

The Siren Call of Optimized Trading Systems

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With the advent of today's high performance desktop computers and software and the availability and cheapness of historical data, trading systems are more prevalent than ever. These systems usually hold out the promise, either implicitly or explicitly, of assured trading rewards from their use. The majority of the trading systems being offered to the trader today are presented with hypothetical track records showing the excellent profitability and performance that *could* have been obtained by using that system. The system parameters are usually found by the process of optimization. Optimization, in this context, means that all the parameters of the system are varied until a parameter set is found that produces the best performance of the system over some tradable price series. Usually, tens of thousands of parameter sets are examined. The parameter set that gives the best results, that is profitability, or percentage wins, etc. is chosen and a hypothetical track is generated using these parameters. This type of optimization is also known as curve fitting

Over the years, many arguments have been put forth about how this type of curve fitting methodology is a valid procedure for capturing the dynamics of a price series. The inference of these arguments is the assured future profitability of the system. Nothing could be farther from the truth. The only thing that has been shown by this type of optimization procedure is that a price series, over some pre-selected fixed dates, has been curved fitted very well by the system. In reality, it is impossible to know whether or not the price dynamics of the series has been captured by the system or whether the system will generate any profits in the future. The usual way to validate an optimized trading system is to test the system on data it has never been tested on before... that is, to test the system on some hold out section of data that wasn't used in the optimization. This hold-out data is called out-of-sample data. If system performance holds up well on the out-of-sample data, confidence is gained that the system will perform as well in the future as it has in the past. However, it should be noted that while good out-of-sample performance increases the probability that the system will perform well in the future, it is still not a guarantee that future performance is assured. Why is That? One reason, is that the price dynamics of the future can be very different from all past price dynamics because of the impact of modern technologies. Another reason is that, by chance or by design, the selected out-of-sample data section price dynamics is very similar to the curve fitted data section price dynamics. This chance similarity would cause a positive out-of-sample performance but would not enhance the probability of future performance of the system.

In addition, it has been proposed by many market pundits that although technology has changed, people will react the same, in mass, in the future as they have in the past. It is argued that, it is this similar behavior that gives systems their future performance predictability. Do traders, in mass, change their trading behavior with knowledge from the past and new technology or not? This "react the same" supposition is suspect and needs to be proved by more than just anecdotal examples.

To emphasize the points made above, we will develop and examine an optimized system on a yet undisclosed price series. First without knowing the system, we will examine its performance summary and trade by trade results. Then we will examine the system that generated these results followed by an examination of the price series that the system operated on.

Mystery System Results & Observations

Figure 1 presents the performance summary for the optimized mystery system for the weekly time period from January 3, 1986 to April 12, 1996. Examination of the performance summary shows that the long trades were profitable 91% of the time and short trades were profitable 73% of the time. 82% of the combined long and short trades were profitable. The long trades had a maximum of 9 consecutive winners in a row with only a maximum of only 1 consecutive loser. The shorts had a maximum of 3 consecutive winners in a row with only a maximum of only 1 consecutive loser. The profit factor, which is defined as gross profits divided by gross losses, was 4.47. A profit factor above 4 is considered excellent.

Figure 2 presents the Trade by Trade summary for the optimized mystery system. Examination of the trade by trade summary in Figure 2 shows a maximum closed trade loss of minus 10.09% and a maximum closed trade profit of 14.65%. Out of 22 trades 18 were profitable. The average win was 5.65% over 18 trades and the average loss was minus 5.32% over 4 trades. The system had only one big loss of 10.09% in ten years, with numerous and steady trade gains.

Figures 3A and 3B present the charts of the mystery price series with all the buy and sell signals from the trade by trade summary of Figure 2 indicated on the charts. Many of the buy and sell signals were picture perfect, selling very near exact tops and buying very near exact bottoms. The buy of 9/30/94 at 268.58 was a bad buy signal causing a drawdown of 20% and a close trade loss of 10.09%. Other than this one bad trade the system performance is quite good.

The Mystery System

The Mystery System is quite simple and used quite often by many people. The system is based on Wilder's relative strength index or RSI. RSI has three parameters; the RSI length, the RSI Buy Zone and the RSI Sell Zone. The system is as follows:

Buy Criteria:

if $RSI(\text{length}) > \text{BuyZone}$ and $RSI(\text{length})[1] \leq \text{BuyZone}$ then Buy on Close.

Sell Criteria:

If $RSI(\text{length}) < \text{SellZone}$ and $RSI(\text{length})[1] \geq \text{SellZone}$ then Sell on Close.

$RSI(\text{length})[1]$ is defined as the previous weeks RSI value.

The system was optimized using TradeStation. Length was varied from 3 to 12 in steps of 1, the BuyZone was varied from 20 to 70 in steps of 5 and the SellZone was varied from 40 to 90 in steps of 5. Case runs were skipped when the BuyZone was greater than the SellZone in the optimization run. From the optimization run the parameters that generated the highest % wins

with the highest net profits were chosen. These parameters were *Length=4, BuyZone=55, SellZone=85*.

The Mystery Price Series

So far nothing very special has been proved or done. A simple system was chosen and optimized and very good results were produced. The final question to be answered is what the price series was that the system operated on. The price series was artificially manufactured and was a completely random number generated price series! The prices were generated by the Excel program random number generator. The first price was set at 100. The second price was the first price times one plus some random number between plus and minus 3%. The third price was the second generated price times one plus some random number between plus and minus 3%. This process was repeated until 1060 prices were generated. In other words each price is bigger or smaller than the previous price by some random percentage. The random percentage multiplier cannot have a absolute value greater than 3%. The random prices were assigned the dates from 1/2/76 to 4/12/96. The random prices were saved in a text file and TradeStation used the prices from 1/3/86 to 4/12/96 to further mask the fact that the price series was random.

