QF5206

Group Project

A Comparison of MA and RSI Returns of Exchange Rates

– A review and further implementations

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A Comparison of MA and RSI Returns of Exchange Rates – A review and further implementations

This project examines the profitability of the Moving Average (MA), Exponential Moving Average (EMA), Relative Strength Index (RSI) and Relative Strength Index with overbought and oversold levels trading rules on daily exchange rates ETN published by Barclays PLC and Goldman Sachs of three currencies, namely US dollar (USD) quotes for Japanese Yen (JPY), Great British Pound (GBP), and Euro (EUR). The main motivation and methodology is based on a paper by Thomas and Terence (2007)[1]. The returns and relative statistics are calculated and compared similar to that paper.

I. Introduction

The project is based on the study by Thomas and Terence (2007) on MA and RSI. Other related strategies on EMA and RSI with overbought and oversold are subsequently implemented in our project for further comparisons. While the paper evaluates more scenarios including removal of interest rates and studying the impact of government interventions on trading rules, our project focuses mainly on the profitability of the trading strategies based on backtesting of the historical prices.

The programs are written in Java leveraging on the Algoquant codes. The positions set in the programs are always either buy 1 unit or sell 1 unit depending on the trading signals. We do not close the positions once trading is initiated. Charts and information of buy and sell are extracted from Algoquant. Statistical calculations are done in Excel due to unfortunately our limitation of knowledge in Java. The codes and calculation files are appended to this report as attachments.

As the codes are originally designed to extract data from Yahoo Finance, we have used the iPath Exchange rate data as a proxy to the currency exchange rates. Although we have found some relevant exchange rates data, we still need to acquire more knowledge to program or use a CSV reader in Java or Algoquant. Nonetheless, we proceeded examining the strategies based on the related currency derivative data that we can obtain from Yahoo Finance.

[1] Thomas C Shik and Terence Tai-Leung Chong (2007) A Comparison of MA and RSI returns with exchange rate intervention, *Applied Economics Letters, 2007, **14**, 371 - 383.*

II. Data

The data we used in this project are iPath Exchange Rate Exchange-Traded Notes (ETN) figures from Yahoo Finance starting from Dec 2007 for three currencies, JYN (iPath JPY/USD Exchange Rate ETN), GBB (iPath GBP/USD Exchange Rate ETN) and ERO (iPath EUR/USD Exchange Rate ETN). The iPath ETNs are senior, unsecured, unsubordinated debt securities linked to exchange rate issued by Barclays Bank PLC. Since there is no historical exchange rate on Yahoo Finance, we used the iPath ETN as a proxy to track the exchange rate of the three currencies.[2]

Alternatively, we also attempted to source for investigated the exchange rate samples which were chosen in a way analogous to the reference paper by Thomas and Terence. The noon buying rates New York time are available for the three currencies JPY/USD, GBP/USD, EUR/USD from H.10 Federal Reserve Statistical Release since 1971.[3]

At the same time, we tried to apply for access to "WRDS" (Wharton Research Data Services)[4], but unfortunately the application was not approved by the Department of Business, NUS.

With reference to the intervention data which was used in the reference paper, we could only find the data for JPY which were obtained from the Ministry of Finance Japan website.[5] For a fair comparison across the currencies, this data is not used and we focus the procedure and concentrate our study on the iPath ETN figures.

III. Trading Strategies

We implemented MA and RSI trading strategies to the data obtained above according to the reference paper of Thomas and Terence. There is a difference however in the underlying formula of the RSI implemented by Thomas and Terence compared to the RSI formula we used in our project. This will be further illustrated in the subsequent subsection when we analyzed a generalized form of RSI. Moreover to make some improvements, we examined other strategies as well such as Exponential Moving

[2] iPath ETN resource. http://www.ipathetn.com/pdf/leveraged_launch_press_release.pdf
[3] H.10 Federal Reserve Statistical Release from 04 Jan 2011, *http://www.federalreserve.gov/releases/h10/hist/default1989.htm*
[4] Wharton Research Data Services[4] ***https://wrds-web.wharton.upenn.edu/wrds/***
[5] JPY/USD Intervention Data from Japanese Ministry of Finance website. http://www.mof.go.jp/english/e1c021.htm

Average (EMA), and modified RSI with two more control levels namely the overbought and oversold regions.

1. Moving Average(MA)

- **Definition**

$$MA(N)_t = \frac{1}{N}\sum_{i=0}^{N-1} P_{t-i} \qquad (1)$$

Where N is the length of the moving average, t is the time, and P_t is the exchange rate. The Moving Average Method is defined as the simple Moving Average, which is the unweighted mean of the previous N data points.

- **Trading strategy:**

a) **Long the USD if** $P_t \geq MA(N)_t$.
b) **Short the USD if** $P_t < MA(N)_t$.

The trading rule is to long the US dollar if the exchange rate is above or equal to the MA. In contrast, a sell signal is triggered when the exchange rate is below the MA.

2. Exponential Moving Average[6]

- **Definition**

$$EMA(N)_t = \alpha \times P_t + (1-\alpha) \times EMA(N)_{t-1} \qquad (2)$$

Where the coefficient α represents the degree of weighting decreases, and it is a constant smoothing factor between 0 and 1. P is the exchange rate at a time period t.

$$\alpha = \frac{2}{N+1} \qquad (3)$$

We need to define the value of $EMA(N)_0$, the first value of the EMA. The choice of $EMA(N)_0$ is not unique. Some practitioners may use the asset price at the time when they first implement the strategy as $EMA(N)_0$ and some may use a SMA of the prior N

[6] Wikipedia. http://en.wikipedia.org/wiki/Moving_average

data points. In our project, we compute $EMA(N)_0$ as the EMA of the prior first N data points using the same window width N.

