EXAMINING TECHNICAL TRADING PROFITABILITY IN COTTON FUTURES MARKET

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Abstract

Technical trading is the process of anticipating future prices based on past prices, trading volume, breadth, open interest or a combination of any other indicators. Technical trading has been accepted as the dominant practice by many market participants in analyzing price trends. The purpose of this paper is to evaluate the profitability of technical trading strategies pertaining to cotton. Cotton (CT) is traded at the New York Board of Trade (NYBOT) with a trading unit of 50,000 lbs. The tick size for cotton is 0.01 cent/lb or $5 per contract with a daily price limit of 3 cents or $1500 per contract. Seventeen years of daily futures price data for cotton was used in this study to evaluate the performance of technical trading rules. A total of seven popular trend following systems were analyzed in the paper. Performance measures that indicate the profitability of technical trading rules include but are not limited to: net profit, maximum drawdown, profit factor, ratio of average win to average loss and ratio of profit to maximum drawdown. Results clearly show that traders will benefit by applying money management rules to their trading positions. Out of the seven systems studied, only one system demonstrated consistent profitability for the testing period.

Introduction

Technical analysis is the study of recurring patterns in financial market data with the intent of forecasting future price movements (Aronson, 2007). A technical trading system consists of a set of rules or conditions and when these rules are satisfied, it generates trading signals to go either long or short. Technical analysis gives the researcher the ability to backtest historical price data and estimates the expected returns from the trading rules along with other measures like maximum loss, standard deviation of returns etc. Technical analysis is considered as the dominant practice by many market participants and currently billions of dollars are traded using various technical trading techniques. Figure 1 shows the total money being managed under managed futures which indicates a steady upward trend for the last twenty five years (Barclay Hedge, 2007). There are a number of advantages in using technical approach as it introduces objectivity into trading by following the rules systematically rather than making trading decisions based on gut feeling or being influenced by any other external sources. Technical trading also ensures consistency in trading approaches in terms of implementing buy and sell signals. Another big advantage is that it provides the decision maker with a method for controlling risk. With money management rules, the decision maker can decide early when he/she should get out of the position if the outcome is against to the original position.

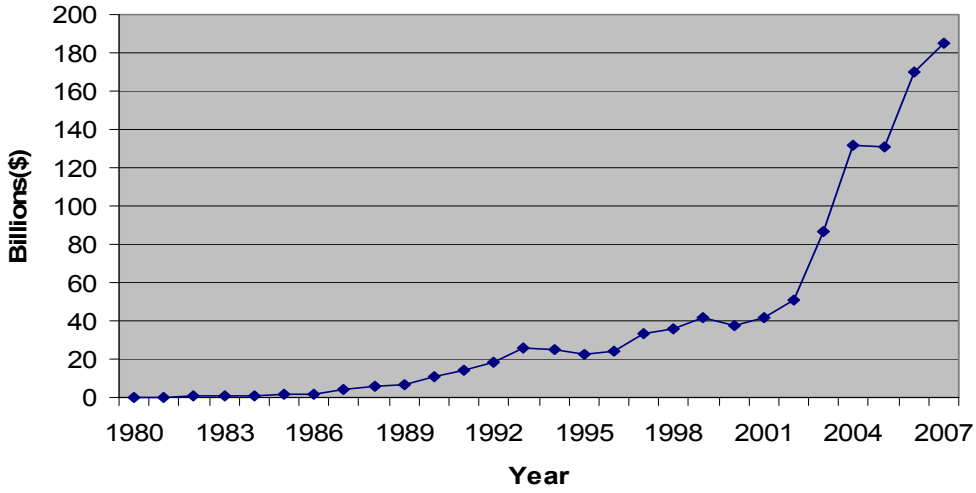

Figure 1: Money under Management under Managed Futures

Commodity markets are primarily driven by fundamentals like supply and demand for the crop, political factors, weather expectations etc, and these fundamentals will help in deciding the broader direction of price movement. Applying fundamentals to trading also requires an in-depth analysis of the trading market. On the other hand, using technical rules or indicators does not require specialized knowledge of the market fundamentals by the technician. The same technical rules can be applied to cotton, Japanese Yen, crude oil, or S&P 500 index futures. Technical analysis also helps the trader in timing their trading decisions regarding when to enter and exit the position with greater certainty. Wayne Purcell in his book, Agricultural Futures and Options: Principles and Strategies (1991) explained the importance of technical analysis:

> *"Technical analysis brings an additional set of tools to the decision maker. Disciplined use of technical dimensions of the market can help the producer avoid the frustrations of margin calls and the significant opportunity costs in a pricing program and provide a "safety net" against potentially ruinous price moves. The ability to analyze the charts is important to decisions on whether protection should be established and to the correct timing of the price actions."*

Schwager (1996) based on trading approaches, broadly classified trading systems into three categories: i, trend following systems ii, counter-trend systems and iii, pattern recognition systems. Trend following systems initiates a position in the same direction of the price trend where as counter trend systems wait for a significant price move and places their positions against the price trend. In pattern trading, the decision maker uses price patterns to predict the future movement of prices. Examples of this type of trading analysis include but are not limited to head and shoulder pattern, double top, triangles, flags, and penants. Pattern trading rules are not clearly defined and it involves subjective analysis by the decision maker. As a result, their applicability in mechanical trading systems is very limited, therefore coverage of pattern trading profitability is beyond the scope of this paper.

Data and Trading Methods

Trending systems are very popular among technical traders. Fung and Hsieh (1997) reported that majority of the CTA fund returns have trend following as their dominant trading strategy. These systems are developed to catch the big moves while limiting losses during sideways or direction less periods. Trending systems usually have a low winning percentage and are psychologically very difficult to trade. Profits are concentrated on few big winning trades far exceeding the losses of many losing trades. Because of the importance of trend following systems among traders, this paper specifically focuses on the trading profitability of trending methods.

A total of seven popular trend following methods are analyzed in this paper. They are: i, two moving average crossover (MA2), ii, three moving average crossover (MA3), iii, triple exponential smoothing (TSM), iv, moving average with true range bands (MATR), v, moving average percent bands (MAB), vi, volatility systems (VLT) and vii, channel breakout methods (BRKOT). Moving averages are the simplest and most widely used trend following systems available in the market. Moving averages are helpful to traders as they filter out noise associated with market fluctuations and give a clearer visual picture to the market participant as to where the market is heading. Two moving average crossover systems as their name indicates employ two moving averages. It generally consists of one long-term average (slow average) that is used to determine the trend and a shorter-term average that gives trading signals as it crosses the longer-term average. Simply stated, the moving average crossover means "buy" when the shorter average crosses over the longer and "sell" when the opposite occurs (longer average crosses over the shorter average). Three moving average crossover systems use three moving averages in order to make buy and sell signals. The slope of a third moving average can be used as a confirmation of direction and to avoid entry into a trade that is going the wrong way. As a result, triple moving average offers a neutral zone (no trade region) as opposed to single or double moving average. Under triple exponential smoothing method, a buy signal will be generated when the triple smoothed trendline rose for two consecutive days and a sell signal will be generated if there is a two day decline in the trendline. A band is an area that acts as a zone of commitment for the traders depending upon on the relative position of prices (Kaufman, 2005). One of the popular versions of using bands is constructing a percentage band from a moving average. If the moving average value is 42 and the band is 3%, then the upper band is 43.26 and the lower band is 40.74. Moving average with true range bands generate a buy signal when prices close above the point that is the sum of the moving average trendline and the average true range times a multiplying factor. A sell signal occurs when prices close below the trendline minus the band. The average true range is always calculated over the same period as the moving average period. Under volatility method, trading signals will be generated when ever there is an unusually large price move relative to average volatility. This system

generates a buy signal when the net change for the day exceeds the value of the average true range times a volatility factor. A sell signal occurs when the net change for the day is negative and exceeds the same threshold value. The theory behind the channel breakout system is to buy, when the market makes an 'N' day high, and to sell when the market makes an 'N" day low. Under this method, once a buy signal occurs because of new high prices, the trade is reversed only when new low prices occur. Breakout systems are generally considered as high risk systems when compared to moving average systems. In the moving average systems, because there is a time lag involved, a single price move will not influence a buy or sell signal. Contrary to moving averages, breakout methods are event driven and a single price move may cause an immediate buy or sell signal.

