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Full Length Research Paper

A profitability study on the Malaysian futures markets using a new adjustable technical analysis indicator, adjustable bands Z-test-statistics' (ABZ')

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Financial markets all over the world generally exist in 2 conditions: trending and ranging. One of the most frustrating issues confronting market technicians daily is the critical definition when market is ranging and when the market is trending. Applying a trending algorithm to a ranging market will result in whipsaws that yield losses. To avoid some of these false entry signals, this research proposed to vary the moving average and standard deviation parameters to avoid some of these false entry whipsaws and yet capture a new trend early. Adaptive algorithm like the Adjustable Bands Z-Test-Statistics' (ABZ'), seeked to provide a solution to this issue. For the year 2008, ABZ' showed an abnormal return of 316 index points for Malaysian Kuala Lumpur Composite Index Futures (FKLI) compared with a negative return of -562 index points for the passive buy-and-hold strategy and 690 for Malaysian Crude Palm Oil Futures (FCPO) compared with a negative return of -1387. Results from this research interest investors world wide who are trying to overcome this baffling issue of ranging versus trending markets.

Key words: Technical analysis indicators, automatically adjustable algorithm trading systems futures trends.

INTRODUCTION

Adaptive algorithm trading systems are the future of technical trading rules in financial markets. This can be seen in the new emerging combination of technical trading rules in genetic programming, artificial neural networks and now, adaptive bands z-test statistics. An adaptive algorithm trading system is defined as an automated trading system that can adjust its parameters to adapt to the current market condition. The special feature of an adaptive algorithm trading system is its ability to automatically adjust its parameter to become a large variable in range trading period, and to become a small variable in trend trading period. The technical trading system functions according to the inherent algorithm which first recognises the state the market is in, ranging or trending, and then adjusts the parameters accordingly.

Balsara et al. (1996) write that flexible trading systems that can adjust its parameters automatically to changes in market conditions, are the key to success in any technical trading programmes in the futures market. The technical trading system basically consists of a set of trading rules selected after a series of tests, to generate trading signals. The trading rules consist of algorithms with optimised parameters to indicate trading signals. The trading signal is either to extend or to shorten a futures contract.

Therefore, this research shall develop from a set of trading rules, on adaptive bands to become an algorithm trading system, called Adjustable Bands Z-Test-Statistics' (ABZ') that professional market technicians can use on the model trading desk. Algorithmic trading (also known as Automated, Algo, Black Box or Robo Trading) is the science of finding an algorithm that is suitable to the prevailing market condition and automatically executing

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the trading signal by a computer programme. An algorithm trading system is used because historically, it has been tested and proven to have an statistical edge in generating positive abnormal return above the buy-and-hold policy. The choice and implementation of an algorithm trading system can be the defining factor to determine the overall profit or loss of the financial institution for each accounting period. The benefit of using an algorithm trading system is all trading decisions are objective and quantifiable, which means that every trade can be accounted for by the algorithm when audited. This ensures that all trades, profits and losses are systematic, with no drastic, unexpected huge losses of gigantic nature compared to its paid up capital. Algorithm trading system involves not only signal generation but also automated stop loss. Therefore, all losses are expected.

The novelty of this research lies in the conception of efficacy ratio, a new technical indicator that is adaptive in nature, used to design and develop ABZ' algorithm trading system. ABZ' is designed to overcome some of the common problems encountered by trend trading systems.

According to Chande (1997), a trading system is used to gain a statistical edge, objectivity and consistency. The trading system must be robust. A robust trading system is defined as one that can withstand a variety of market conditions across many markets and timeframes. The trader can trade in timeframes of seconds, minutes (5, 10, 15, 30), hourly, daily and weekly. Two of the most important conditions for traders are:

i. Range market when there is little price movement which results in small gains for the range trader and small losses for the trend trader.
ii. Trend market when there is large price movement which results in huge gains for the trend trader and huge losses for the range trader.

The trading system must be backtested to withstand these two very different market conditions and the results of these tests must be positive. As Chande (1997) puts it, the trading system must have a positive expectation. He also states that the most important reason to use a trading system is to gain a statistical edge. This statistical edge also refers to the probability of ruin. The smaller the probability of ruin, the more likely the trader survives and profits from the trading system in the long run.

Objectives

The new algorithm trading system, ABZ', is designed, using moving average and standard deviation technical indicators to generate automatically adaptive parameters to fit historical and current data. ABZ' has a return to risk ratio of at least more than 1.5, it has low maximum drawdown with inherent loss control mechanism due to the adaptive nature of moving average and standard deviation, the number of winning trades to losing trades is 50:50 and the average gain is at least 1.5 times larger than average loss.

ABZ' uses efficacy ratio to automatically adjust its parameters, moving average and standard deviations to suit the two different market conditions. The trading rules for ABZ' are buying long above the upper standard deviation band, selling short below the lower standard deviation band and not trade within the bands. ABZ' is expected to capture a larger portion of abnormal profits by automatically adjusting the parameters according to the prevailing market condition, thus:

i. Narrowing the bands width to enter a new trend early in a trending market.
ii. Widening the bands width to avoid some whipsaws when the market is ranging.
iii. Constantly adjusting the parameters to stay with the major trend movement for as long as possible.

LITERATURE REVIEW

This investigation addresses Fama (1965) challenges to anyone with more than a passing interest in price behavior. The test approach is similar to that of Lukac et al. (1988) to test for statistically significant returns. This study is based on the insights of Mandelbrot and Hudson (2004)'s proof that market is not random. Mandelbrot and Hudson (2004) observes that markets are ruled by power curves, and not normal probability curves, and that long-term dependence of sequential price action exists. Lukac et al. (1988), Brock et al. (1992), Bessimbinder and Chan (1995) and, Irwin and Park (2009), demonstrate that the technical trading systems generally generate abnormal returns larger than that by the passive buy-and-hold policy. These studies test different mechanical technical trading systems and find evidence consistent with technical analysis being able to identify trends for the purpose of trading profitably.

