Do Turtles Have Fat Tails?
Donchian Channels and Turtle Trading: The Case of Soybeans
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Abstract

The movie "Trading Places" starring Dan Aykroyd and Eddie Murphy premiered in 1983 and concerned a friendly wager between two long time traders as to whether traders were born or could be "made". Unbeknownst to the cast of the movie, a real experiment was taking place in Chicago at the same time. Richard Dennis had advertised in the Wall Street Journal, selected ten candidates (and added three others), and taught them to trade like "turtles". Twenty years later their story is the stuff of legend. This paper attempts to simulate "Turtle Trading" to ascertain whether the legend holds kernels of truth. More importantly, the research provides information on whether the turtle system has merit, and what the more important ingredients might be.

The system, a channel breakout system, is tested with data from soybean futures contracts over a 27 year period; from 1980 into 2007. An initial amount of capital of $5,000.00 grows to $187,762.50 under the best case scenario. One of the most important ingredients in the turtle system is the use of stops to preserve capital. Indeed, the capital preservation rules may be the most important ingredient.

Random behavior in the financial markets, as predicted by efficient market proponents, would lead to normal distributions of returns with "skinny" tails. Trend traders, like the turtles, believe that prices move in trends that defy the description of random movement. These trends lead to distributions of returns with "fat tails". The analysis of more than 100 futures contracts and several hundred trades over more than 27 years in this paper lend credence to the idea that the "Turtles" do have "fat tails".

I. Introduction

Richard Dennis and his partner William Eckhardt conducted an experiment in Chicago in the 1980s. They taught a group of new traders their "turtle" system and supplied them with capital to begin trading. Some reports indicate that the turtles earned annual average rates of return approaching 80 percent for most of that decade. The "Turtle" system became the stuff of legend into the 1990s until some of the former turtles began conducting seminars to teach others how to invest like a turtle. Since that time various web sites and books have appeared related to "turtle trading".

This study analyzes the "turtle trading system" that has been published in recent years. The system is based on a form of channel breakouts first exposited by Richard Donchian. Richard Dennis, a legendary commodities trader further developed the breakout system. This was the system named "Turtle Trading", so named for the two groups of traders Dennis hired and trained in the 1980's. This paper utilizes the system Dennis taught his traders to determine its success in trading soybean futures contracts from 1980 until early 2007. Soybeans are a good

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starting point for the examination of the "Turtle Trading" system since Richard Dennis reportedly made his early fortune trading soybeans.

II. Literature Review

Charles Dow, the founder of the Wall Street Journal created the first market index and the first widely followed public information on business activity. Dow could also be considered the father of technical analysis, since his Dow Theory was the first technical method to predict future movements of security prices. Dow was one of the first to suggest that prices moved in trends and the recognition of such trends was a key in profitable investing (Pring 2002). Technical analysis' main purpose is to identify trends in security prices (Kirkpatrick and Dalquist 2007). The existence of these trends that last longer than random behavior would predict is the key to profitable trends. These are the "fat tails" that are explained well in A Short Course in Technical Trading (2003) by Perry Kaufman.

Channel breakouts have been studied in the financial literature since the early 1960's. Edwards and McGee (2007) describe support and resistance levels in their classic work. Alexander's filter rules (1961) were one of the first academic studies of this phenomenon. Lukac and Brosen (1990) conducted a comprehensive study of technical trading systems analyzing twelve different trading signals, including breakouts, on several markets over a ten year period. Taylor (1994) conducts a simulation of currency futures trading based on channel breakouts.

Lo, Mamaysky, and Wang (2000) in a significant article in the Journal of Finance analyze several technical analysis formations, including double tops and bottoms, head and shoulders formations, among others. These formations can be demonstrated to be related to channel breakouts. More recently, Sehgal and Garhyan (2006) utilized technical analysis and channel breakouts to test their effectiveness on the Indian stock market, as did Mitra (2002). Tian, Hua, and Guo (2002) analyzed returns from the U.S. equity market and the Chinese equity market utilizing trading systems with technical analysis, including channel breakouts.

Academic research on "turtle trading" is rather sparse. Anderson (2003, and in an undated working paper) examined a breakout system modeled after the Turtles' system to trade U.S. Bond and Corn futures contracts. Miyazaki and Riles (2004) reported on a group of traders working in a Japanese investment house, who based their trading strategy on the channel breakout system as posited by the Turtles.

The popularity of Michael Covel's books on trend trading and the turtles' system (2006, 2007) has illuminated the timeliness and relevance of this subject. Curtis Faith (2007) one of the original, and by some reports, the most successful "Turtle", has also published a book explaining the details of the "Turtle Trading" system.

Rayome and Jain examined the usage of Donchian channels for 20 day breakouts (2008a) and again for 55 day breakouts (2008b). The combination and synthesis of these two breakout systems with Richard Dennis' money management rules result in the "Turtle System".

The "free for all" of information that has descended on all investors through the rise of the Internet has created a new environment for technical analysis and investing. Information that was previously available to a privileged few, if at all, can now be downloaded for free and on a regular basis from many websites.

III. The Model

The success of the "Turtle Trading" system depends on a security's price continuing in motion once it moves out of its channel (up or down). The channel is formed over time as the price moves up and down between resistance and support levels. Donchian described a channel as a minimum of twenty trading days (Donchian, 1995), (Dixon, 1978). The channel is formed by the daily high and low prices. Richard Dennis and the Turtles used the 20 day channel but also used a 55 day channel for a more conservative approach. If the closing price for the day exceeded the previous twenty days' high prices then a long position was initiated and the contract was purchased. The same strategy holds true for the 55 day channel. Alternatively, if the day's closing price was lower than the previous twenty days' low prices then a short position was initiated and the futures contract was sold.

