Non-Discretionary S&P 500 Options Trading Systems Backtest

By:
Mike Barna
tsda@attglobal.net

8/15/04

SUMMARY

Using an Options Data Base engine and an actual options data base provided by IVolatility, a backtest of several options strategies was accomplished producing equity streams of trades taken in the test. These equity streams were compared to results obtained by trading the underlying index and futures contract with the same trading system used to trade the options strategies. Both Long Only strategies (only buying puts and calls), Short Only strategies (only selling puts and calls) as well as several spread and hedging strategies were evaluated. Theoretical tests underestimated the returns in the Short Only Options case and overestimated the returns in the Long Only Options case primarily due to underestimation of Theta decay in the Bjerksund and Stensland approximation model for American Puts. Additionally a dynamic rehedging strategy, holding delta neutral, was developed. The results indicated that Long Only and Short Only strategies were the most viable strategies. Spread strategies and dynamic rehedging strategies were shown not to be as viable (on S&P 500 data using the employed trading system) on a risk to reward basis using both a directional trading strategy, for those strategies that benefited the most from directional correctness, or using a trading system that traded volatility, for those strategies that benefited the most from volatility based directional correctness. Results using the theoretical options backtest engine are presented in Appendix 1. Summary options results using the actual bid/ask options data are presented in Appendix 2. The performance of the underlying trading system on the S&P 500 Futures contract from 1982 to 2004 is presented in Appendix 3. The results of Short Only Option trading over the S&P 500 futures contract using the SPX options data as a proxy with a 250 multiplier verses a 100 multiplier is presented in Appendix 4.

INTRODUCTION

Option trading is perhaps one of the least understood trading vehicles. The complexity of analyzing option data and combinations contributes to this lack of understanding. Moreover, a trader can be correct on direction, yet still lose money because one or more of the other forecasted dimensions (i.e. volatility and time) were incorrectly forecasted. With time working against an option holder, the other dimensions must move well in his favor to extract a profit. On the other side, the longer a seller of an option can remain correctly positioned, the higher his probability of a profit. In fact, my studies here confirm that a seller of options runs a higher percent accuracy over simply applying the trading system directly on the underlying security, primarily due to the Theta decay of the option and the price waning effect of delta.

There are countless options combinations and spreads using options alone and in concert with a position in the underlying commodity or security. Many books have been written on strategies surrounding limited loss options positions like spreads, straddles, strangles, ratio backspreads, condors, butterflies as well as simple long only positions (only buying puts and calls). Many software products are available that will assist you in determining the least expensive option or option combination to enter given your market sentiment or

outlook. Using volatilities that are "implied" from the current option chain price data, scenarios employing various option types, strike prices and expiration dates can be sorted and screened for optimum use.
Despite this significant analytical capability, an option trader has several substantial limitations facing him:

1. He must still be correct on direction, or if a directionless strategy, like straddles, or ratio backspreads are employed, the movement in one direction has to be substantial enough to compensate for the decay in the other dimensions.
2. **Although the theoretical profit of an option position may be evaluated quite easily, there remains no quantitative way to actually "backtest" a strategy using actual option chain data, much like we routinely backtest a pattern or indicator on actual stock or commodity market data. Thus options investigations are limited to only a prediction of the theoretical movement of an option position based on a snapshot of only current quotes.**

There are substantial problems for the option trading system developer:

1. There is a full 3 dimensional array of prices required for each DAY of history.
2. There will be many missing option prices due to liquidity issues particularly at the far out of the money (OTM) options.
3. Interpolation between missing strike prices needs to be accomplished as required.
4. The size of the data base is massive, with approximately 5-16MB of data required per year per symbol, depending on the data reduction techniques employed.
5. The cleansing and error checking of the data becomes a serious problem since large sets of data may be corrupted and this would only become evident when the strategy calls for data within that data area.
6. Although theoretical options data may be used to produce a backtest, using price data alone and underlying volatilities as inputs to options models has proven to be inaccurate.
7. Rollovers prior to option expiration must be accomplished and, if necessary, a resetting of the optimum strike price should be accomplished.
8. Optimization of expiration and strike price for each option strategy must be employed.
9. Once the developer has created a final trading system, that system must be implemented and traded in the real world since that is the final goal of this development process.

Despite these obstacles, I decided to develop a backtest engine from which I could evaluate the efficiency of using directional and volatility based mechanical trading strategies as an option trading approach. This paper is not intended to be an exhaustive analysis and "definitive conclusion" based paper. Trading System development is too vague a discipline with many surprises that come up along the way…some pleasant and some not so pleasant. Actual implementation is yet another issue and my analysis is well

rooted in the "this has to work in the real world" thinking. My opinions presented herein are just that; however they are based on empirical testing and evidence derived during and after the development of this engine. Since there is no commercially available convenient testing platform that accomplishes what I have accomplished here, this project remains a "work in progress" and the opinions presented herein are "subject to change". The main purpose of this paper is to document this effort, to raise interest in mechanical options trading and to show that a mechanical option trading is ready for implementation and actual trading.

THE UNDERLYING TRADING SYSTEM

The underlying trading system makes use of a primary counter trending mode incorporating a pattern and non-linear filter triggering a buy or sell. The system is a stop and reverse (SAR) type system and is always in the market. Optional stop loss and profit exits, adaptive volatility based, were evaluated for inclusion and some improvement was observed, however only a large stop loss was included in the tested system. The performance of the base underlying system is presented in Appendix 2. It should be noted that the typical "bend" in the equity curve beginning in the 1996 time frame is present in this equity curve. Most momentum based systems, like opening range breakout, have this characteristic knee as well. Of course, opening range breakout type systems do not produce robust equity streams prior to 1996 and they are noted to have decaying equity streams post 2002 as well. This system has a relatively smooth equity stream from 1982 to 2004 and an approximately 100:1 trade to parameter ratio tested on one market. The system equity curve is similar on ND, DJ, RU, SG, SP, MD, ES, NQ markets.

ENGINEERING DEVELOPMENT BACKGROUND

Using DLL extensions, TradeStation PS2000i and an actual options data base provided by IVolatility, a backtest of several options strategies was accomplished producing equity streams of trades taken in the backtest. These equity streams are compared to results obtained by trading the underlying index with the same trading system used to trade the options strategies. Both long only strategies (only buying puts and calls), short only strategies (only selling puts and calls) as well as several spread and hedging strategies were evaluated. Additionally, a dynamic rehedging strategy, holding delta neutral, was developed. The results indicated that long only and short only strategies were the most viable strategies. Spread strategies and dynamic rehedging strategies (on the S&P 500 index and futures) were shown not to be as viable on a risk to reward basis using both a directional trading, for those strategies that benefited the most from directional correctness, or using a trading system that traded volatility directionally, for those strategies that benefited the most from volatility based directional correctness. The testing window was from 1/1/2001 to 8/13/2004 for the options strategies and 4/21/1982 to 8/13/2004 for the testing of the underlying trading system on the S&P 500 futures contract.

THEORETICAL AND DATA BASE ENGINE DEVELOPMENT

The development approach took two paths. First, a theoretical backtesting engine was developed using various options models, including the generalized Black-Scholes for American Calls and the Bjerksund and Stensland approximation model for American Puts. Results of the theoretical backtest engine are presented in Appendix 1.