- **Trading Strategy:**

a) **Long the USD if** $P_t \geq EMA(N)_t$
b) **Short the USD if** $P_t < EMA(N)_t$

The trading rule is still to long USD dollars when the RSI is greater than or equal to 50, while a sell signal is generated when the RSI is smaller than the threshold.

3. Relative Strength Index(RSI)

- **Definition given by Thomas and Terence**

$$RSI(N)_t = \frac{\sum_{i=0}^{N-1}(P_{t-i} - P_{t-i-1})I_{\{P_{t-i} > P_{t-i-1}\}}1}{\sum_{i=0}^{N-1}|P_{t-i} - P_{t-i-1}|} \times 100 \qquad (4)$$

Relative Strength Index is defined as a ratio of the sum of all positive changes of prices to the total of absolute changes of prices in a given period, multiplied by 100. The RSI ranges from zero to 100. It gives a reading of zero if there are pure downward price movements, and a reading of 100 if there are pure upward price movements. The middle point of the oscillator, 50, is set as the threshold value. This definition is used by Thomas and Terence.

Trading strategy:

a) **Long the USD if** $RSI(N)_t \geq 50$
b) **Short the USD if** $RSI(N)_t < 50$

The trading rule is to long USD dollars when the RSI is greater than or equal to 50, while a sell signal is generated when the RSI is smaller than the threshold.

3.1 A general form of RSI

To investigate into the trading strategy of RSI, we notice that actually there are different methods for RSI method although the basic idea is the same. The method used in the reference paper is different from the code in Algoquant. A more general form of RSI

shows the percentage of the sum of periods with upward trend over both the upward and downward trend during the whole period.

$$RSI(N)_t = 100 - \frac{100}{1 + RS} \quad (5)$$

$$RS = \frac{Average(U,t)}{Average(D,t)} \quad (6)$$

Where $Average(U,t)$ represents the average of N days up prices and $Average(D,t)$ is average of N days down prices.

The only difference of different RSI methods comes from the different definition of the Relative Strength (RS). In the reference paper, RS is an index of Simple MA as shown below.

$$RS = \frac{SMA(U,t)}{SMA(D,t)} \quad (7)$$

where $SMA(N)_t = \frac{1}{N}\sum_{i=0}^{N-1} P_{t-i}$.

3.2 The RSI in our project

While in Algoquant, Relative Strength is computed by Exponential MA.

$$RS = \frac{EMA(U,t)}{EMA(D,t)} \quad (8)$$

where EMA as defined earlier.

4. Modified RSI with two more control levels

This is a popular technique used by practitioners of RSI methods. Two additional limits are added in the trading strategy. Instead of setting the middle point of the oscillator 50 as the only threshold value, we set two more control levels. The higher control level is usually set at 70 which correspond to the overbought situation while the lower control level is usually set at 30 corresponding to an oversold situation.

While the RSI increases and overcomes the top control level (above 70) from below, the indicator displays the oversaturation of the market with buy trades, and our trading strategy change to the zone of sales. Conversely, when the RSI crosses the low bottom control level (below 30) from above, the indicator displays the oversaturation of the market with sell trades, and our trading strategy is starting buying.

These bounds are based on observations. Practitioners observed that usually market would have a RSI trend reversal soon after reaching either of the two regions. Though there were other observations that the levels should vary depending on whether the market is in the bull or bear market. There are also situations where the RSI values remain in the regions for prolong periods.

We use constant overbought and oversold levels of 70 and 30 respectively in our project. The trading strategy can hence be re-written as:

- **Trading strategy:**

  a) **Short the USD if** $RSI(N)_t \geq 70$
  b) **Long the USD if** $RSI(N)_t \geq 50$
  c) **Short the USD if** $RSI(N)_t < 50$
  d) **Long the USD if** $RSI(N)_t < 30$

IV. Statistical Analysis

The returns in our project are computed for both absolute returns and log returns. The charts are generated from Algoquant and the P&L chart lines are reflecting the absolute returns. Meanwhile the log returns are also computed and analyzed.

We also compare our strategies against as benchmark of buy(sell) and hold strategy. In this strategy, there is only a single trading execution depending on the first buy or sell signal and the asset is held on subsequently. The profit at the last update is computed in both absolute and log returns for comparison purpose.

In calculating the log returns in our project, we assume that there is little or no difference between domestic and foreign interest rates. The daily log return denoted by π_t is thus simplified and defined as:

$$\pi_t = \alpha_t(\ln P_{t+1} - lnP_t) \qquad (9)$$

where

$$\alpha_t = +1 \text{ for buy signal}$$
$$\alpha_t = -1 \text{ for sell signal} \qquad (10)$$

The total rate of log returns for the period of time zero to time T is the sum of daily log returns.

$$\Pi = \sum_{t=0}^{T-1} \pi_t \qquad (11)$$

The mean daily log returns $\bar{\pi}$ with a sample size T;

$$\bar{\pi} = \frac{\Pi}{T} = \frac{\sum_{t=0}^{T-1} \pi_t}{T} \qquad (12)$$

Let σ be the standard deviation of the daily log returns.