One of the advancements incorporated in Richard Dennis' system is the analysis and inclusion of risk into the trading system. All trades were analyzed from a risk perspective utilizing a concept of "N". "N" is a measure of daily price volatility that is then used for several purposes. "N" is the 20 day exponential moving average of the True Range. The True Range in turn is defined as the following:

Daily True Range (TR) = *Maximum* (H-L, abs(H-PDC), abs(PDC-L))

Where: H = the day's high price
L = the day's low price
PDC = the previous day's closing price
abs = absolute

N is then computed as: $$N = \frac{(19 \times PDN) + TR}{20}$$

Where: PDN = Previous day's N

The initial PDN is calculated as a simple average of the first 20 days of True Ranges in the beginning of the price series.

"N" then is used by the Turtles as a measure of volatility to place protective stops and exits. It is also used in an algorithm for position sizing that the Turtles used to determine order size and for diversification purposes. This paper is interested in the predictive power of the trading system and uses "N" for stops and exits. Position sizing and diversification effects are of secondary interest and are therefore relegated to future inquiries.

The 20 day breakout system was referred to as System 1. If the price of a commodity they traded exceeded the price for the previous 20 days, it was purchased. A buy order (limit order) was placed if the price exceeded the previous 20 days by 1 tick. The turtles did not wait until the close or until the next day's open. The converse was also true. If the price of the commodity was lower than the previous 20 days by just 1 tick, a sell order (again a limit order) was placed.

The exception to this rule was that if the previous 20 day signal was a profitable signal (whether or not it was taken) then the current signal was to be ignored. So, buy/sell signals were only taken if the previous signal had been an unprofitable one.

The System 2 was based on a 55 day breakout. System 2 was called the failsafe signal. If the previous signal was skipped because the signal prior to that was profitable, and the 55 day signal was triggered, the order would be placed regardless of the previous signals.

All orders filled were protected by stops (mental stops as opposed to market stop orders). The stops were placed 2 N above sell orders and 2 N below buy orders. These 2 N protective stops are referred to as "N-Stops" throughout the paper. The Turtles used the mental stops because at the time their positions were obvious to other traders in the market because of the size of the orders.

Once a signal was generated and a position established, additional orders in the same direction would be issued as the price moved ½ N in the appropriate direction. Each time an additional order was filled the stop for the overall position was also adjusted in the same amount; 2 N above (or below) the new position, as appropriate.

System 1 trades were exited if one of the following three occurred: 1 - a stop order was triggered, 2 – the daily price made a 10 day low for a long position or a 10 high for a short position, 3 – the contract was within 10 days of the Last Trading Day.

System 2 trades were similarly exited if: 1 – a stop order was triggered, 2 – the daily price made a 20 low for a long position or a 20 day high for a short position, 3 - the contract was within 10 days of the Last Trading Day.

The 10 and 20 day high and low exits explained above are incorporated into the model and referred to as "T-stops" or trailing stops (exits).

The primary purpose of this paper is to examine the performance of the "Turtle Trading" system and to attempt to isolate the successful and unsuccessful components of the system. Therefore, several different scenarios are possible for the utilization of the system. The breakout system can be employed with both N-Stops and T-Stops, with one or the other, or without stops altogether. The four different scenarios are all analyzed throughout the entire time period. Each scenario is contrasted to comparative investments in both the S$P 500 Index and U.S. Treasury Bills (T-Bills).

The models were programmed in Visual Basic for Applications which in turn utilizes Excel spreadsheet data. The programming creates a very powerful tool for research. Chandan Sengupta (2004) has written an excellent book on the subject.

IV. Data

The turtles, as trained by Richard Dennis, were allotted amounts of money ranging from several hundred thousand dollars to several million to trade. They were trained over a period of two weeks and were instructed in how to trade multiple markets to diversify their risk. But, they were not allowed to trade Soybean markets, because Dennis, himself, traded that market and the exposure for he and the group would be too large (Covel 2007) (Faith 2007). Dennis had purportedly made his legendary fortune in the Soybean markets. This, then, becomes an interesting starting point on which to examine the Donchian Breakout and Turtle Breakout system. The purpose of this study is to find whether the breakout system has merit and is warranted further study. If this is so, further research can be conducted to analyze the significance of trading other markets and combinations of those markets.

The model found the same percentage returns whether $5,000 or some amount larger was used as a starting point. If $2,000,000 is used, as some of the Turtles began with, the percentage results are the same, only the dollar amounts are larger. Since most investors do not start with

$2,000,000, we asked the system to compute the minimum amount necessary for the system to be successful. Surprisingly, $5,000 was an adequate amount to fund the system. Less than $5,000 and the system went broke.

The Grain Products traded on the Chicago Board of Trade are some of the oldest traded commodities in the United States. Soybean contracts are one of the most important and well followed of the grain contracts. This commodity is highly dependent upon weather as well as supply and demand forces. If a financial product is subject to long trends in market price, it may be a product such as soybeans. The primary months of activity are January, March, July and November. The models are tested on daily data for those months from January 1980 through January 2007. 109 contracts are examined over 27 years. The most liquid (*front*) months are used for the tests and there is no overlap of daily prices for the contract months traded. The front month during each quarter is used for the data source. The closing daily price is used for the entry price. The exit prices are recorded as signaled. Because all trades occur in the front, most liquid contracts, slippage is assumed to be a minor effect.