In the second phase of this effort, initial trials using large options data bases proved cumbersome and optimization became difficult, however later models using reduced IVolatility data, proved excellent, fast and reliable.

The bottom line goal was to develop a testing engine that could be used to test an options strategy from "end to end" of the data window. In other words, backtested trading must replicate real world trading as much as possible, including buying on the ask and selling on the bid, assuming that the data being used contained the bid/ask spread. For each entry signal, the appropriate bid/ask data must be looked up for the selected Put/Call, strike and expiration. When the positions became unwound, or reversed as in our case, the net profit/loss of the exiting position must be stored and the new position initiated. At the end of the run, a typical set of summary statistics must be developed which is common to any testing platform. Optimization over expiration date, strike price, as well as internal system parameters and criteria must be accomplished.

The theoretical options testing engine provided an excellent way to evaluate quickly various strategies and this engine was used to test hundreds of stocks and dozens of directional and volatility options strategies. Initial studies using this engine showed that simple directional strategies involving buying puts or calls, or simple selling of puts and calls offered the optimum return to risk. Spread strategies and dynamic rehedging approaches were shown to be less efficient when compared to other strategies. It is believed that when the underlying directional trading strategy is efficient, as measured by its performance when applied directly on the underlying, limiting profit as is the case with spreads or attempting to trade volatility proves to be less optimum. Simply put, from a mechanical trading system viewpoint, take a good trading system and either:

a. Trade the underlying directly using the base mechanical trading system or
b. Trade options directionally by going long puts and long calls as appropriate or
c. Trade options directionally by going short puts or short calls as appropriate.

Limitations of the Theoretical Engine were primarily due to the underestimation of the decay of option prices resulting in higher returns than was noted with later data base engines.

With this fast theoretical options trading system engine now developed, I unleashed it on a basket of stocks representing the 100 most liquid option-able stocks based on relative

volume of all options contracts traded over a 1 year period. Some results for this test are presented in Appendix 1.

Following the theoretical backtest engine development, I undertook the development and testing of an integrated options data base read engine and trading system. Several subs or functions needed to be developed including:

GetStrike: Allows for the designation of strike prices at either in the money (ITM) or out of the money (OTM) for any underlying price.

GetOptPriceIVa: Performs the options data base lookup for a predefined expiration date, strike and type option and returns the bid/ask and any required greeks needed for the trading or rehedging system.

Interpolation: Should the data base lookup result in a strike price that was not present, an interpolation needed to be done to return the correct option price.

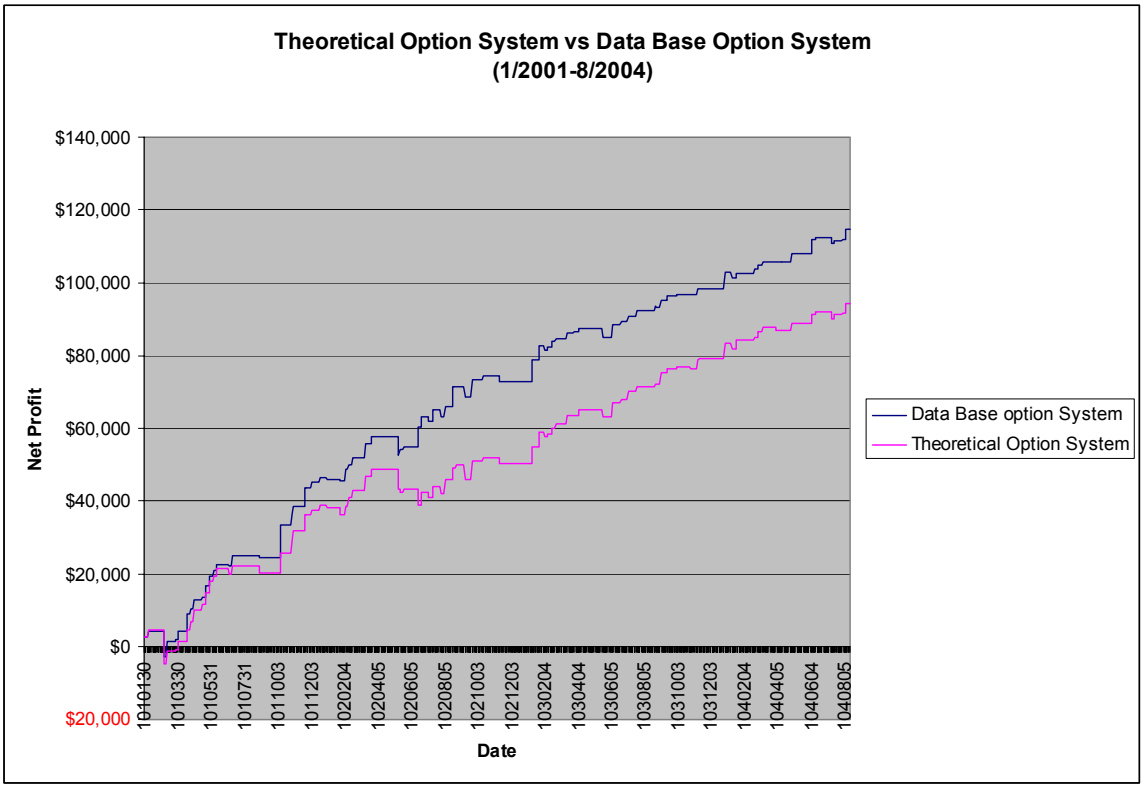
Rollovers: The capability to optimize on the rollover criteria needed to be implemented so that a rollover to a new contract and strike may be accomplished at a predefined number of days prior to expiration. Of course commissions generated at this time needed to be taken into account.

Error Handling: Should an option strike group not be present at all, the read engine needs to return values that will trigger awareness that a trade might be in error. It should be noted that NO fatal error messages occurred during my tests. Depending on the distance to expiration chosen, one half to one third of the options was located directly in the data base while the remaining option prices were interpolated for.

Additionally, date stamp reformatting and comparison needed to be done within the DLL to allow for proper comparison of date stamps during the search, within memory, following the uploading of the historical options prices.

The following chart shows the comparison of a Short Only Options Strategy using Theoretical options data and Actual Options price data. The Theoretical Options data under estimated returns in the Short Only Options case due primarily to the underestimation of Theta decay in the options that were bought back. An over estimation of returns for the Long Only Options case occurs as well, again due to the underestimation of Theta decay.

SHORT ONLY OPTIONS TRADING SYSTEM THEORETICAL VERSES ACTUAL PRICE DATA RETURNS



In my Short Only tests a protective stop loss was set at 7 times the 4 day average true range, basis the underlying index. This is a wide, adaptive stop and was not hit during the test. Nevertheless, it offers a protection from significant adverse movement and complements the advantage that waning dimensions offers us.

FUTURE PLANS

This options mechanical trading system is ready for trading, however as is the case with all research, one is never done. One of my highest priorities is to empirically calibrate the Theoretical Options Model using actual options data. The second highest priority item is the development of an optimum strategy search engine which will allow the sorting of various option combinations, sentiment dependent, prior to the position being implemented in the backtest engine. In other words, at any entry point in time, the most efficient option or combination of options will be chosen.

