Turtle Trading Rules (TTR)

Executive Summary

This is a paper in module FE5101 – Financial Engineering Project. The purpose of this paper is to examine and validate the Turtle Trading Rules (TTR) which provide traders with a strategy (or a set of rules) to follow in order to make profits in financial markets.

The paper consists of the following sections:

1. **TTR Overview:**

A brief overview of the entire trading rules and specifications

1. **Implementation and Adjustment:** 
   1. Data source and data selection to implement TTR
   2. Assumptions and adjustments during the implementation of TTR.
2. **Result and Evaluation:**

A discussion about results, strengths and weaknesses of TTR

1. **Experiment:**

A discussion about tweaks in TTR parameters.

1. TTR Overview

The complete details of the Turtle Trading Rules can be downloaded free at

* <http://bigpicture.typepad.com/comments/files/turtlerules.pdf>
* <http://www.dailystocks.com/turtlerules.pdf>

The TTR is a complete trading system which covers all aspects of a trading decision and this section describes briefly key components of TTR

1. Markets

TTR focuses on trending markets and the targeted instruments are future contracts with the underlying of good liquidity and trading volume.

1. Position Sizing

This is the heart of TTR on which all of the following components depend. The position sizing algorithm normalizes the dollar volatility of a position by adjusting the position size based on the dollar volatility of the market.

Position sizing calculates the quantity N which represents the underlying volatility of a market. N is simply the 20-day exponential moving average which is now known as the ATR.

TTR defines a position as a collection of pieces which is called Units. Units are sized so that one N is equal to 1% of the account equity

1. Entries

Generally speaking, traders enter a trade when a breakout happens. A breakout is defined as the price exceeding the high or low of a particular number of days. In TTR, there are 2 entry systems:

* 1. Short-term system based on 20-day breakout
  2. Long-term system based on 55-day breakout

1. Stops

Turtle traders stop loss when the position risk is at 2% which would be equal to two N of price negative movement.

1. Exits

Turtle traders also use breakout-based exits to make profits from profitable positions. Similar to Entries, Exits are also based on 2 systems

1. 10 day low/high for long/short positions
2. 20 day low/high for long/short positions
3. Implementation and Adjustment

The entire TTR model is written in R programming language from scratch. One of the main supporting libraries is the XTS (eXtensible Time Series) package which stores time-series data from the beginning to the end for the purpose of back testing.

1. Data Source and Data Selection

All future data including high, low, settlement, and etc. are sourced from Quandl (<https://www.quandl.com/c/futures>).

Quandl provides one R package which allows to download a future contract data as an XTS object.

Following the future contract list detailed in the original document, future contracts of

* + heating oil
  + cocoa
  + copper
  + silver

are selected in this paper for back testing and experiments (details in the following sections).

1. Adjustment

During implementation, there are a few adjustments and assumptions which lead to better analysis yet make minimal deviation from the original models.

* We assume that on a day, there is only one breakout which is either high breakout or low breakout.
* Breakouts are checked at end of the day with settlement price, therefore traders can enter a trade at the next day open price should breakout happen.
* All of entry, exit and stop-loss trades are made at breakout even though original rules define particular levels of price at which exit and stop-loss trades can happen.

For the purpose of better back testing, we allow traders to re-enter a position of the same future contract even after the position has already realized its profit and loss. This kind of re-entering is possible until the last day of future contract.

All of profit/loss and capital of the previous position will be used for the re-entering. Profit and loss are accumulated during the entire life of future contract.

1. Evaluation

Like all other trading systems, TTR model has its own strengths and weaknesses which are covered as follow

1. Strengths

The first noticeable strength is that TTR takes volatility into account. At the time of 1980s, volatility was not really well-known to most traders.

The dollar volatility of markets used in TTR was quite advanced at that time because it normalized the volatility of a position, which made it easy for traders to compare and adjust position sizes across different markets. During actual trading activities, specific details of particular contracts do never confuse traders’ actions.

The second remarkable strength of TTR is its completeness. TTR is one of the first trading systems which cover markets, position sizing, entries, stops and exits.

The immediate benefit of a complete trading system is that it rules out trading emotion. In markets, being emotional when price goes against the position is the number one cause to make bad trading decisions. Thanks to the model’s completeness, traders could make a trade emotionlessly, which eventually generate profits most of the time.

Last but not least, with advanced technology today, such a complete trading system like TTR can be easily implemented in algorithm and automated trading machines.

1. Weaknesses

Perhaps, the biggest weakness of TTR is that it relies on trending markets and trending contracts. In the original specification document, trending feature is the most important aspect for which traders look to pick up markets and contracts to trade.

This is arguably the reason which TTR is no longer in use in modern markets which are less and less trending in a long enough period for TTR to make profits. The actual coding implementation of this paper has a clear result of TTR’s failure in today market.

This paper has addressed this issue to see if the modified TTR could perform in today market. It is discussed in the following “Improvement” section.

1. Improvement

From technical view point, TTR depends on a few parameters which are:

1. The number of days on which ATR is calculated
2. The number of days for Entry breakout
3. The number of days for Exit breakout

Since the weakness of TTR pinpointed in the previous section is the trending feature which requires long enough periods, one way to reduce the trending dependence is to shorten the 3 parameters.

The purpose of shortening the number of days in 3 parameters is to enable TTR to better catch shorter trends of modern markets. By doing so, TTR should not miss short trends, thereby entering and exiting a position more frequently to make profits.

Adjustments to the 3 parameters, proposed in this paper, are to halve all 3 parameters. The next sections will show and compare the performance of TTR before and after tweaking its parameters.

1. Result comparison

Graph