Futures trading by nature, involves the use of leverage, so at no time could 100% of the capital be employed. One adverse day could result in the failure of the account. The Turtles were instructed to allot no more than 2% of their account to any one position. This is an indirect method of controlling risk. For the purpose of this study, the system was allowed to determine the amount of leverage that could be employed without jeopardizing the system's success. The system analyzed the performance of leverage from 0% to 100% with and without stops. The results indicate that the use of 20% leverage was adequate. The system employed up to 15% of the available capital in the account for the sale and purchase of the Soybean contracts. The margin on Soybean contracts fluctuates as the price in the market moves. Generally speaking, the margin ranges between 2 and 3 percent of the value of the contract. In 1980, for example, a starting balance of $5,000 with 20% leverage would allow $1,000 for the sale/purchase of one contract. This relationship is maintained throughout the study.

Transaction costs were ignored in this study. Once the profitability of these strategies is established, transactions costs can be included. Each contract, if open, is closed ten days before expiration of the contract.

V. Analysis

Table I shows the results for the Trading System for the four scenarios.

(Table I – Summary for Four Trade Systems.)

A trader or speculator is recognized to be a risk taker. These investors need to be rewarded for the risk they bear. One comparison that may be made is between the speculative investment and a relatively risk free investment. Lukac and Brorsen (1990) demonstrated that there is no correlation between futures or derivatives trading and the stock market (with the exception of stock market index futures contracts and perhaps single stock futures contracts). However, a correlation and relationship between the risk free rate, represented by 90 Day U.S. Treasury Bills, and the risky investment, in this case Soybean futures contracts can be examined. When a buy or sell signal occurs the trader can use his or her capital to make the trade, or alternatively, the speculator could buy a U.S. T-bill and hold it for the same period of time. Another option in lieu of taking a trade would be simply to invest (buy) in the S&P 500 Index for the same period as the trade occurrence. Table I also provides the results from these alternative investments.

The system, utilizing 20 and 55 day breakouts combined with N-stops and T-stops is productive over the period in question. However, without the trailing stops, the system fails. The use of the trailing stop is critical to the success of the system.

(Table II – Long Trade Results)

Table II provides a closer inspection of the trade system from the long (buy) position. The system initiates 375 long positions of which 160 are profitable and 215 are not. The concept of risk management is again the critical focal point. The losing trades from the long side vary from -$844.12 for the System with stops to -$3,496.25 to the System with no stops. Minimizing the losses while allowing the profitable trends to run is one the key factors in play. The average profit of $2,276.72 compared to the average loss of -$844.24 offset the win ratio of less than 50%. Investors and traders should take note of this important point.

(Table III – Short Trade Results.)

Table III also corroborates the information provided in Table 2, except these trades are from the short (sell) side. The system generates 400 short positions of which 165 are profitable and 235 are not (for System with Stops). Again, controlling the risk and minimizing the losses are the critical factor for the success of the system. An average profit of $1,042.35 offsets the average loss of -$756.97.

(Table IV – System Results.)

Table IV provides some interesting and important information. The most profitable system, System with Stops, has a winning percentage of 41.94% of trades taken. The average profit on a trade is $228.08. The resulting conclusion is that the success of the system is minimizing losses (controlling the risk) and accumulating profits over time.

The following charts provide a graphical representation of the results.

(Figure I- System with Stops.)

Figure I illustrates how the system performs over the 26.25 years that the data is tracked. On three occasions, 1983, 1988, and 2003 the system catches significant trend breaks. The rest of the time it appears to slightly trend downwards. The graph also illustrates how the system outpeforms the S&P 500 and also T-Bills over the same investment periods.

(Figure II - System No N-Stop.)

Figure II illustrates the performance of the system without N-stops but still utilizing the T-stops. The performance is similar to that of the system in Figure I. The System without N-stops actually has a slightly higher rate of return, but also has increased volatility.

(Figure III - System w/o Stops.)

Figure III shows the System without any stops. The results are extremely volatile and the system underperforms the S&P 500 and T-bills beginning in 1986 and finally fails in 1988. The lack of stops usage fails to control the inherent volatility of the soybean prices and leads to the system's failure.

(Figure IV - System No T-Stop.)

Figure IV again demonstrates clearly the importance of stops in the success of the system. Without the trailing stops, the system fails in the first year. The N stops provided too much latitude for the volatility of the underlying commodity. The first major spike in the prices (positively or negatively) bankrupted the trading system.

(Figure V - System Comparison.)

Figure V provides graphical representation of the trading system with its different variations. The systems that utilize trailing stops for risk management control are the successful methods.

Statistical Analysis

The data were back-tested using our model via a back-testing simulation software application built using Visual Basic for Applications. The software was designed to read the three sets of data – Soybean Futures, S&P and T-Bill prices – one by one. First, the software used the Turtle System rules to determine appropriate entry and exit points for the Soybean Futures data, and calculated the returns generated thereof. Then, the software determined what alternate returns would have accrued if the same entry and exit points were applied to long positions in the S&P or the T-Bill data. In this back-testing process, investment opportunities in the first contract period are explored with a certain amount of capital in hand. Then, when this contract period ends, the then available capital is used to explore investment opportunities in the next contract period, and so on, till the end of the last contract period.

When back-testing, the simulation software makes it possible to include or not include the different kinds of Stops that may be employed. Thus, four different sets of back-tests were performed using varying combinations of inclusion for T-Stops and N-Stops, and the four are described in the table below. By employing the different permutations of Stops in different back-tests, we can determine the utility of the various kinds of Stops.

(Table V – Backtests)

The back-tests indicated that only under back-test # 1 and back-test #4 could on-hand capital be sustained till the end of the back-testing period. That is, when no Stops are used, or when no T-Stop is used, sustained losses lead to capital depleting and the trade system going bankrupt.

Back-test # 1 is the principal back-test we are concerned with because we wish to analyze the System with all Stops included. From the table below, Back-test # 1, the system return on soybean futures yielded a much higher mean return than investing in T-Bills. All statistical analyses were performed using SPSS v12.

(Table VI - Back-test # 1 Descriptives (Turtle System vs. T-Bills).)