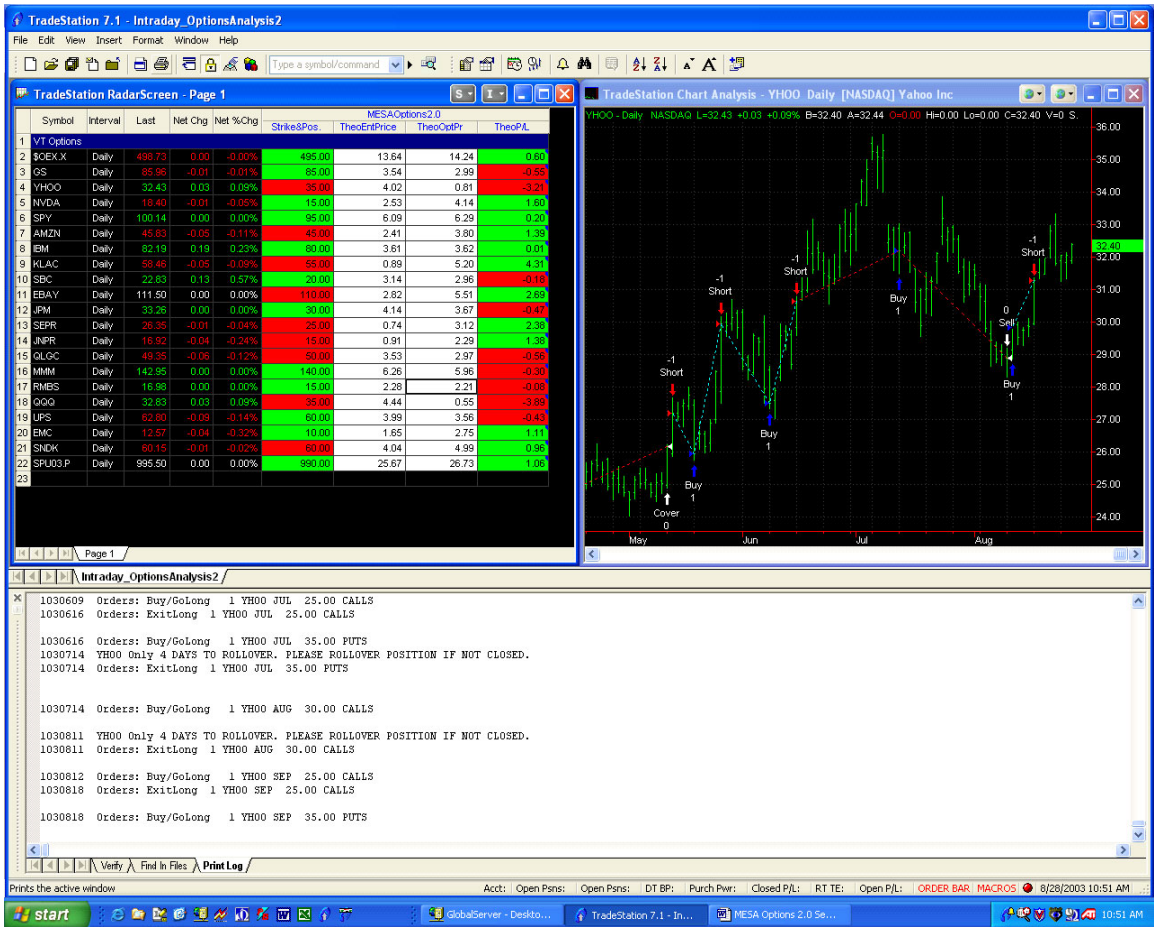
CONCLUSIONS

The relative smoothness of the options systems backtest equity curves for both the Long only and Short only case was noted. Only a slight difference in the ex post Sharpe Ratio was noted. Of particular interest was the fact that the percent accuracy of the Short Only case was well above the both Long Only case and the underlying trading system. Due to waning dimensions, the Long Only case had its percent profitable below the underlying case. Also noted was the fact that the net profit to drawdown ratio for the Short Only case was approximately equal to the Underlying System, whereas the net profit to drawdown ratio for the Long Only case was well below both other cases. Finally, a key element was noted that when the Short Only case was wrong on direction, the losses, as evident by the max drawdown and largest loss numbers, were lower than in the underlying system case. This is due to the fact that the decay in premium due to Theta decay was working well in your favor as the position was moving against you. In addition, the lower delta helped mitigate the losses even more when compared to the Underlying System case.

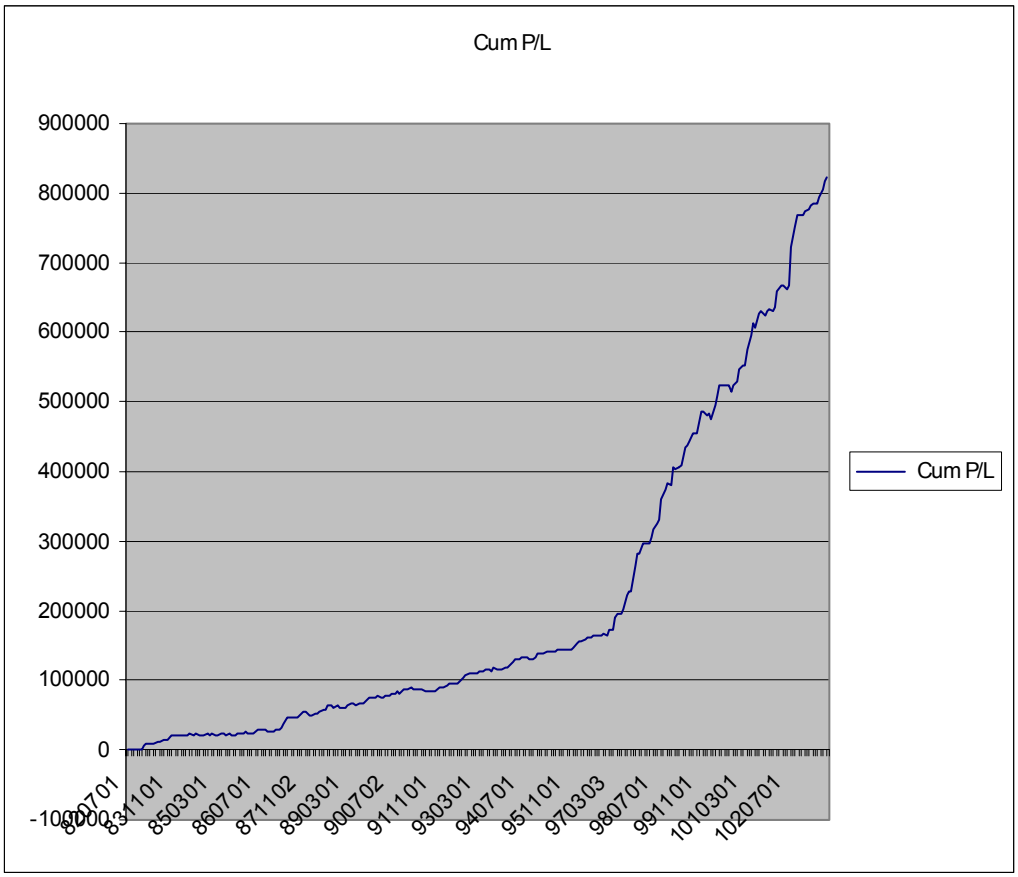
Merging a robust directional trading system and an options testing engine as demonstrated here has shown that simple mechanically based trading strategies for options are viable. The Short Only option strategy is a viable trading approach and presents a lower risk profile than trading the underlying with the same directional trading system. Per trade risk may be even further mitigated with adaptive stops positioned on the underlying which will trigger unwinding of the current position.