The purpose of this paper is to evaluate the profitability of technical trading rules for cotton futures market. Table 1 represents the operational details of cotton futures contract including contract size, exchange traded, trading hours, tick size and trading months. Daily market data for the 1990-2007 period is used to examine the profitability of various technical trading rules. In order to eliminate price distortions caused by price gaps located between expiring contracts and subsequent futures contracts, this study uses continuous cotton futures contract developed by Pinnacle Data. The test period is divided into two sample periods one is an in sample period (01/01/1990 to 12/31/1999) and the other is an out of sample period (01/01/2000 to 05/26/2007). The purpose of out sampling also called as walk forward testing is to set aside a statistically significant portion of the original data sample to ensure a high correlation between backtested results and real-time trading account results (Weissman, 2004). Another important factor to consider in trading is the cost of commissions and slippage. Broker commissions for executing the trades have decreased substantially in the last ten years due to intense competition among brokerage houses. Even though transaction costs are minimal on per trade basis, frequent trading activity by traders can minimize such cost advantages over the long run. Slippage is the difference between stop/limit price and the actual fill price. It is unrealistic to assume that our stop price is also the same as fill price. Depending on the liquidity or lack of it, slippage sometimes can be substantial. A $100 slippage and transaction cost per round turn trade is used in this paper for backtesting purposes.

Table 1. Cotton contract profile

Symbol	CT
Exchange	NYBOT
Contract Size	50,000 pounds net weight (approximately 100 bales)
Price Quote	Cents and hundredth of a cent/pound
Trading Months	March, May, July, October, December
Last Trading Day	Seventeen business days from the end of spot month
Trading Hours	10:30 A.M.-2:15 P.M. EST., Mon-Fri
Tick Size	0.01 cent/lb ($5 per contract)
Daily Price Limit	3 cents ($1500 per contract)

Results

Before actually going through the backtested results for the technical trading profitability in cotton, it is important to explain various terminologies that have been employed in this paper. *Total net profit (NP)* gives the overall profit associated with a particular strategy. *Number of trades (#TR)* shows the total number of trades taken during the period of study. Generally, higher the number of trades in a given period, the greater the risk associated with a particular system. *Percent winners (%W)* is the percentage of winning trades. Generally, trend following systems have fewer winning trades with average winning trades significantly greater than the average losing trade. On the other hand counter trend systems have high percentage of winning trades with less profit per trade. *Maximum drawdown amount (MXD)* is the maximum peak to valley equity drawdown during the study period. This indicates the absolute minimum capital needed in order to trade a system. *Maximum consecutive losses (MCL)* are the maximum number of consecutive losses encountered during the testing period. This number is especially important for psychological reasons. This number along with the maximum drawdown will give the trader an idea of the pain that must be prepared to endure. *Profit to maximum drawdown (P:MD)* refers to the average profit to maximum drawdown ratio. The higher the ratio, the better are the system results. This number is important because it allows the user to compare the profit in relation to risk associated in order to achieve the net profits. *Average win to average loss ratio (W/L)* refers to the average win to average loss ratio. The higher these numbers are, the better the results. Generally trend following systems have a high average win to average loss ratio where as mean reversion

systems typically have low numbers. *Average Trade (AVTR)* gives the dollar value of average trade executed by the system. *Number of days (#Days)* indicates the average length of typical trade by the system. *Annual Return (%R)* represents the average annualized return produced by the system.