Next, a one-tailed independent samples t-test was conducted to determine whether the difference between the returns from the system return on soybean futures and comparative investment in T-Bills is statistically significant. The table below describes the t-test. The t-test results indicate that the returns from the trade system on soybeans are indeed significantly higher than returns from the T-Bills ($p < 0.004$). The previous table also indicates that the standard deviation is quite different between the trade system on soybeans and the T-Bills results. Thus, this likely violates the equal variances assumption for t-tests. However there are two reasons why the results have high validity. Firstly, t-tests are robust to violations of the equal variances assumption when sample sizes are large (~ 100) as is the case here. And secondly, in the bottom row of Table VI below, are the results in the case that equal variances were not assumed, and these results are negligibly different from the actual t-test results.

(Table VII - One-tailed Independent Samples t-test (Turtle System vs. T-Bills).)

In Tables VIII and IX, similar analyses are produced (that were displayed in the Tables VI and VII), except in these cases returns from investing in S&P are compared to returns from T-Bills. Note that T-Bills yielded higher returns than S&P during the investment periods recorded.

(Table VIII - Back-test # 1 Descriptives (S&P vs. T-Bills).)

Next, Table IX indicates that this difference (in the returns between T-Bills and S&P) is not statistically significant ($p < 0.44$).

(Table IX - One-tailed Independent Samples t-test (S&P vs. T-Bills).)

Table X contains a comparison of the returns from the two back-tests that produced positive capital for the entire length of contracts (i.e., Back-test # 1 and Back-test # 2). Tables X and XI display the descriptives that enable this comparison.

(Table X - Back-test # 1 Descriptives.)

(Table XI - Back-test # 1 Descriptives.)

The results of Back-test # 1 indicate that the returns from investing in the trade system in soybeans with Stops are significantly higher than the returns from the T-Bills and further, that there is no significant difference between the returns from investing in S&P and T-Bills.

The statistical software SPSSv12 is utilized to not only compile the basic statistics of return, variance and standard deviation, but the returns of the risky trading strategy are also compared to the risk free returns of the U.S. 90 Day T-Bill to ascertain whether the returns are justified in a traditional return-risk relationship.

The T-Bill is recognized as a proxy for the risk free rate of interest. This interest rate is also a basic building block in all interest rates of return. The risk free rate includes the real rate of return plus any anticipated inflation. All subsequent rates of interest in an economy must include the risk free rate and then include appropriate risk premiums. Many return risk analyses examining equity securities are framed in the Capital Asset Pricing Model (CAPM) structure. Lukac and Brorsen (1990) demonstrated that there is no correlation between equity markets and currency or futures markets, therefore the CAPM framework is not appropriate for the analysis of futures returns. The appropriate comparison is then between the risky returns of the futures trading system and the opportunity costs forgone in the riskless T-Bill.

The Sharpe Ratio is one appropriate measure of the return risk relationship. According to William Sharpe (Fama and Sharpe, 1994) "The historic Sharpe Ratio is closely related to the t-statistic for measuring the statistical significance of the mean differential return. The t-statistic will equal the Sharpe Ratio times the square root of T (the number of returns used for the calculation). If historic Sharpe Ratios for a set of funds are computed using the same number of observations, the Sharpe Ratios will thus be proportional to the t-statistics of the means."

The Sharpe Ratio is useful in comparing returns of varying volatility. Sharpe suggests that the ratio is useful in comparing returns over short periods, i.e. monthly return, and then annualizing the results over longer periods for comparison (Fama and Sharpe, 1994). The risky component of the respective returns is isolated separate from the risk free component. Table XII compares the Sharpe Index of the Trading system to that of the S&P 500 over the same investment time periods.

(Table XII- Sharpe Index Ratios.)

The results of both systems with stops provide higher Sharpe Ratios than the alternative investment in the S&P 500. The statistics indicate that not only do the Trading Systems utilizing stops have higher returns that are significantly different from the returns available from either a risk free approach of U.S. T-bills or that obtainable from an investment in the S&P 500, but also that those returns are also significant from a risk adjusted perspective.

VI. Conclusion

This paper analyzes the breakout systems based on the work of Richard Donchian and trend traders like Richard Dennis and the Turtles. Data from over twenty seven years from 1980 until early 2007 is filtered through a program created on with VBA programming for Excel.

The key goals of this research were to understand how the Turtle Rules can yield a profitable trading strategy in a highly volatile and risky commodities futures market such as Soybean futures. This research project produced several statistically significant findings. First, when applied over the period in consideration, Turtle Rules indeed yield a positive annual rate of return (14.67% compounded) over the more than 27 year period. An initial capital amount of $5,000 in 1980 grows to an ending capital amount of $181,762.50 in 2007. The research also evaluates the efficacy of the two kinds of stops used in the Turtle Rules. T-stops are revealed to be critical to the success of the system with soybean futures. However, the N-stops are problematic. N-stops seem to work in conjunction with T-stops, but apparently are not successful in managing risk without the additional contribution provided by the T-stops. Future research could examine the conditions under which N-stops are effective.

This return is dampened somewhat when considered in the context of several factors. The returns are highly volatile (leading to greater risk), and as illustrated in Figure I, most of the gains occur in three short time-frames (1982-83, 1987-88, 2002-2003) within the entire examination period. Nevertheless, it is notable that at no time does the amount of available capital dip below the initial starting capital. Since historical prices have no discernable relationship to future prices, the replication of these returns in the future may be suspect.

The analysis uses a modified version of the original Turtle rules. It is a best fit based on the data available. One improvement to the analysis would use actual intra-day tick data for the entire period considered. Such data is difficult, if not impossible to obtain for such a long time period.

With Soybean futures, the Turtle Rules system patiently waits for high gain opportunities while minimizing losses during barren times.