APPENDIX 1- OPTIONS 2.0 TRADING SYSTEM-THEORETICAL SYSTEM

SCREEN SHOT OF THE THEORETICAL OPTIONS TRADING SYSTEM



S&P 500 FUTURES OPTIONS EQUITY CURVE-THEORETICAL OPTIONS



The above shows the Theoretical Options Model integrated with Multi-Market Directional Adaptive Trading System tested on S&P 500 Futures data from 1982 to 2003.

- Sharpe Ratio = 1.6
- Theoretical Return per Year on Required Equity = 1987%
- Pessimistic Return Per Year on Required Equity = 400%
- Total Years in test = 21
- Total Trades in test = 542
- Average Yearly Reward/Risk = 8.0
- Options Model = Bjerk-Stens
- Options Positions = Directional
- Trading System-Adaptive Trend/Countertrend
- Long Puts and Long Calls only

S&P 500 FUTURES OPTIONS TRADE BY TRADE-Theoretical Model

SystemName	Calls=1/Puts=-1	Roll	EntDate	ExDate	EqReq	StkEntPr
Options2.0	-1	0	820607	820614	945.09125	512.65002
Options2.0	1	1	820614	820712	945.09125	512.59998
Options2.0	1	0	820713	820802	237.50305	515.84998
Options2.0	-1	-1	820802	820913	237.50305	514.04999
Options2.0	-1	-1	820914	821011	625	527.5
Options2.0	-1	0	821012	821025	1350.84534	537.84998
Options2.0	1	0	821025	821103	587.4939	537.25
Options2.0	-1	0	821103	821108	1515.96069	547.65002
Options2.0	1	0	821108	821206	712.4939	546
Options2.0	-1	0	821206	821220	1182.09082	547.15002
Options2.0	1	0	821220	821227	524.9939	540.04999
Options2.0	-1	0	821227	830103	1602.84424	547.90002
Options2.0	1	0	830103	830110	774.9939	542.20001
Options2.0	-1	0	830110	830124	1621.42944	551.90002
Options2.0	1	0	830124	830131	1149.9939	544.84998
Options2.0	-1	-1	830131	830214	1149.9939	550.40002
Options2.0	-1	0	830215	830222	1463.95117	552.54999
Options2.0	1	1	830222	830314	1463.95117	549.45001

StkEntPr	StkExPr	ExpMonth	DaysToExpEnt	Strike2Ent	Price2Ent	DaysToExpEx	Strike2Ex
512.65002	512.59998	7	39	515	2.34998	32	515
512.59998	516.29999	7	32	515	3.78036	4	515
515.84998	514.04999	9	38	515	3.75055	18	515
514.04999	527.90002	9	46	515	0.95001	4	515
527.5	539.59998	10	31	515	2.5	4	515
537.84998	537.25	11	38	540	2.15002	25	540
537.25	547.65002	12	25	535	5.40338	16	535
547.65002	546	12	44	550	2.34998	39	550
546	547.15002	1	39	545	6.06384	11	545
547.15002	540.04999	1	46	550	2.84998	32	550
540.04999	547.90002	1	32	540	4.72836	25	540
547.90002	542.20001	2	25	550	2.09998	18	550
542.20001	551.90002	2	46	540	6.41138	39	540
551.90002	544.84998	2	39	555	3.09998	25	555
544.84998	550.40002	2	25	540	6.48572	18	540
550.40002	554.15002	2	18	540	4.59998	4	540

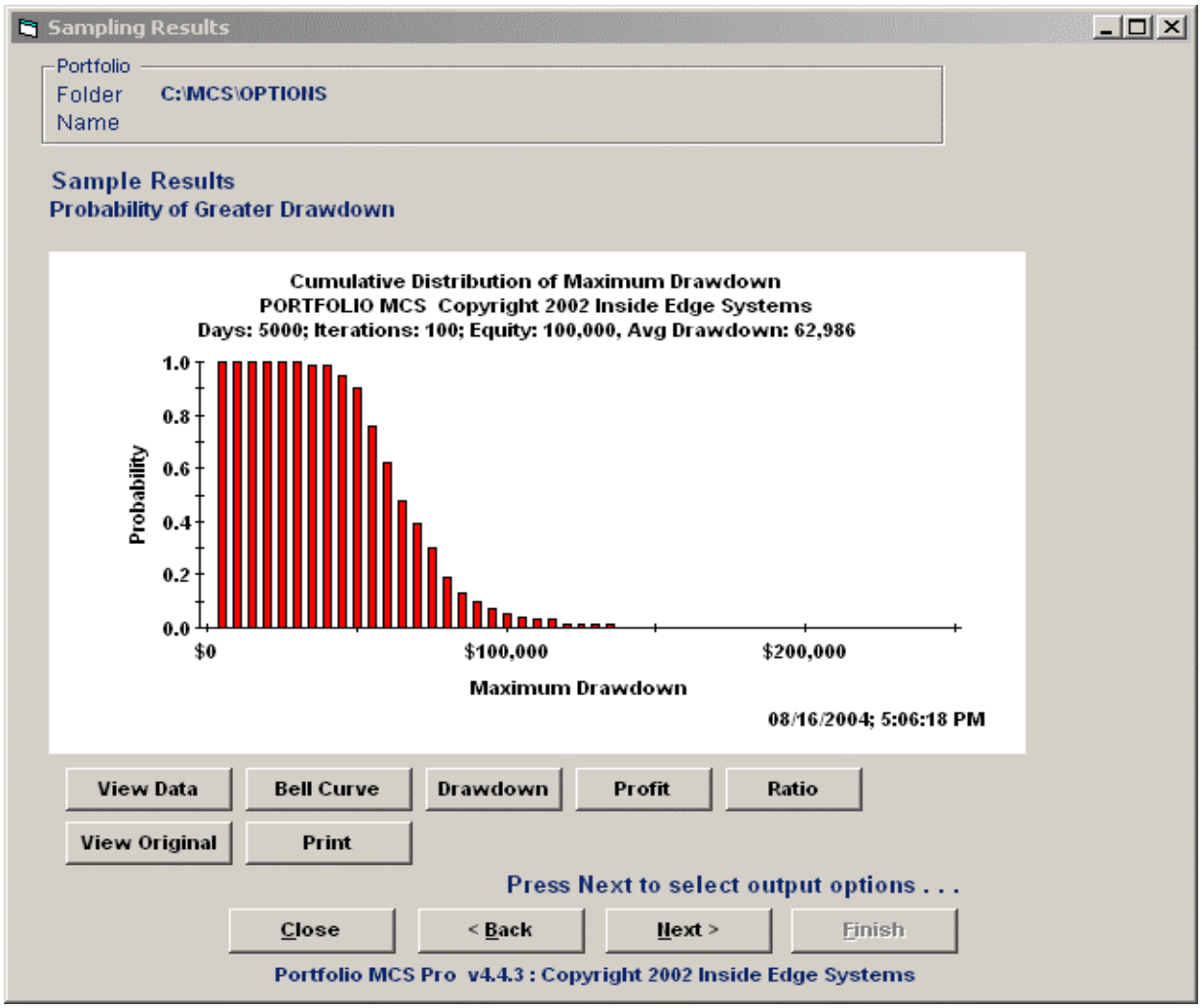
Strike2Ex	Price2Ex	Comm	P/L Trade	Cum P/L				
515	2.40002	45	-32.48779	-32.48779				
515	6.30801	45	586.91223	554.42444				
515	1.673	45	-564.38629	-9.96185				
515	0	45	-282.50305	-292.4649				
515	0.00018	45	-669.95422	-962.41913				
540	2.75	45	104.9939	-857.42523				
535	13.01834	45	1858.73999	1001.3147				
550	4	45	367.5061	1368.8208				
545	4.30136	45	-485.62042	883.20038				
550	9.95001	45	1730.00916	2613.20947				
540	9.2468	45	1084.60815	3697.81763				
550	7.79999	45	1380.00305	5077.8208				
540	12.96765	45	1594.0686	6671.88965				
555	10.15002	45	1717.51221	8389.40234				
540	10.65997	45	998.56384	9387.96582				
540	0.84998	45	-982.5	8405.46582				