Table 2 presents the backtested trading results for cotton futures contract from January 1, 1990 to December 31, 1999. The results are from the in sample without employing any money management rules. Among the entire in sample results, two moving average crossover system exhibited highest losses during the test period. This system lost a total of $9700 for a year trading period with a maximum drawdown of $24,190. It also generated the maximum number of trades for the testing period with an average trade lasting for about 22 days. Compared to two moving average crossover, three moving average crossover showed remarkable improvement. The number of trades is lower because three moving average crossover method stays out of the market during sideways period. The average trade duration is higher compared to the earlier system. This system has a net profit of $24,035 with an average profit of $534 and a maximum drawdown of $27,885. Of all the seven trading systems tested in this study, triple exponential smoothing method produced the highest drawdown of $38,655 and an overall net loss of $4,565 for the test period. This system has produced a total of 83 trades for the test period with the lowest winning percent ratio of only 20.48%. Even though this system has produced an average winning trade 3.65 times bigger than the average losing trade, its lower winning percent made the system a big loser for the test period. Triple exponential smoothing also has the highest maximum consecutive losses of 16 making it even more psychologically a difficult system to trade in the long run. Moving average with true range system produced the highest profit of $25,820 among all the system analyzed in this study. This system also has the characteristics of highest winning percentage, lowest drawdown, lowest consecutive losers and a high profit to maximum drawdown ratio making it a desirable trend following system to watch. The only drawback of the system is its trade length averaging about 100 days. In general, the longer you hold the trade, the greater the risk exposure. A typical trade by this system has approximately twice the holding period compared to the other six systems studied. Moving average with percent bands system was not profitable for the test period and produced a net loss of $4,285 with a maximum drawdown of $25,745. This system has an average trading length of 54 days and lost approximately $100 per trade. Volatility system proved to be one of the profitable systems with an average winning trade three times bigger than average losing trade. This system has a 30% winning rate and an average trade produced a profit of approximately $353. The last system studied is a channel breakout system and this system was not profitable for the test period. Over a period of ten years, channel breakout system lost $5,160 with a maximum drawdown of $28,735. The gains associated with the higher average win to average loss ratio was negated by the low winning percentage making it a net loser.

Table 2. Trading results of the systems: In sample, without money management rule (1990-1999)

TM	NP	#TR	%W	MXD	MCL	P:MD	W/L	AVTR	#DAYS	% R
MA2	-9,720	114	31.58	-24,190	11	-0.4	1.93	-85.26	22	-4.01
MA3	24,035	45	35.56	-27,885	10	0.86	2.65	534.11	55	8.62
TSM	-4,565	83	20.48	-38,655	16	-0.11	3.65	-550.0	29	-1.18
MATR	25,820	21	52.30	-22,745	3	1.13	1.65	1229.5	100	11.35
MAB	-4,285	43	32.56	-25,475	10	-0.16	1.93	-99.65	54	-1.68
VLT	17,660	50	30.00	-33,440	10	0.52	3.09	353.20	48	5.28
BRKOT	-5,160	77	25.97	-28,735	13	-0.18	2.67	-67.01	33	-1.79

Money management plays an important role in successful trading. The objective of money management is to choose a desired risk to return ratio that is acceptable to the long term interests of the trader. With regards to money management, the trader has to make a number of decisions like how many contracts of each commodity to trade and how much equity is to be risked at any given time. Traders typically use protective stops and profit targets as a part of their money management rules. A protective stop or stop loss order is a pre determined price level at which the trader decides close the position if the open position turns against to the wishes of the trader. A profit target indicates the desired pre determined price level at which trader closes his/her profitable open position. Typical money management rules suggest the trader not to risk more than 2% on any given trade. Risking too much money on any given trade leads to quick blow out of the trader's finances if any few consecutive positions turns out to be losers. On the other hand risking a little on a single trade helps the trader to survive the inevitable long string of losses which may happen any time in the trading careers of individuals. Using a fixed dollar stop works fine for a single market but becomes useless for a diversified portfolio, because different markets have different volatility rates. A $1,500 stop in soybeans does not have the same effect in corn. Even with in a single market, during some periods

markets exhibit higher volatilities resulting in quick activation of stop loss orders. Another factor to consider is where to place the protective stop for the money management rules. If you place the protective stop very close to entry price, you will soon be whipsawed. On the other hand, placing the protective stop too far way may not activate the stop at all. For the purposes of this paper a protective stop 3 times the average true range is used which is a characteristic of a typical trend following stop level. Table 3 represents the trading results of the systems with the application of money management rule. Lot of improvements were observed in the cotton profitability when compared to previous trading results without money management rules. The maximum drawdowns have declined in all the seven trading systems. Notably, three moving average crossover and volatility systems showed a significant improvement of approximately $10,000. Except for three moving average crossover, all the remaining six trading systems profitability has improved with money management rules. Moving average percent bands which was in negative profits in the earlier test results turned positive as a result of adding a protective stop. The biggest gainer in all the seven trading systems is moving average with true range which showed an improvement in its annual average returns from 11.35% to 20%. As a consequence of adding a protective stop, average trade length has decreased for all the seven trading systems.