The test results indicate the returns are significant from a statistical and a risk adjusted analysis. Trend trading with channel breakouts is experiencing renewed interest by the investing public. It is important that researchers investigate the validity of such a strategy.

The returns generated require a risk tolerance that may beyond that of most investors. More importantly, even the study of 27 years of data and hundreds of ex post trades may provide little real guidance to the ex ante returns generated by today's volatile markets. However, producers of soybeans and end users of the product may be able to better hedge their exposure to uncertainty by employing the system explained in this paper. Users of the underlying commodity seek to manage the risk of the price uncertainty inherent in this, one of the most volatile products traded. The use of Trend Trading or Turtle Trading to offset the uncertainty of uncertain pricing may prove to be its most important product.

Future research combining this system with other important filters such as other technical signals or fundamental analyses could indeed make the results more robust and certainly worthy of future investigation.

The Turtle Rules trading system cannot predict when significant trends will occur. However, consistent application of the trading system can minimize the risk involved and be in position to capitalize on a significant trend when it does occur. So after all, it does appear that "Turtles" may have fat tails.

Tables and Figures

Table I – Summary for Four Trade Systems.

Summary Statistics			
Trade System	Stops	T-Bill	S&P Index
Beginning Amount	$5,000.00	$5,000.00	$5,000.00
Profit	$176,762.50	$2,052.18	$1,472.07
End Amount	$181,762.50	$7,052.18	$6,472.07
APR	14.6698%	1.3187%	0.9879%

Trade System	No N Stop	T-Bill	S&P Index
Beginning Amount	$5,000.00	$5,000.00	$5,000.00
Profit	$198,412.50	$2,383.11	$3,034.57
End Amount	$203,412.50	$7,383.11	$8,035.47
APR	15.1624%	1.4959%	1.8233%

Trade System	No T Stop	T-Bill	S&P Index
Beginning Amount	$5,000.00	$5,000.00	$5,000.00
Profit	-$7,362.50	$2,052.18	$1,472.07
End Amount	-$2,362.50	$7,052.18	$6,472.07
APR	N/A	1.3187%	0.9879%

Trade System	No Stops	T-Bill	S&P Index
Beginning Amount	$5,000.00	$5,000.00	$5,000.00
Profit	-$7,750.00	$1,630.85	$1,472.07
End Amount	-$2,750.00	$6,630.85	$6,472.07
APR	N/A	3.2788%	2.9932%

Table II – Long Trade Results

Trade System	Stops	No N Stop	No T Stop	No Stops
Max Contracts	17	17	8	16
Max Capital Used	$12,750.00	$12,750.00	$6,000.00	$12,000.00
# Long Wins	160	152	1	23
# Long Losses	215	218	6	30
# Longs	375	370	7	53
Long Gross Profit	$364,275	$412,050.00	$5,125.00	$107,875.00
Long Gross Losses	-$181,512.50	-$205,850.00	-$10,650.00	-$104,887.50
Net Profit (Longs)	$182,763	$206,200.00	-$5,525.00	$2,987.50
Max Long Win	$12,387.50	$14,275.00	$5,125.00	$10,362.50
Max Long Loss	-$3,275.00	$4,275.00	-$3,275.00	-$10,700.00
Ave Long Win	$2,276.72	$2,710.86	$5,125.00	$4,690.22
Ave Long Loss	-$844.24	-$944.27	-$1,775.00	-$3,496.25
Max Long Win (Days)	57	57	6	85
Max Long Loss (Days)	32	32	18	83
Min Long Win (Days)	1	1	1	1
Min Long Loss (Days)	1	1	1	1

Table III – Short Trade Results.

Trade System	Stops	No N Stop	No T Stop	No Stops
# Short Wins	165	159	5	21
# Short Losses	235	226	1	18
# Shorts	400	385	6	39
Short Gross Profit	$171,987.50	$164,525.00	$2,862.50	$23,800.00
Short Gross Losses	-$177,887.50	-$172,312.50	-$87.50	-$34,537.50
Net Profit (Shorts)	-$5,900.00	-$7,787.50	$2,775.00	-$10,737.50
Max Short Win	$5,525.00	$4,400.00	$1,125.00	$3,937.50
Max Short Loss	$4,625.00	$3,325.00	-$87.50	-$18,162.50
Ave Short Win	$1,042.35	$1,034.75	$572.50	$1,133.33
Ave Short Loss	-$756.97	-$762.44	-$87.50	-$1,918.75
Max Short Win (Days)	45	45	18	84
Max Short Loss (Days)	22	24	3	82
Min Short Win (Days)	1	1	1	1
Min Short Loss (Days)	1	1	1	1

Table IV – System Results.

Trade System	Stops	No N Stop	No T Stop	No Stops
Winning Percentage	41.94%	41.19%	46.15%	47.83%
Average Profit/Trade	$228.08	$262.80	-$566.35	-$84.24

Table V - Backtests

Backtest #	T-Stop	N-Stop
1	Included	Included
2	Not Included	Not Included
3	Not Included	Included
4	Included	Not Included

Table VI - Back-test # 1 Descriptives (Turtle System vs. T-Bills).

	N	Mean	Std. Deviation	Std. Error Mean
Return per contract (%) Turtle System	104	6.74	36.85	3.61
Return per contract (%) T-Bills	109	0.32	0.37	0.04

Table VII - One-tailed Independent Samples t-test (Turtle System vs. T-Bills).

	t	df	Sig. (1-tail)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Upper	Lower
Equal variances assumed (t-test)	1.82	211	**0.004**	6.43	3.53	-0.53	13.38
Equal variances not assumed	1.78	103	0.004	6.43	3.61	-0.74	13.59

Table VIII - Back-test # 1 Descriptives (S&P vs. T-Bills).