STOCK BASKET TESTING-Theoretical Model

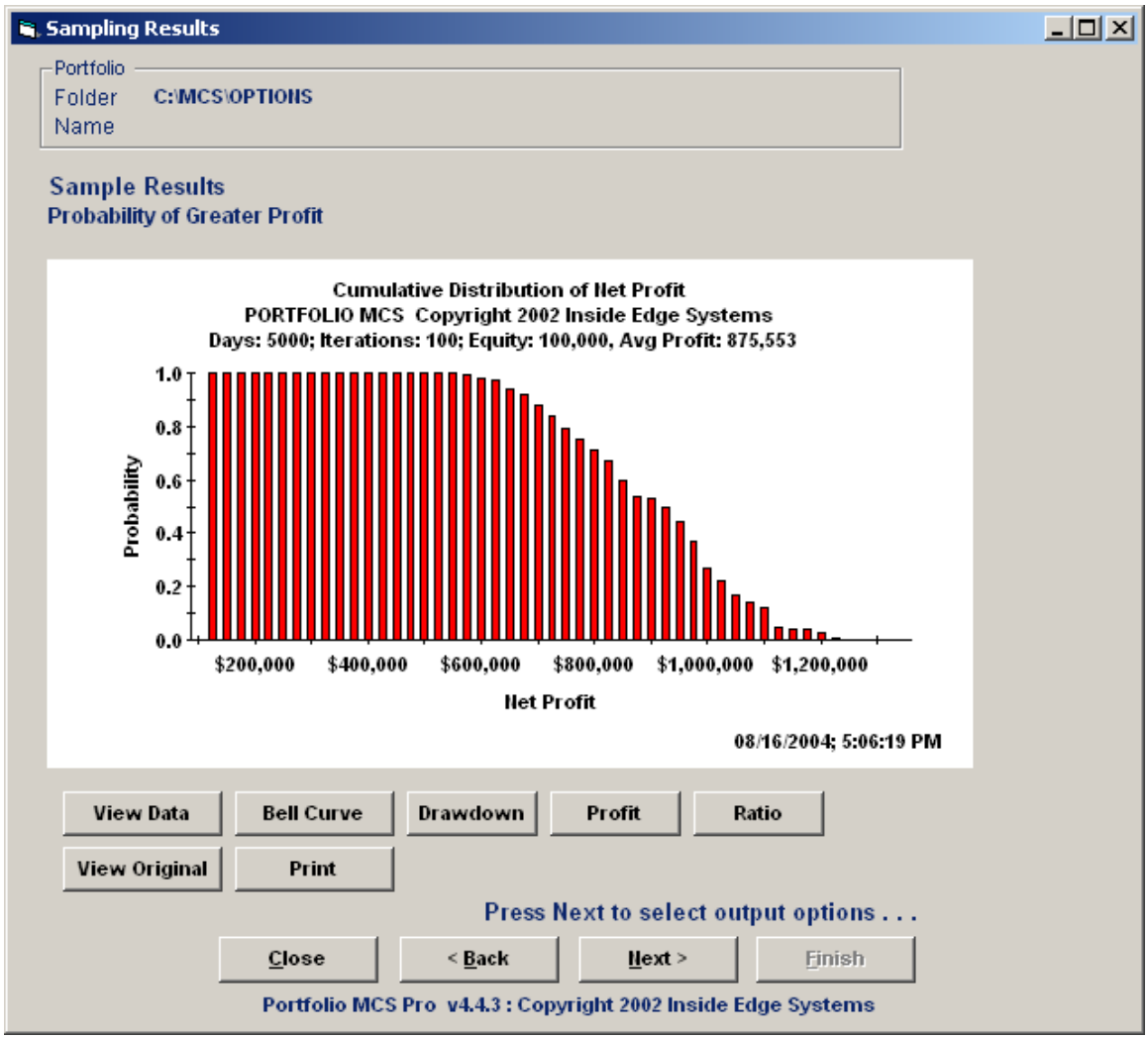
SYM	BEG	END	NET$	AVGEQREQD	MAXEQREQ	DD	AVGTRADE	TRADES	COMM
OEX	920313	1030825	108198.7188	629.96692	2681.69409	5574.77344	441.62741	245	45
BRCM	980629	1030825	24282.03906	534.22998	2833.02393	6951.61719	247.77591	98	45
LXK	960130	1030825	17892.17383	329.62802	1233.83716	2251.50098	115.43338	155	45
AMZN	970728	1030825	13286.74902	343.99982	1264.047	1770.06836	108.02235	123	45
OVTI	1000925	1030825	4537.38281	248.71675	659.11847	1316.23315	76.90479	59	45
IBM	920313	1030825	21581.92383	331.86615	936.1889	3082.64819	93.42824	231	45
SEPR	920501	1030825	14275.26074	274.65268	1509.22351	3058.88452	69.97677	204	45
SEBL	960911	1030825	10284.00879	324.88144	4224.35352	3292.94995	90.2106	114	45
MWD	930505	1030825	15104.89746	323.00647	831.65778	2326.46851	75.90401	199	45
YHOO	960624	1030825	11243.90137	379.11346	2336.57446	3469.59473	84.54061	133	45
KLAC	920923	1030825	12477.71973	306.7424	1113.79248	2275.40332	57.23725	218	45
JPM	920313	1030825	16240.89355	355.32727	2269.65381	4992.93555	65.75261	247	45
DNA	990929	1030825	5633.87744	374.58203	909.94568	2351.31152	67.87804	83	45
SPY	930416	1030825	13117.15137	320.5733	764.36804	3256.66553	62.46263	210	45
SNDK	960123	1030825	9129.28906	339.21475	2151.896	3585.04785	63.39784	144	45
BEAS	970623	1030825	5790.98877	292.81284	1377.67505	2987.04443	49.92232	116	45
EK	920313	1030825	10833.87402	302.94931	602.42462	2741.13574	44.04014	246	45
FNM	920313	1030825	8788.75488	290.38644	659.00916	2121.15527	39.58899	222	45
LLY	920313	1030825	8613.2793	285.28113	1105.11853	2927.86133	40.43793	213	45
MER	920313	1030825	8154.35938	277.0918	631.62653	2155.65674	38.64625	211	45
MMM	920313	1030825	8677.4873	327.62173	764.06628	1930.14941	37.40296	232	45
UPS	1000124	1030825	2002.21814	271.27069	793.09692	1190.0293	27.42765	73	45
PSFT	930316	1030825	4691.6377	263.97183	822.03467	2825.31665	23.45819	200	45
PEP	920313	1030825	6132.1123	266.66214	500.255	2434.71313	27.87324	220	45
PG	920313	1030825	6346.35742	305.48825	829.24268	3455.67139	28.33195	224	45
EMC	920313	1030825	2367.03516	219.74974	2398.68042	4576.44434	13.37308	177	45
LU	960617	1030825	2998.68506	236.11067	898.90442	4035.70459	23.79909	126	45
COF	950130	1030825	4462.75928	308.1795	739.26794	3424.7561	28.24531	158	45