We use a 250 trading days per annum in this project. The annual mean return $\overline{\pi_A}$ and annual standard deviations σ_A can be computed as: [7]

$$\overline{\pi_A} = \bar{\pi} \times 250$$
$$\sigma_A = \sigma \times \sqrt{250} \qquad (13)$$

Using the values from (12), we can find the Sharpe ratios. The risk free interest rate is assumed to be zero in this project and thus Sharpe ratio is the ratio of annual mean return and annual standard deviation. It can then be computed as:

$$Sharpe = \frac{\overline{\pi_A}}{\sigma_A} \qquad (14)$$

A t-statistic is also done for the sample data where T is the sample size. For a large sample size, $\bar{\pi} \sim N\left(\mu, \frac{\sigma^2}{T}\right)$. Under the null hypothesis, H_0: $\mu = 0$ against alternative hypothesis H_1: $\mu \neq 0$. The t-statistic is tested at 95% confidence level. The test statistic is

$$t = \frac{|\bar{\pi}|}{\sigma/\sqrt{T}} \qquad (15)$$

[7] The annual mean return as described in LeBaron(1999) and the annual standard deviation is based on method at www.investopedia.com. http://www.investopedia.com/articles/04/021804.asp and http://www.investopedia.com/articles/04/101304.asp

We consider the absolute value of the mean daily log returns because this value may be negative. The corresponding *p*-value is the inverse of equation(15). Since there are no constraints on the data, the degree of freedom is sample size.

V. Empirical Results

The findings are compiled in tables. Some charts are also compiled to demonstrate the trends.

Observation 1:

All *p*-values in different trading strategies are above 0.05. Thus we are not able to reject the null-hypothesis. There are only a few exceptions, for example JYN/USD currency pair at window period 20-days for all strategies. However, this currency does not make profit in all trading strategies. Another exception is ERO/USD under the RSI(50) with 3 levels which has a *p*-value below 0.05. This strategy manages to make a profit.

We are not able to reject the null hypothesis. Basing on these data sets alone, we may not be able to use our trading strategies to trade these products. These strategies may require further testing on other exchange rates.

Observation 2:

The absolute returns generated by EMA strategies for all currency pairs give lower returns compared to MA. This is counter intuitive to the idea that EMA is meant to be an improvement to MA strategy since EMA gives lesser weights to historical data that are far away that should have little influence on current prices. This warrants further backtesting using other exchange rates or products.

Observation 3:

The RSI with three levels, namely inclusion of overbought and oversold regions improves the yields compared to the RSI with only a single level, namely a single midpoint benchmark at 50. Across the currency pairs, we observed better absolute and log returns. Even if the result is a loss, the amount is smaller compared to the RSI with single level. Thus the inclusion of overbought and oversold regions improves the performance of RSI.

Observation 4:

Looking at the window width that performs best for a certain currency pair and comparing that with the reference buy(sell) and hold strategy, we can observe that applying a trading strategy does give a much positive results. For example if we choose ERO/USD which performs the best at window width 50-days, the absolute return from the strategy is $17.62 vis-à-vis to the reference strategy which results in a loss at -$4.86. Similarly, if we compare GBB/USD using RSI at window width 150-days, the return is $8.10 vis-à-vis to a loss at -$9.18 from the reference strategy. It does give some motivation for apply a strategy.

Observation 5:

From Figures 1 to Figures 3 which compares the performance of different trading strategies at the same window width of 50-days, we observe that MA works better for ERO but RSI works better for GBB. Different trading strategies works better for different products. Nonetheless, it is observed that the improved RSI with 3-levels outperformes both MA for ERO and RSI for GBB. Thus it is a significant improvement that should be tested further.

Observation 6:

From Figures 4 and Figures 5, there is no best window width to make the most profit. For example if we observe the ERO/USD currency pair in the Moving Average strategy, the absolute profit is initially at $4.14 at window width of 10-days. This increases to $17.62 at window width 50-days but dropped to -$1.49 at window width 150-days. However, a different trend is observed for GBB/USD. When the window width is increased to 150-days, this GBB/USD MA(150) produced an even bigger profit that MA(50). While 150-days window width may result in a loss for ERO/USD but 150-days window width works well for GBB/USD. Thus, the selection rule of window width is not fixed.

1. Moving Average

iPath Exchange Rates ETN		MA(10)			MA(20)		
		ERO/USD	GBB/USD	JYN/USD	ERO/USD	GBB/USD	JYN/USD
Absolute Return	Cumulative returns($)	4.14	-5.40	-14.37	4.57	3.50	-31.83
Log Returns	Daily mean return(%)	0.009	-0.003	-0.019	0.011	0.031	-0.065
	Daily standard dev.(%)	0.999	1.096	0.891	1.003	1.096	0.889
	Annual mean return(%)	2.324	-0.696	-4.662	2.840	7.721	-16.191
	Annual standard dev.(%)	15.790	17.333	14.088	15.856	17.327	14.054
	Sharpe ratio	0.0093	-0.0025	-0.0209	0.0113	0.0282	-0.0729
Buy (Sell) & Hold Strategy	Absolute return	-2.36	7.34	17.87	-2.13	-8.06	16.55
	Log return	-0.0432	0.1559	0.2835	-0.0391	-0.1700	0.2596
T-statistics	No. of data	791	791	791	781	781	781
	T-value	0.2618	0.0714	0.5886	0.3186	0.7926	2.0492
	p-value	0.3968	0.4715	0.2781	0.3750	0.2141	0.0204

iPath Exchange Rates ETN		MA(50)			MA(150)		
		ERO/USD	GBB/USD	JYN/USD	ERO/USD	GBB/USD	JYN/USD
Absolute Return	Cumulative returns($)	17.62	2.51	-4.25	-1.49	13.46	-17.07
Log Returns	Daily mean return(%)	0.044	0.024	-0.003	-0.005	0.047	-0.045
	Daily standard dev.(%)	1.015	1.096	0.891	1.060	1.095	0.890
	Annual mean return(%)	11.095	5.936	-0.867	-1.333	11.787	-11.166
	Annual standard dev.(%)	16.044	17.329	14.091	16.761	17.317	14.074
	Sharpe ratio	0.0437	0.0217	-0.0039	-0.0050	0.0430	-0.0502
Buy (Sell) & Hold Strategy	Absolute return	-4.86	-9.21	13.55	-6.41	-9.18	-17.21
	Log return	-0.0870	-0.1920	0.2073	-0.1132	-0.1915	-0.2715
T-statistics	No. of data	751	751	751	651	651	651
	T-value	1.2301	0.6093	0.1094	0.1415	1.2107	1.4113
	p-value	0.1095	0.2713	0.4564	0.4438	0.1132	0.0793

Table 1: Moving Average. Window lags 10-days, 20-days, 50-days, 150-days.