	Code	N	Mean	Std. Deviation	Std. Error Mean
Return per contract (%) S&P	2	108	0.28	2.75	0.27
Return per contract (%) T-Bills	3	109	0.32	0.37	0.04

Table IX - One-tailed Independent Samples t-test (S&P vs. T-Bills).

	t	df	Sig. (1-Tail)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Upper	Lower
Equal variances assumed	-0.15	215	**0.44**	-0.04	0.27	-0.57	0.48
Equal variances not assumed	-0.15	110	0.44	-0.04	0.27	-0.57	0.49

Table X - Back-test # 1 Descriptives.

withStops				
	N	Mean	Std. Deviation	Variance
Return on System minus Risk Free Rate	104	6.43	36.72	1348.50
Return on S&P minus Risk Free Rate	108	-0.04	2.81	7.89
Valid N (listwise)	103			

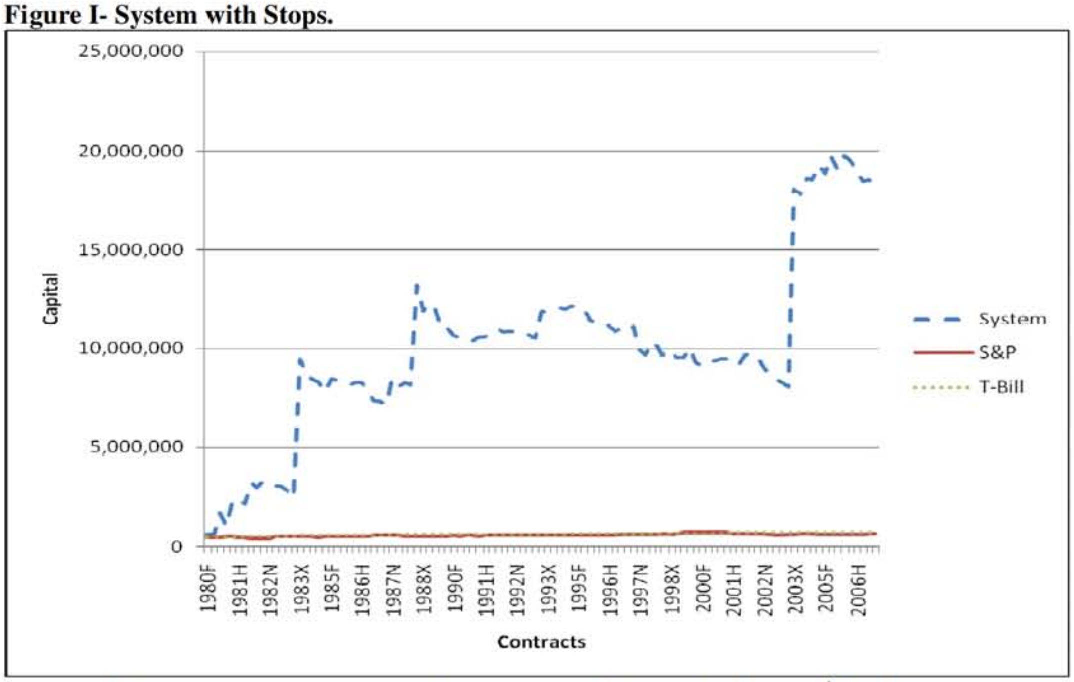
Table XI - Back-test # 1 Descriptives.

no NStop				
	N	Mean	Std. Deviation	Variance
Return on System minus Risk Free Rate	103	6.93	39.11	1529.83
Return on S&P minus Risk Free Rate	108	0.13	3.18	10.11
Valid N (listwise)	102			

Table XII- Sharpe Index Ratios.

	Sharpe
System with Stops	Ratio
Return on System without Risk Free Rate	0.1750
Return on S&P without Risk Free Rate	-0.015
System no N-Stop	
Return on System without Risk Free Rate	0.17708
Return on S&P without Risk Free Rate	0.03974

Figure I- System with Stops.



(Soybean futures contracts are priced in cents/pound, eg. 25,000,000 = $250,000)

Figure II - System No N- Stop

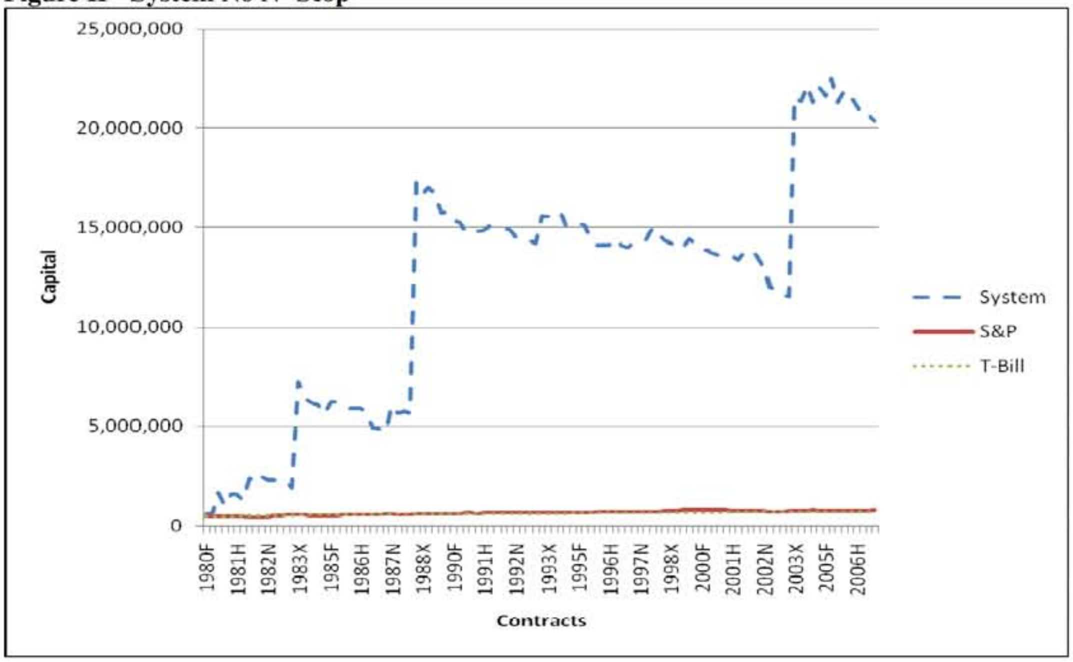


Figure III - System w/o Stops.