APPENDIX 2. PERFORMANCE OF THE UNDERLYING TRADING SYSTEM
S&P 5050 FUTURES CONTRACT 1982-2004

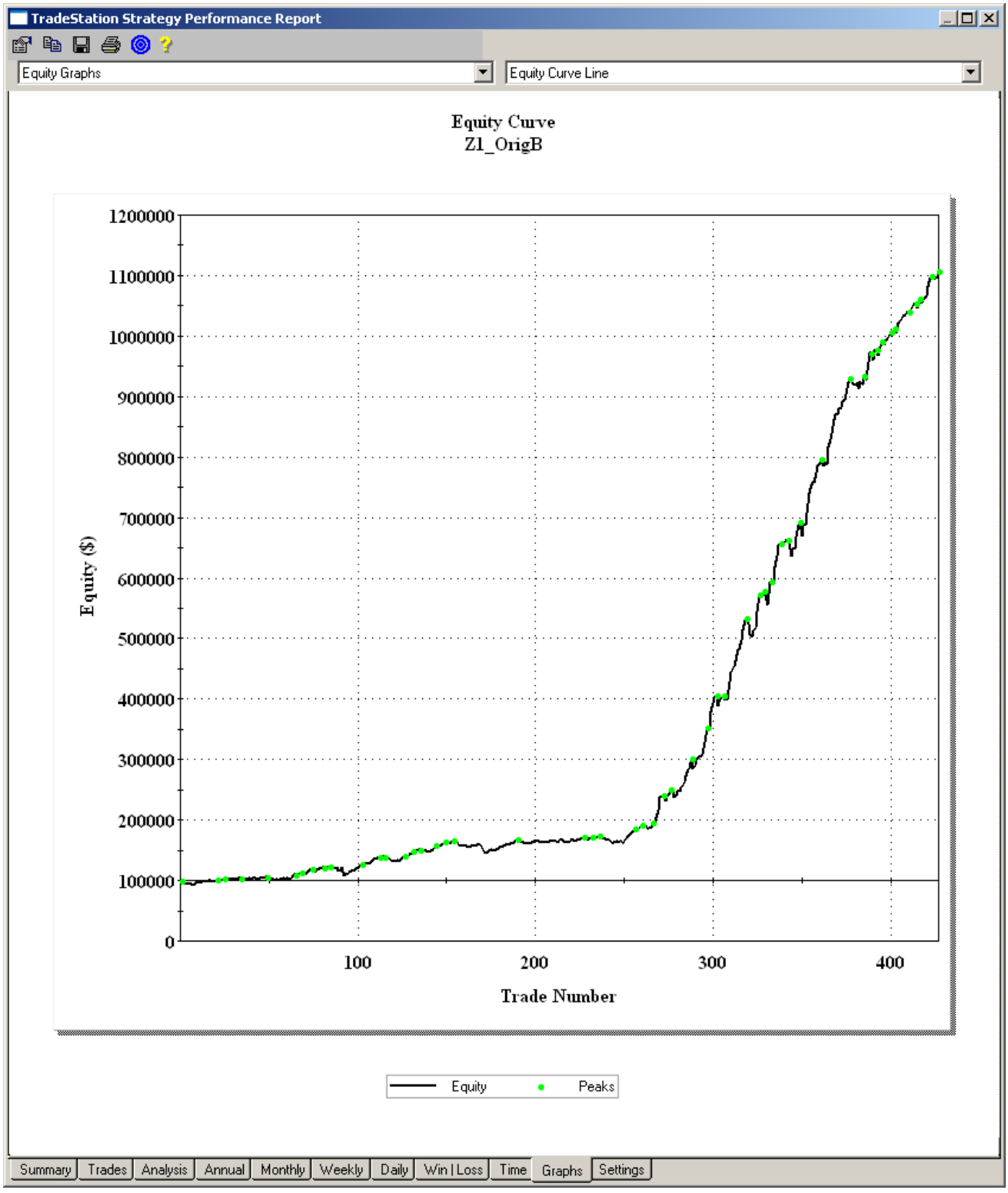
UNDERLYING TRADING SYSTEM
MONTE CARLO SIMULATIONS-ODDS OF DRAWDOWM



UNDERLYING TRADING SYSTEM
MONTE CARLO SIMULATIONS-ODDS OF PROFIT



UNDERLYING TRADING SYSTEM-EQUITY CURVE (1982-2004)



APPENDIX 3-PERFORMANCE RESULTS OF DATA BASE OPTIONS ENGINE

SHORT ONLY STRATEGY ON SPX OPTIONS 1/2001-8/2004
(Puts and Calls are sold short)

(subset of trade by trade report)

20040802 OptData Yr= 2004 MoOpt= 10 StrikePr=1065 AssetPrice= 1106.60
Ask= 58.54 Bid= 56.54 InterpolationCodes= 1.00
20040802 SellCall at= 56.54 ExpDate= 20041016.00 PremiumAccepted= 5654.00

20040809 OptData Yr= 2004 MoOpt= 10 StrikePr=1065 AssetPrice= 1065.20
Ask= 32.20 Bid= 30.20 InterpolationCodes= 1.00
20040809 BuyBackCall at= 32.20 DaysToExp= 68 NetTrade$= 2434.00
Cum$= 114505.00 %Ret= 75.59 Cum%Ret= 58262.80 RollReq?= FALSE