2. Exponential Moving Average

iPath Exchange Rates ETN		EMA(10)				EMA(20)		
		ERO/USD	GBB/USD	JYN/USD		ERO/USD	GBB/USD	JYN/USD
Absolute Return	Cumulative returns($)	-4.08	5.66	-17.99		3.81	-0.26	-32.33
Log Returns	Daily mean return(%)	-0.011	0.028	-0.037		0.009	0.009	-0.066
	Daily standard dev.(%)	0.999	1.096	0.894		1.003	1.096	0.896
	Annual mean return(%)	-2.666	7.024	-9.316		2.338	2.329	-16.376
	Annual standard dev.(%)	15.790	17.328	14.135		15.857	17.333	14.163
	Sharpe ratio	-0.0107	0.0256	-0.0417		0.0093	0.0085	-0.0731
Buy (Sell) & Hold Strategy	Absolute return	-2.36	7.34	17.87		-2.13	-8.06	16.55
	Log return	-0.0432	0.1559	0.2835		-0.0391	-0.1700	0.2596
T-statistics	No. of data	791	791	791		781	781	781
	T-value	0.3004	0.7210	1.1723		0.2606	0.2375	2.0437
	p-value	0.3820	0.2355	0.1207		0.3972	0.4062	0.0207

iPath Exchange Rates ETN		EMA(50)				EMA(150)		
		ERO/USD	GBB/USD	JYN/USD		ERO/USD	GBB/USD	JYN/USD
Absolute Return	Cumulative returns($)	11.72	3.85	-19.69		-3.71	8.10	-9.21
Log Returns	Daily mean return(%)	0.029	0.023	-0.039		-0.012	0.027	-0.023
	Daily standard dev.(%)	1.015	1.096	0.906		1.060	1.096	0.891
	Annual mean return(%)	7.320	5.783	-9.834		-2.890	6.664	-5.703
	Annual standard dev.(%)	16.052	17.330	14.326		16.761	17.328	14.087
	Sharpe ratio	0.0288	0.0211	-0.0434		-0.0109	0.0243	-0.0256
Buy (Sell) & Hold Strategy	Absolute return	-4.86	-9.21	13.55		-6.41	-9.18	-17.21
	Log return	-0.0870	-0.1920	0.2073		-0.1132	-0.1915	-0.2715
T-statistics	No. of data	751	751	751		651	651	651
	T-value	0.7904	0.5784	1.1898		0.2783	0.6206	0.6533
	p-value	0.2148	0.2816	0.1173		0.3904	0.2675	0.2569

Table 2: Exponential Moving Average. Window lags 10-days, 20-days, 50-days, 150-days.

3. RSI with 1 level

iPath Exchange Rates ETN		RSI(10)			RSI(20)		
		ERO/USD	GBB/USD	JYN/USD	ERO/USD	GBB/USD	JYN/USD
Absolute Return	Cumulative returns($)	-4.08	5.66	-17.99	5.23	-0.26	-33.27
Log Returns	Daily mean return(%)	-0.011	0.028	-0.019	0.013	0.009	-0.058
	Daily standard dev.(%)	0.999	1.096	0.891	1.003	1.096	0.889
	Annual mean return(%)	-2.666	7.024	-4.663	3.157	2.329	-14.588
	Annual standard dev.(%)	15.790	17.328	14.088	15.856	17.333	14.061
	Sharpe ratio	-0.0107	0.0256	-0.0209	0.0126	0.0085	-0.0656
Buy (Sell) & Hold Strategy	Absolute return	-2.36	7.34	17.87	-2.13	-8.06	16.55
	Log return	-0.0432	0.1559	0.2835	-0.0391	-0.1700	0.2596
T-statistics	No. of data	791	791	791	781	781	781
	T-value	0.3004	0.7210	0.5887	0.3541	0.2390	1.8454
	p-value	0.3820	0.2355	0.2781	0.3617	0.4056	0.0327

iPath Exchange Rates ETN		RSI(50)			RSI(150)		
		ERO/USD	GBB/USD	JYN/USD	ERO/USD	GBB/USD	JYN/USD
Absolute Return	Cumulative returns($)	11.92	3.85	-23.35	-11.63	8.10	-10.93
Log Returns	Daily mean return(%)	0.030	0.023	-0.033	-0.034	0.027	-0.027
	Daily standard dev.(%)	1.015	1.096	0.891	1.060	1.096	0.891
	Annual mean return(%)	7.431	5.783	-8.268	-8.420	6.664	-6.724
	Annual standard dev.(%)	16.052	17.330	14.082	16.753	17.328	14.085
	Sharpe ratio	0.0293	0.0211	-0.0371	-0.0318	0.0243	-0.0302
Buy (Sell) & Hold Strategy	Absolute return	-4.86	-9.21	13.55	-6.41	-9.18	17.21
	Log return	-0.0870	-0.1920	0.2073	-0.1132	-0.1915	0.2715
T-statistics	No. of data	751	751	751	651	651	651
	T-value	0.8234	0.5936	1.0444	0.8940	0.6841	0.8491
	p-value	0.2053	0.2765	0.1483	0.1858	0.2471	0.1980

Table 3: RSI with 1 level. Window lags 10-days, 20-days, 50-days, 150-days.