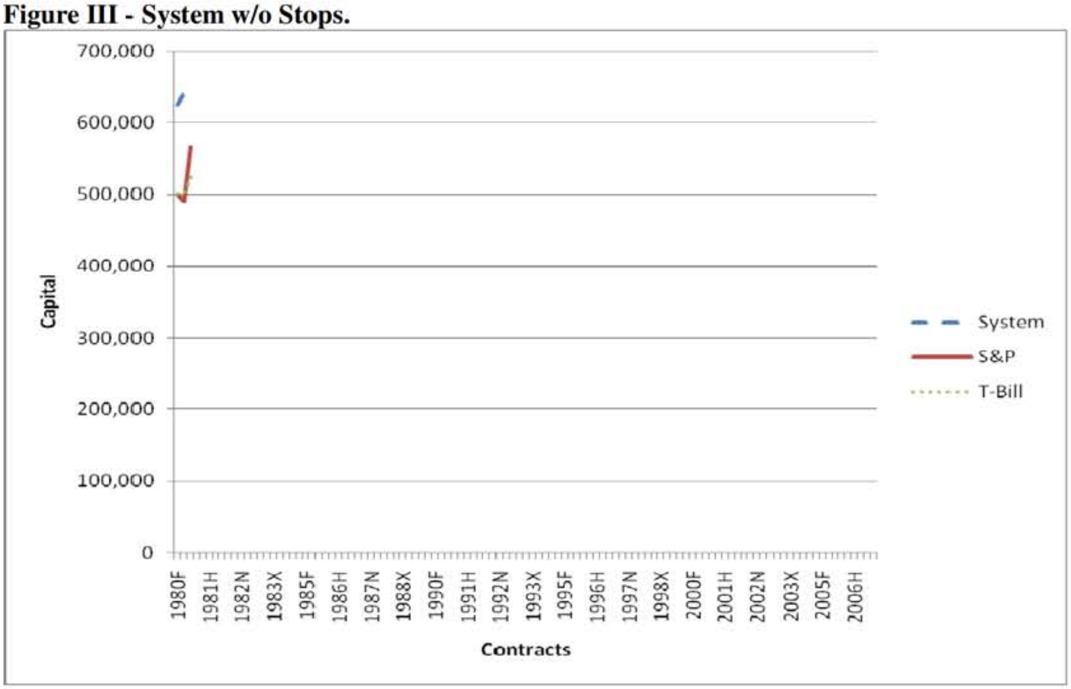


Figure IV - System No T-Stop.

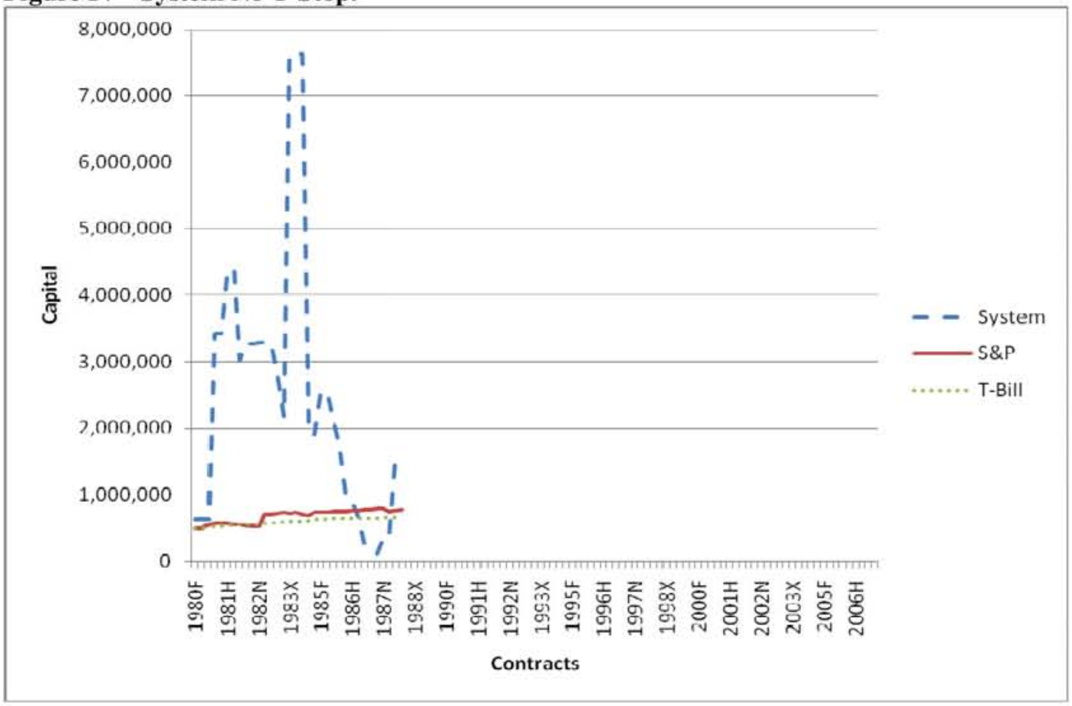
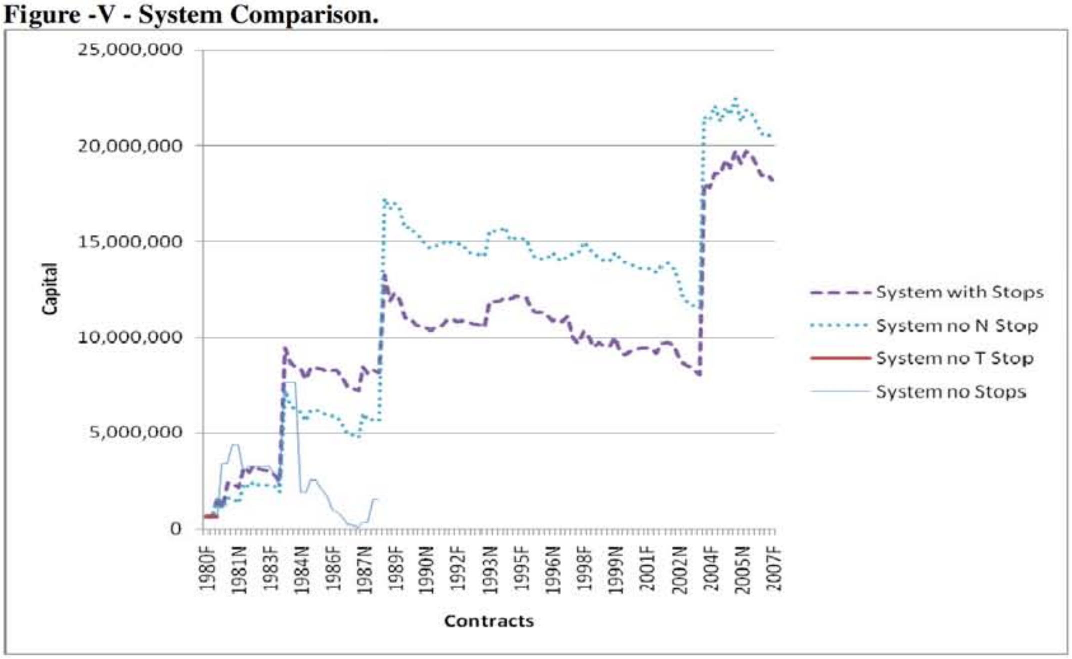