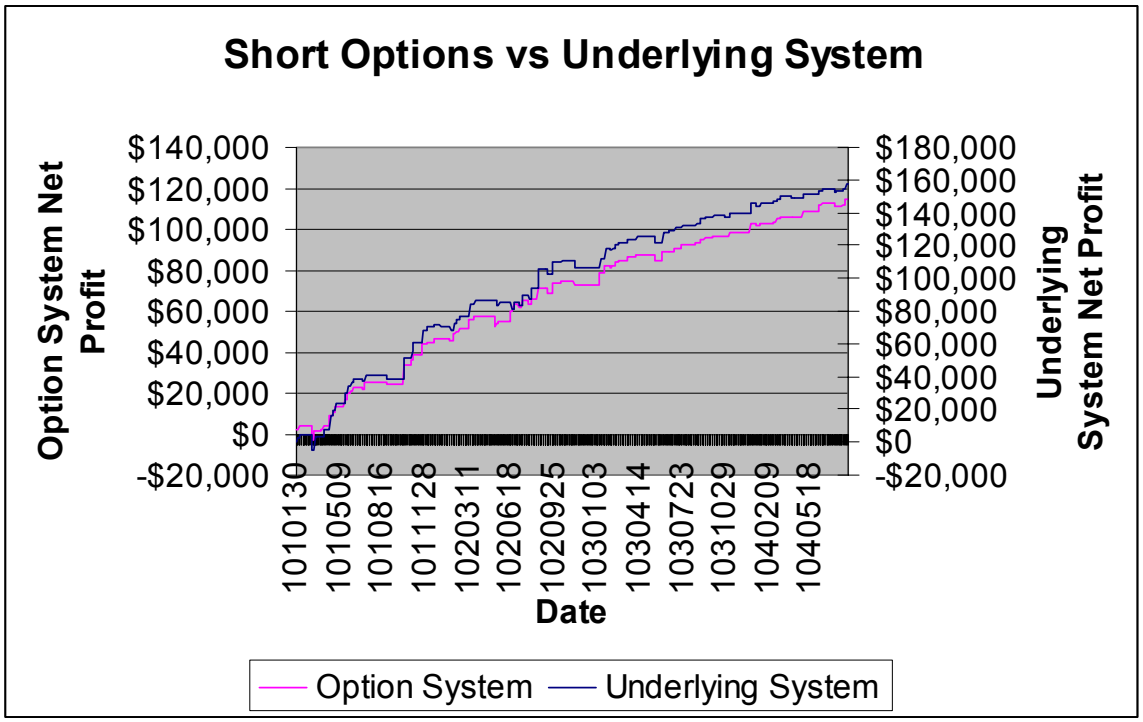
20040809 OptData Yr= 2004 MoOpt= 10 StrikePr=1110 AssetPrice= 1065.20
Ask= 58.10 Bid= 56.10 InterpolationCodes= 1.00
20040809 SellPut at= 56.10 ExpDate= 20041016.00 PremiumAccepted= 5610.00

20040813 OptData Yr= 2004 MoOpt= 10 StrikePr=1110 AssetPrice= 1064.80
Ask= 55.58 Bid= 53.88 InterpolationCodes= 1.00
20040813 BuyBackPut at= 55.58 DaysToExp= 64 NetTrade$= 52.00
Cum$= 114557.00 %Ret= 0.94 Cum%Ret= 58263.70 RollReq?= FALSE

>>>>>>>>>>>>>SHORT ONLY OPTIONS SYSTEM SUMMARY<<<<<<<<<<<

Last Date	=	**20040813**
Symbol	=	**SPX**
Net$	=	**114,557.00**
TotTrades	=	**82**
AvgTrade	=	**1397.04**
NetPuts	=	**53473.70**
NetCalls	=	**61083.80**
MaxDrawdown	=	**6694.00**
Net/DD	=	**17.11**
%Correct	=	**78.05**
MaxLoss	=	**-6694.00**
Commission	=	**0.00**
YearsInTest	=	**3.67**
%NPft/yr/3*DD	=	**155.58**
SR	=	**0.36**

COMPARISON OF SHORT ONLY OPTIONS SYSTEM VERSES UNDERLYING SYSTEM



LONG ONLY STRATEGY ON SPX OPTIONS 1/2001-8/2004
(Puts and Calls are purchased)

(subset of trade by trade report)

20040802 OptData Yr= 2004 MoOpt= 10 StrikePr=1150 AssetPrice= 1106.60
Ask= 55.60 Bid= 53.60 InterpolationCodes= 0.00
20040802 BuyPut at= 55.60 ExpDate= 20041016.00 EquityRequired= 5560.00

20040809 OptData Yr= 2004 MoOpt= 10 StrikePr=1150 AssetPrice= 1065.20
Ask= 89.30 Bid= 87.30 InterpolationCodes= 0.00
20040809 ExitPut at= 87.30 DaysToExp= 68 NetTrade$= 3170.00 Cum$= 72414.10
%Ret= 57.01 Cum%Ret= 1130.60 RollReq?= FALSE ErrCode= 0.00

20040809 OptData Yr= 2004 MoOpt= 10 StrikePr=1025 AssetPrice= 1065.20
Ask= 58.40 Bid= 56.40 InterpolationCodes= 0.00
20040809 BuyCall at= 58.40 ExpDate= 20041016.00 EquityRequired= 5840.00

20040813 OptData Yr= 2004 MoOpt= 10 StrikePr=1025 AssetPrice= 1064.80
Ask= 58.30 Bid= 56.30 InterpolationCodes= 0.00
20040813 ExitCall at= 56.30 DaysToExp= 64 NetTrade$= -210.00 Cum$= 72204.10
%Ret= -3.60 Cum%Ret= 1127.00 RollReq?= FALSE ErrCode= 0.00

>>>>>>>>>>>>>LONG ONLY OPTIONS SYSTEM SUMMARY<<<<<<<<<<<

Last Date	=	**20040813**
Symbol	=	**SPX**
Net$	=	**72204.10**
TotTrades	=	**82**
AvgTrade	=	**880.54**
NetPuts	=	**51269.40**
NetCalls	=	**20934.70**
MaxDrawdown	=	**6874.00**
Net/DD	=	**10.50**
%Correct	=	**64.63**
MaxLoss	=	**-5882.00**
Commission	=	**0.00**
YearsInTest	=	**3.67**
%NP/yr/3*DD	=	**95.49**
SR	=	**0.23**