4. RSI with 3 levels

iPath Exchange Rates ETN		RSI(10)				RSI(20)		
		ERO/USD	GBB/USD	JYN/USD		ERO/USD	GBB/USD	JYN/USD
Absolute Return	Cumulative returns($)	-3.86	11.40	3.15		11.91	7.88	-25.13
Log Returns	Daily mean return(%)	0.007	0.040	0.02		0.042	0.040	-0.05
	Daily standard dev.(%)	1.060	1.096	0.89		1.059	1.096	0.89
	Annual mean return(%)	1.794	9.887	4.48		10.417	9.894	-13.13
	Annual standard dev.(%)	16.761	17.322	14.09		16.749	17.322	14.07
	Sharpe ratio	0.0068	0.0361	0.0201		0.0393	0.0361	-0.0590
Buy (Sell) & Hold Strategy	Absolute return	2.36	-7.34	-17.87		-2.13	8.06	-16.55
	Log return	0.0432	-0.1559	-0.2835		-0.0391	0.1700	-0.2596
T-statistics	No. of data	791	791	791		781	781	781
	T-value	0.1904	1.0152	0.5659		1.1063	1.0160	1.6604
	p-value	0.4245	0.1552	0.2858		0.1345	0.1550	0.0486

iPath Exchange Rates ETN		RSI(50)				RSI(150)		
		ERO/USD	GBB/USD	JYN/USD		ERO/USD	GBB/USD	JYN/USD
Absolute Return	Cumulative returns($)	24.36	10.89	-0.17		-11.63	10.56	-10.93
Log Returns	Daily mean return(%)	0.080	0.046	0.01		-0.034	0.036	-0.03
	Daily standard dev.(%)	1.057	1.095	0.89		1.060	1.096	0.89
	Annual mean return(%)	19.939	11.575	2.94		-8.420	9.063	-6.72
	Annual standard dev.(%)	16.714	17.318	14.09		16.753	17.324	14.09
	Sharpe ratio	0.0754	0.0423	0.0132		-0.0318	0.0331	-0.0302
Buy (Sell) & Hold Strategy	Absolute return	4.86	-9.21	-13.55		-6.41	-9.18	17.21
	Log return	0.0870	-0.1920	-0.2073		-0.1132	-0.1915	0.2715
T-statistics	No. of data	751	751	751		651	651	651
	T-value	2.1220	1.1888	0.3714		0.8940	0.9305	0.8491
	p-value	0.0171	0.1174	0.3552		0.1858	0.1762	0.1980

Table 4: RSI with 3 level. Window lags 10-days, 20-days, 50-days, 150-days.

ERO(window width 50)



MA(50). Absolute return of $17.62 as of 28 Feb 2011



EMA(50). Absolute return of $11.72 as of 28 Feb 2011



RSI(50) with 1 level . Absolute return $11.92 of as of 28 Feb 2011



RSI(50) with 3 levels. Absolute return of $24.36 as of 28 Feb 2011

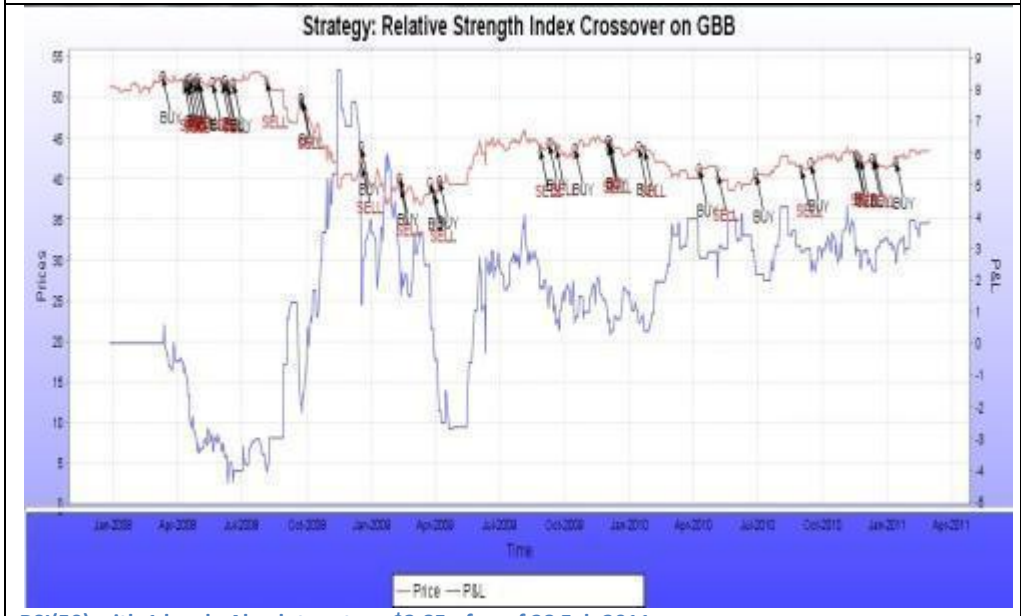
Figure 1: A comparison of different trading strategies of window 50 for ERO. In general, all strategies are profitable.