Table 3. Trading results of the systems: In sample, with money management rule (1990-1999)

TM	NP	#TR	%W	MXD	MCL	P:MD	W/L	AVTR	#DAYS	% R
MA2	-7,895	114	31.58	-21,415	11	-0.36	1.97	-69.25	21	-3.68
MA3	9,965	89	33.71	-17,450	8	0.57	2.32	111.97	19	5.72
TSM	-3,580	95	22.11	-37,360	11	-0.09	3.36	-37.68	26	-0.95
MATR	33,600	23	47.83	-16,785	3	2.00	2.63	1460.87	85	20.01
MAB	1,650	47	29.79	-19,310	11	0.08	2.43	35.11	40	0.86
VLT	24,720	53	28.30	-23,570	11	1.04	3.84	466.42	40	10.48
BRKOT	-2,565	78	25.64	-27,070	13	-0.09	2.81	-32.88	31	-0.95

Out of sample or walk forward testing is an important step involved in system development and testing to tackle problems associated with curve fitting. Curve fitting is the process of intentionally or unintentionally applying trade parameters that match in sample data. As a result, the beacktested trading results look very promising yet the system fails to perform in the real-time trading environment. To avoid these problems, traders set aside a sufficient sample of data usually the most recent data and use that data to predict possible future returns associated with a particular trading strategy. Table 4 represents the out of sample results for the trading systems discussed in this paper. These out of sample results are then compared to our in sample money management results. Any significant deviations in terms of maximum drawdowns, or net profits associated with any particular strategy results in either totally abandoning that particular strategy or a complete reevaluation of our initial trading strategy. Our out of sample results appear to be with in the normal limits of the in sample results. For the two moving average crossover system, maximum drawdowns have declined from $21,415 to $17,790 in the new testing period. Three moving average results were surprising given that its drawdowns are with in the expected range; but its profitability was severely impacted. Its overall profits declined from $9965 to -$15,095; making it an unreliable system with huge swings in its equity curve. For triple exponential smoothing its profit to maximum drawdown ratio has increased from -0.09 to 0.96 making it the biggest gainer in our out of sample testing period. Even though, profits declined nearly half for the true range bands system during our out of sample study, it is the only system which showed consistency in trading results thus making it a reliable system for the long run. Channel breakout method results albeit not useful were also consistent in terms of its performance for the last seventeen years. Volatility method was another big disappointment in its results. Even though the drawdowns have decreased during our out of sample study, at the same time it sacrificed huge profits. Its overall profitability declined from $24,720 to $-1035 making it susceptible to big equity changes. Finally moving average percent band system showed an improvement in it's out of sample results. Profitability of an average trade has increased from $35 to $160 and profits to maximum drawdown ratio also increased from 0.08 to 0.65.

Conclusion

This paper attempted to analyze the profitability associated with technical trading rules specifically focusing on popular trend following methods. A $100 per round-turn transaction costs were applied to calculate the net profits associated with various trading rules. The results clearly indicated that traders will be benefited by using money management rules. With money management rules, profitability levels improved for all the seven trading systems.

Also, the trading systems experienced a decrease in drawdown levels. In order to ensure the profitability of the trading systems, all the seven systems were again tested on an out of sample data over a test period of approximately six and half years. Except for moving average with true range system, the remaining systems did not exhibit consistency in profits for the out of sample results.

Table 4. Trading results of the systems: Out of sample, with money management rule (2000-2007*)

TM	NP	#TR	%W	MXD	MCL	P:MD	W/L	AVTR	#DAYS	% R
MA2	-1,995	72	38.89	-17,790	8	-0.11	1.51	-27.71	28	-1.54
MA3	-15,095	65	32.31	-22,885	6	-0.65	1.40	-232.23	22	-9.03
TSM	10,410	61	36.07	-10,775	5	0.96	2.29	170.66	35	13.23
MATR	11,890	21	23.81	-18,015	6	0.66	4.79	566.19	72	9.04
MAB	8,480	53	37.74	-12,920	5	0.65	2.01	160.0	33	8.99
VLT	-1,035	46	41.30	-19,235	4	-0.05	1.38	-22.50	34	-0.74
BRKOT	-370	56	39.29	-12,480	5	-0.02	1.53	-6.61	32	-0.41

Disclaimer

The risk of loss in futures and options can be substantial. These instruments are not suitable for all individuals. The content of this article is the opinion of the author alone and no representation is being made that any account will or likely achieve profits or losses similar to those shown in this article. Actual trading results can be substantially different than simulated trading results.

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