SPX UnwindSPos    StkPr=  1354.30 DaysToExp =    39.00 PctTrd =     0.05 Cum$=  2679.00
```