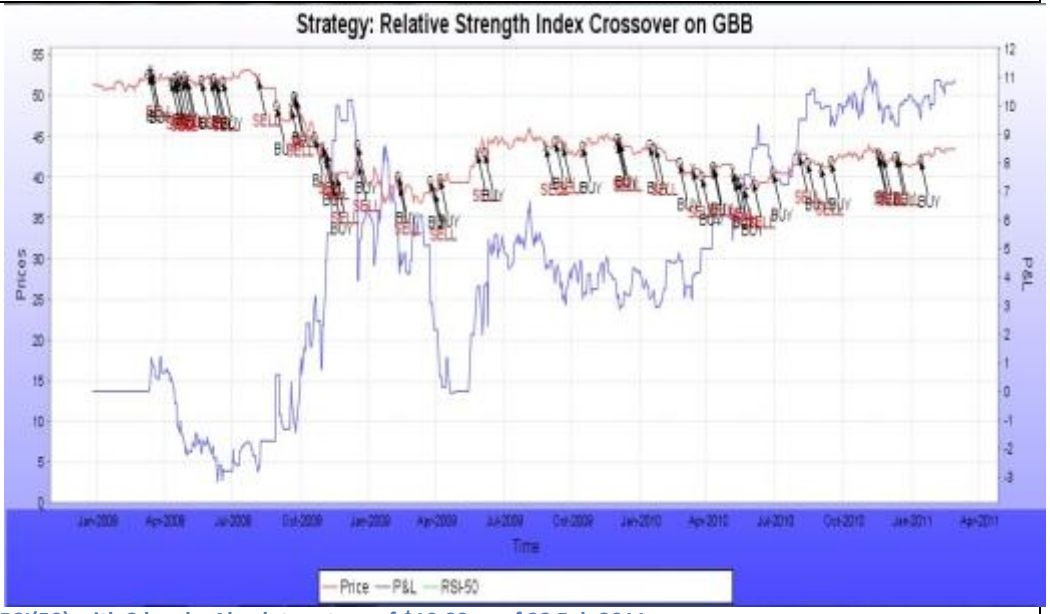
MA(50). Absolute return of $2.51 as of 28 Feb 2011



EMA(50). Absolute return of $3.85 as of 28 Feb 2011



RSI(50) with 1 level . Absolute return $3.85 of as of 28 Feb 2011



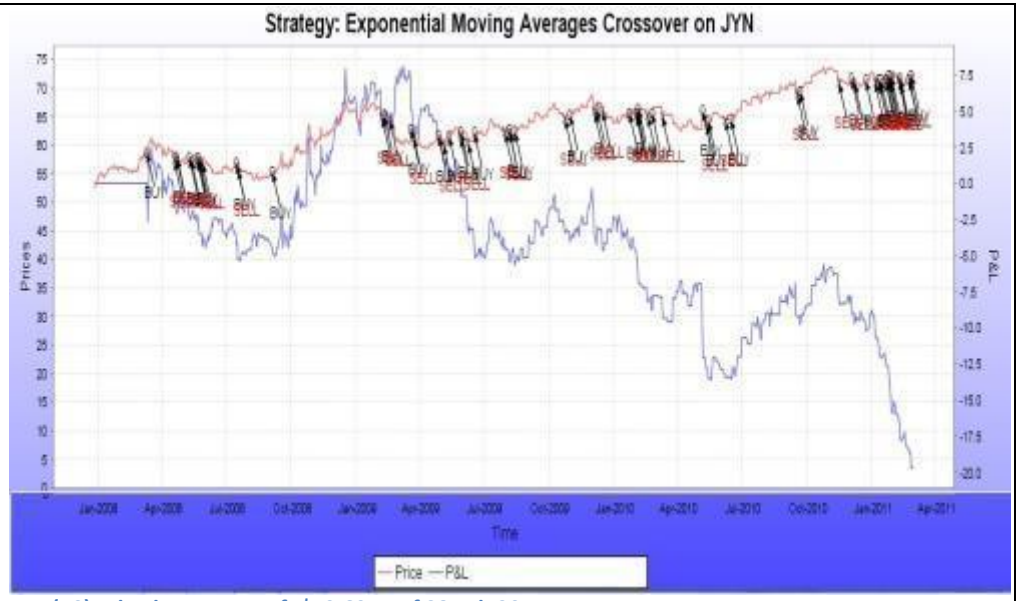
RSI(50) with 3 levels. Absolute return of $10.89 as of 28 Feb 2011

Figure 2: A comparison of different trading strategies of window 50 for ERO. RSI(50) with three levels generate a much higher profit than the other strategies.

JYN(window width 50)



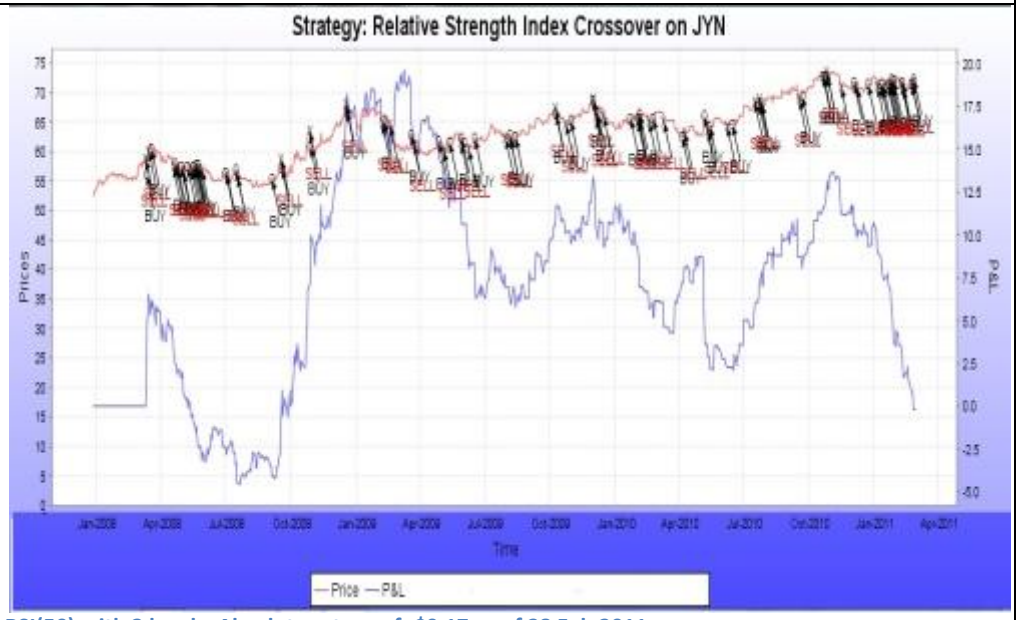
MA(50). Absolute return of -$4.25 as of 28 Feb 2011