Figure -V - System Comparison.



References

Alexander, S.S. "Price Movements in Speculative Markets: Trends or Random Walks", *Industrial Management Review*, II, 2, May, 1961.

Anderson, John A. "Taking a Peek Inside the Turtle's Shell," Queensland University of Technology, undated manuscript,

Anderson, John A. "Optimal f and Portfolio Optimization in US Futures Markets, Discussion Papers in Economics, Finance and International Competitiveness, Discussion Paper # 133, January 2003.

Covel, Michael W., Trend Following, Prentice Hall, 2006.

Covel, Michael W., The Complete Turtle Trader, Collins, 2007.

Edwards, Robert D. and John Magee, Technical Analysis of Stock Trends, 9th edition, CRC Press, Boca Raton, FL, 2007.

Faith, Curtis M., Way of the Turtle, McGraw Hill, 2007.

Fama, William F. and William F. Sharpe, "The Sharpe Ratio," *The Journal of Portfolio Management*, Fall 1994.

Kaufman, Perry J., A Short Course in Technical Trading, John Wiley and Sons, Hoboken, NJ, 2003.

Kirkpatrick II, Charles D. and Julie R. Dahlquist, Technical Analysis: The Complete Resource for Financial Market Technicians, FT Press, Pearson Education, Upper Saddle River, NJ, 2007.

Lo, Andrew W., Harry Mamysky, and Jiang Wang, "Foundations of Technical Analysis: Computational Algorithms, Statistical Inference, and Empirical Implementation," *The Journal of Finance*, LV:4, August, 2000, 1705-1765.

Lukac, Louis P., and B. Wade Brorsen, "A Comprehensive Test of Futures Market Disequilibrium," *The Financial Review*, 25:4, November 1990, 593-622.

Mitra, Subrata Kumar, "Profiting from Technical Analysis in Indian Stock Market," *Finance India*, March 2002, 16:2, ABI/INFORM Global, p. 109.

Miyazaki, Hirokazu, and Annelise Riles, "Failure as Endpoint,"
http://www.lawschool.cornell.edu/international/asianlaw/content/rilespubFailureasanEndpoint.pdf. 2008.

Murphy, John, J. Technical Analysis of the Financial Markets, New York Institute of Finance, 1998.

Pring, Martin J., Technical Analysis Explained, 4th ed., McGraw Hill, New York, NY, 2002.

Rayome, David L. and Abhijit Jain, "Technical Trading: Donchian Channels and Soybeans I", Review of Business Research, 8:4, 2008a.

Rayome, David L. and Abhijit Jain, "Technical Trading: Donchian Channels and Soybeans II", Journal of International Finance and Economics, 8:4, 2008b.

Sehgal, Sanjay and Anurag Garhyan, "Abnormal Returns Using Technical Analysis: The Indian Experience," *Finance India*, March 2006, 16:1, ABI/INFORM Global, p. 181.

Sengupta, Chandan, Financial Modeling Using Excel and VBA, Wiley Finance, 2004.

Taylor, S.J. "Trading Futures Using a Channel Rule: A Study of the Predictive Power of Technical Analysis with Currency Examples," *The Journal of the Futures Markets*, April 1994, 14:2, p. 215.

Tian, Gary Gang, Guang Hua, and Mingyuan Guo, "Market Efficiency and the Returns to Simple Trading Rules: New Evidence," *Asis - Pacific Financial Markets*, 2002, 9:3-4, ABI/INFORM Global, p. 241.