What Does This Mean?

this article shows by example that a system could be optimized and produce good results even on a random series of prices. Anything can be curve fitted and demonstrate good results! It should be fairly clear from this example that the excellent results we obtained by the optimization on the random price series are quite worthless in determining the value of the system or whether the system will perform well in the future. Random price series have no repeatable history, or price dynamics. Yet, when examining the performance results of the curve fitted system, they give the illusion and beckon subtly, that future profits from this system will be forthcoming to those who use it. As we now know, nothing could be further from the truth.

We can see from the above exercise that optimized systems with their hypothetical trades and results prove nothing about their chance for future profits. The excellent results produced by curve fitted systems only entice one to believe in their repeatability. Repeatability of future profits cannot be assured or assumed by use of optimization techniques and their hypothetical track records. Whatever the system, careful testing on out-of-sample price data is needed to establish a system's continued ability to perform. Even when a systems performance holds up in out-of-sample testing, there is still no guarantee that profits from the system will be forthcoming in the future...only a better probability.

Figure 1 Performance Summary for Mystery System

Mystery System Price Series-Weekly 01/03/86 - 04/12/96

Performance Summary: All Trades

Total net profit	\$	185.39	Open position P/L	\$	0.00
Gross profit	\$	238.74	Gross loss	\$	-53.35
Total # of trades		22	Percent profitable		82%
Number winning trades		18	Number losing trades		4
Largest winning trade	\$	37.49	Largest losing trade	\$	-27.09
Average winning trade	\$	13.26	Average losing trade	\$	-13.34
Ratio avg win/avg loss		0.99	Avg trade(win & loss)	\$	8.43
Max consec. winners		7	Max consec. losers		2
Avg # bars in winners		23	Avg # bars in losers		24
Max intraday drawdown	\$	-54.16			
Profit factor		4.47	Max # contracts held		1

Performance Summary: Long Trades

Total net profit	\$	118.62	Open position P/L	\$	0.00
Gross profit	\$	145.71	Gross loss	\$	-27.09
Total # of trades		11	Percent profitable		91%
Number winning trades		10	Number losing trades		1
Largest winning trade	\$	24.59	Largest losing trade	\$	-27.09
Average winning trade	\$	14.57	Average losing trade	\$	-27.09
Ratio avg win/avg loss		0.54	Avg trade(win & loss)	\$	10.78
Max consec. winners		9	Max consec. losers		1
Avg # bars in winners		33	Avg # bars in losers		65
Max intraday drawdown	\$	-54.16			
Profit factor		5.38	Max # contracts held		1

Performance Summary: Short Trades

Total net profit	\$	66.77	Open position P/L	\$	0.00
Gross profit	\$	93.03	Gross loss	\$	-26.26
Total # of trades		11	Percent profitable		73%
Number winning trades		8	Number losing trades		3
Largest winning trade	\$	37.49	Largest losing trade	\$	-13.32
Average winning trade	\$	11.63	Average losing trade	\$	-8.75
Ratio avg win/avg loss		1.33	Avg trade(win & loss)	\$	6.07
Max consec. winners		3	Max consec. losers		1
Avg # bars in winners		11	Avg # bars in losers		11
Max intraday drawdown	\$	-22.28			
Profit factor		3.54	Max # contracts held		1

Figure 2 Trade By Trade Summary for Mystery System

Date	Signal	Entry Price	P/L From Prev Signal	%G/L From Prev Signal	Cumulative P/L
5/16/86	Buy	205.17			
6/20/86	Sell	216.40	\$11.23	5.47%	\$11.23
7/11/86	Buy	213.93	\$2.47	1.14%	\$13.70
10/31/86	Sell	215.71	\$1.78	0.83%	\$15.48
11/21/86	Buy	215.59	\$0.12	0.06%	\$15.60
5/12/89	Sell	229.38	\$13.79	6.40%	\$29.39
10/20/89	Buy	207.55	\$21.83	9.52%	\$51.22
12/8/89	Sell	224.93	\$17.38	8.37%	\$68.60
3/2/90	Buy	237.65	(\$12.72)	-5.66%	\$55.88
5/25/90	Sell	255.93	\$18.28	7.69%	\$74.16
11/23/90	Buy	218.44	\$37.49	14.65%	\$111.65
12/11/92	Sell	234.71	\$16.27	7.45%	\$127.92
3/5/93	Buy	220.30	\$14.41	6.14%	\$142.33
7/2/93	Sell	244.89	\$24.59	11.16%	\$166.92
11/5/93	Buy	258.21	(\$13.32)	-5.44%	\$153.60
4/29/94	Sell	277.31	\$19.10	7.40%	\$172.70
7/15/94	Buy	270.96	\$6.35	2.29%	\$179.05
8/12/94	Sell	276.21	\$5.25	1.94%	\$184.30
9/30/94	Buy	268.58	\$7.63	2.76%	\$191.93
12/29/95	Sell	241.49	(\$27.09)	-10.09%	\$164.84
1/12/96	Buy	241.71	(\$0.22)	-0.09%	\$164.62
3/22/96	Sell	259.75	\$18.04	7.46%	\$182.66
4/12/96	SExit	257.02	\$2.73	1.05%	\$185.39