EMA(50). Absolute return of -$19.69 as of 28 Feb 2011



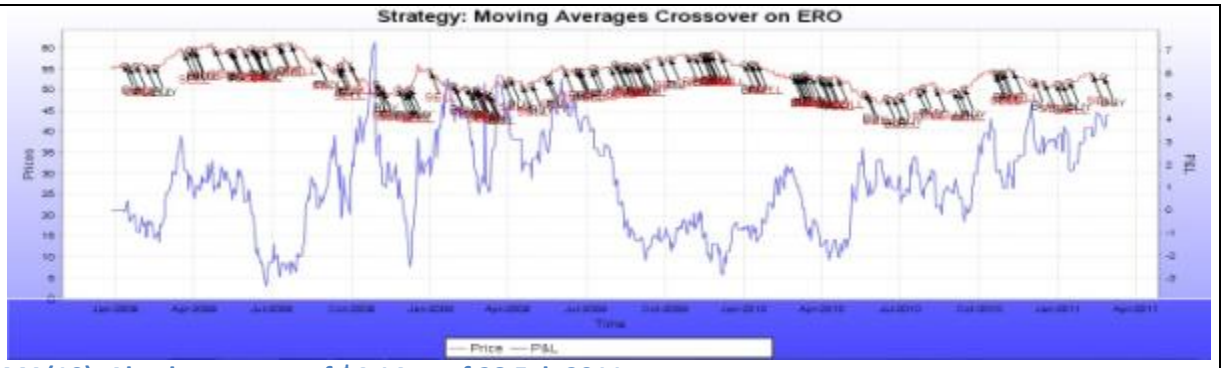
RSI(50) with 1 level . Absolute return -$23.35 of as of 28 Feb 2011



RSI(50) with 3 levels. Absolute return of -$0.17 as of 28 Feb 2011

Figure 3: A comparison of different trading strategies of window 50 for JYN. All strategies are not profitable.

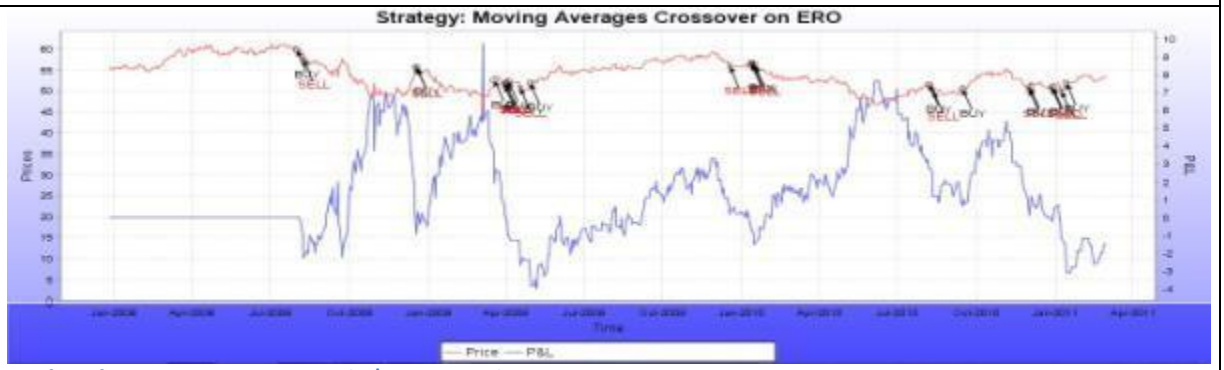
ERO(10), ERO(50) and ERO(150) – Moving Averages



MA(10). Absolute return of $4.14 as of 28 Feb 2011.



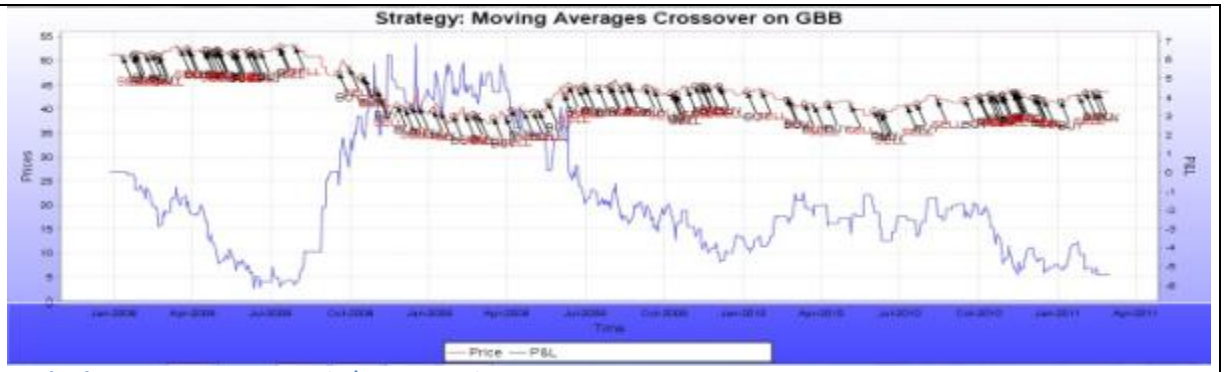
MA(50) . Absolute return of $17.62 as of 28 Feb 2011.



MA(150) . Absolute return of -$1.49 as of 28 Feb 2011.

Figure 4: Comparison of different MA windows for ERO. Window 50 gives the largest return. Profits increases when window width is changed from 10 days to 50 days but become non profitable when increased to 150 days.