COMPARISON OF LONG ONLY OPTIONS SYSTEM VERSES UNDERLYING SYSTEM

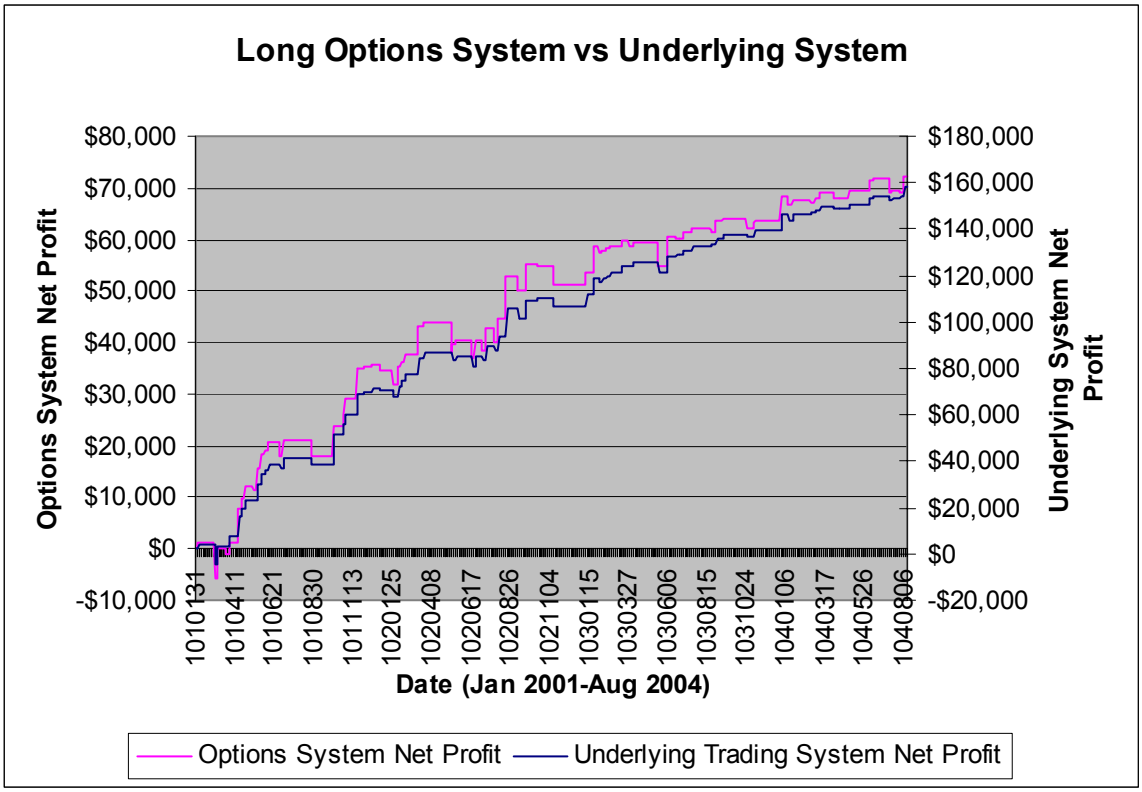


Table 1. OPTIMIZATION OF STRIKE PRICE ITM-SHORT ONLY OPTION TRADING SYSTEM

Symbol	EndDate	Net$	Trades	AvgTrade	MaxDD	NP/DD	% Correct	NP/yr/3*DD	MaxLoss	DaysToExp	Put Dist ITM	Call Dist ITM
SPX	1040813	99789.1	82	1216.94	4990	20	81.71	181.8	-4990	60	39	11
SPX	1040813	93255	82	1137.26	4990	18.69	82.93	169.89	-4990	60	35	11
SPX	1040813	109045	82	1329.82	5870	18.58	80.49	168.88	-5870	60	39	15
SPX	1040813	102511	82	1250.14	5870	17.46	81.71	158.76	-5870	60	35	15
SPX	1040813	86134.7	82	1050.42	4990	17.26	84.15	156.92	-4990	60	31	11
SPX	1040813	114557	82	1397.04	6694	17.11	78.05	155.58	-6694	60	39	19
SPX	1040813	95390.8	82	1163.3	5870	16.25	82.93	147.73	-5870	60	31	15
SPX	1040813	108023	82	1317.36	6694	16.14	79.27	146.7	-6694	60	35	19
SPX	1040813	100903	82	1230.52	6694	15.07	80.49	137.03	-6694	60	31	19

Table 2. OPTIMIZATION OF STRIKE PRICE-LONG ONLY OPTION TRADING SYSTEM

Symbol	EndDate	Net$	Trades	AvgTrade	MaxDD	NP/DD	% Correct	NP/yr/3*DD	MaxLoss	DaysToExp	Put Dist ITM	Call Dist ITM
SPX	1040813	62893.9	82	767	5320	11.82	63.41	107.47	-560	60	49	21
SPX	1040813	67807.6	82	826.92	6136	11.05	64.63	100.46	-5882	60	49	25
SPX	1040813	72204.1	82	880.54	6874	10.5	64.63	95.49	-5882	60	49	29
SPX	1040813	54088.4	82	659.61	5320	10.17	63.41	92.43	258	60	45	21
SPX	1040813	59002.1	82	719.54	6136	9.62	64.63	87.42	-5508	60	45	25
SPX	1040813	63398.6	82	773.15	6931.33	9.15	64.63	83.15	-390	60	45	29
SPX	1040813	45715.3	82	557.5	5320	8.59	62.2	78.12	-5068	60	41	21
SPX	1040813	50628.9	82	617.43	6136	8.25	63.41	75.01	-5068	60	41	25
SPX	1040813	55025.4	82	671.04	7123.33	7.72	63.41	70.22	210	60	41	29

Table 3. OVERALL SUMMARY-LONG AND SHORT OPTIONS-SPX

System	From	To	NET$	Trades	Average Trade	Drawdown	Percent Correct	Net/DD	NetPft/yr/(3*DD)	MaxLoss	SR
Base Underlying	1/1/2001	8/13/2004	158103	80	1976.29	9240	76.25	17.11	159.17	-9240	0.2
Long Only Options	1/1/2001	8/13/2004	72204	82	880.54	6874	64.6	10.5	95.49	-5882	0.2
Short Only Options	1/1/2001	8/13/2004	114557	82	1397.04	6694	78.05	17.1	155.58	-6694	0.36

Notes:
Table 1-2:
NP/yr/3*DD is the net percent return per year on an account sized at 3 times the max closed trade drawdown. Note that this does not address the minimum margin requirements for the selling of options, however studies have shown that it is results in a close approximation to calculations using the exchange listed margin requirements.
Put Dist ITM/Call Dist ITM is the distance in strike prices that an options strike price was chosen to be, ignoring the first digit, and is based on strike prices at 5 point intervals. E.g.: A 39 Put Dist ITM means that the strike price was chosen to be 9 strikes in the money.
There is no commission in these numbers. Purchases are assumed to occur at the Ask and sales are assumed to occur at the Bid.
Table 3:
SR is based on ex post Sharp Ratio calculations.

APPENDIX 4 - S&P 500 FUTURES OPTIONS BACKTEST

>>>>>>>>>>>>>>>>>>>>>>>>S&P 500 FUTURES OPTIONS BACKTEST SUMMARY<<<<<<<<<<<<<<<<<<<<<<<<

Last Date	=	**20040813**
Symbol	=	**SP 67/99**
Net$	=	**292433.00**
TotTrades	=	**80**
AvgTrade	=	**3655.41**
NetPuts	=	**144211.00**
NetCalls	=	**148221.00**
MaxDrawdown	=	**21785.00**
Net/DD	=	**13.42**
%Correct	=	**80.00**
MaxLoss	=	**-21785.00**
Commission	=	**0.00**
YearsInTest	=	**3.67**
%NP/yr/3*DD	=	**122.03**
SR	=	**0.19**

S&P 500 FUTURES OPTIONS TRADING SYSTEM BACKTEST USING SPX OPTIONS WITH 250 MULTIPLIER AS PROXY