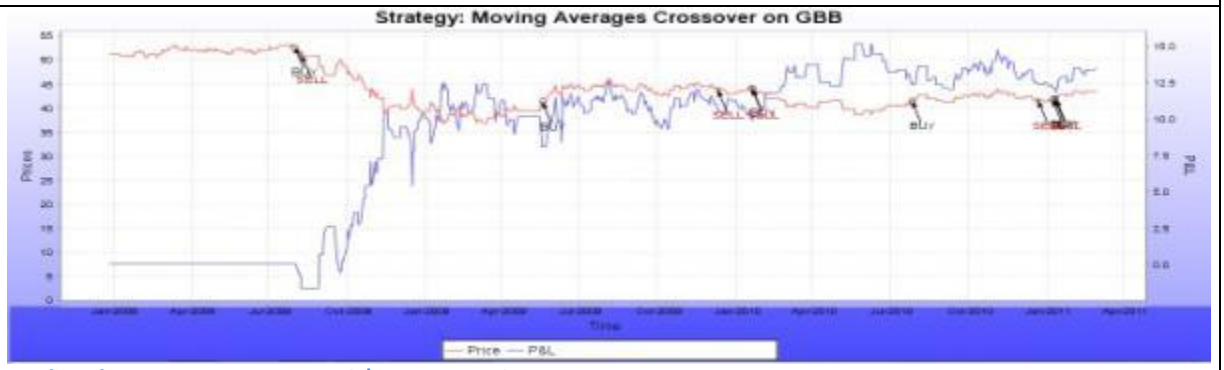
GBB(10), GBB(50) and GBB(150) – Moving Averages



MA(10). Absolute return of -$5.40 as of 28 Feb 2011.



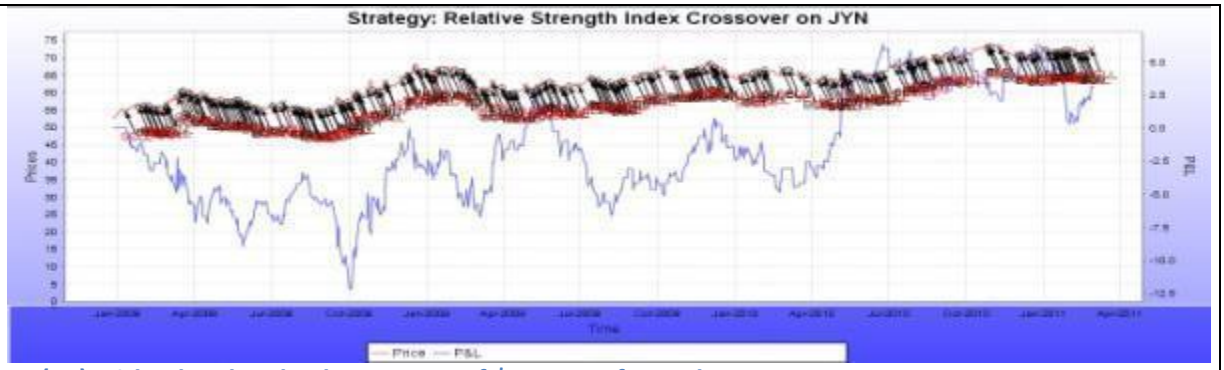
MA(50) . Absolute return of $2.51 as of 28 Feb 2011.



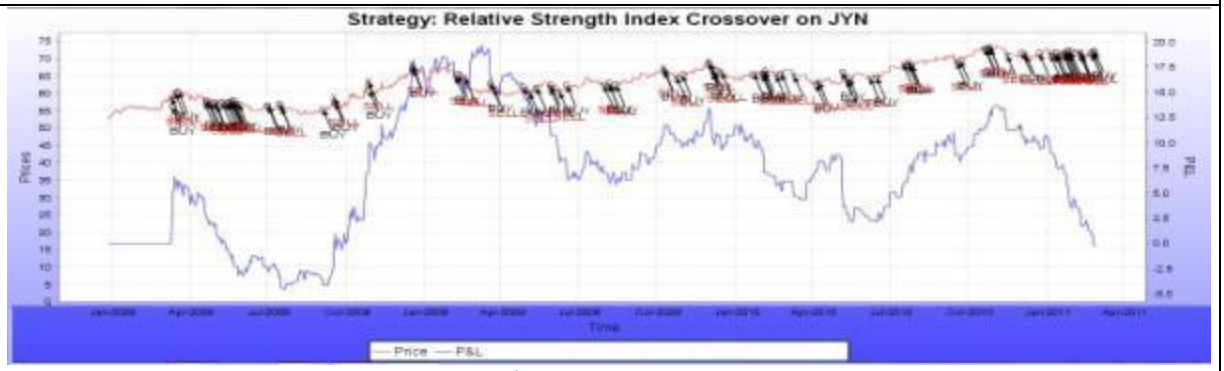
MA(150) . Absolute return of $13.46 as of 28 Feb 2011.

Figure 5: Comparison of different MA windows for GBB. Window 150 gives the largest return

JYN(10), JYN(50) and JYN(150) – RSI with 3 levels.



RSI(10) with 3 levels. Absolute return of $3.15 as of 28 Feb 2011.



RSI(50) with 3 levels . Absolute return of -$0.17 as of 28 Feb 2011.



RSI(150) with 3 levels . Absolute return of -$10.93 as of 28 Feb 2011.

Figure 6: Comparison of different RSI with 3 levels windows for JYN. Window 10 gives some profits while the rest are not profitable.

VI. Conclusion

Based on observation 1, these Exchange Rate ETN may not be suitable products for applying the MA, EMA and RSI strategies. The improvement to RSI by adding the overbought and oversold regions improved the performance of the technical indicator and can perform better than MA strategy too. It may be worthwhile to investigate and test this improved RSI further.

Acknowledgement

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