Brock et al. (1992) test 10 variable-length-moving-average technical rules and 10 fixed-length-moving average rules and 6 trading-range-break rules using Dow Jones Industrial Average. Brock et al. reject the hypothesis that the technical rules in aggregate have no predictive power for return. This finding is very significant because many others like Bessimbinder and Chan (1998) based their studies on the methods used by Brock et al. (1992) to test and achieve significant positive results. This study adopts a similar approach to that of Lukac et al. (1988) and uses some of the tests selected by Brock et al. (1992) and Bessimbinder and Chan (1995) with an improvised technique, ABZ' to identify and trade trends for abnormal returns greater than that by the buy-and-hold policy.

This study draws support from Gandolfi et al. (2008), especially for its concept on dynamic volatility indicator,

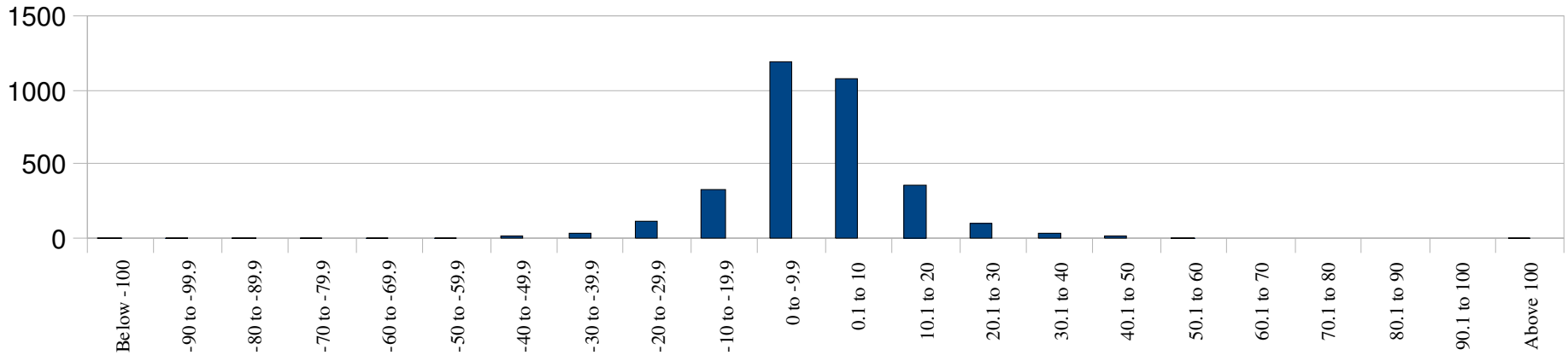

Figure 1. Daily FKLI returns distribution from 15/12/1995 to 31/12/2008.

namely standard deviation that is used to adjust the moving average. In Gandolfi's paper, the 10-day standard deviation of closing prices is divided by a parameter defined by the average of the standard deviation over a 50-day period. This ratio of the 10-day standard deviation of the closing prices divided by the 50-day average of the standard deviation of the closing price defines the excess "volatility" relative to its historical average value.

In this paper, we propose to use a ratio of 34-day standard deviation for long term indicator over 6-day standard deviation for short term indicator. This new indicator is called Efficacy Ratio. When market is ranging, that is when market is moving sideways without any particular direction, the Efficacy Ratio generated is a larger value parameter. This ensures a longer moving average, larger standard deviation bands and thus some of the short term whipsaw losses can be avoided. In a trending market, Efficacy Ratio is a smaller value parameter for moving average and standard deviation, thus ensuring a faster entry into the prevailing trend.

DATA ANALYSIS

Our study begins with data statistics. The data collected is the closing prices of FKLI from its inception on 15th December 1995 to 31st December 2008. The entire sample consisting of all the closing prices has a total of 3,216 trading days. The open, high, low, close and volume are recorded. The main characteristic in time series that traders are interested in is volatility or huge returns which are found in the heavy tails of the returns' distribution. Therefore, this research will first chart the returns' distribution. The prime interest in conducting a descriptive data statistics on the futures returns is to find statistics on its mean, standard deviation, skewness and especially its kurtosis. The purpose of analysing the returns is to find if the return's distribution exhibits lepto-kurtosis. If the return's distribution exhibits excess kurtosis from the normal distribution, then it cannot be inferred that the returns are random.

The distribution of FKLI daily price changes is non-normal for the period of 15/12/1995 to 31/12/2008 with mean of -0.03, standard deviation of 13.97, skewness of -0.0024 and kurtosis of 14.97. The kurtosis of 14.97 for FKLI return exhibits excess kurtosis from the normal distribution of 3, therefore, it cannot be inferred that the returns are random. The daily FKLI returns are depicted in Figure 1. It shows heavy and long tails which imply that large changes occur more frequently than in a normal distribution.

For FCPO, the data collected is the closing prices from 2nd January 2002 to 31st December 2008. The data statistics on FCPO's returns is tabled in Table 2 and the distribution of FCPO's return is depicted in Figure 2.

The distribution of FCPO daily price changes is non-normal for the period of 2/1/2002 to 31/12/2008 with mean of 1.04, standard deviation of 41.42, skewness of -0.31 and kurtosis of 6.73. The kurtosis of 6.73 for FCPO return exhibits excess kurtosis from the normal distribution of 3,

Table 1. Daily FKLI returns distribution from 15/12/1995 to 31/12/2008.

Contract	Mean	Standard deviation	Skewness	Kurtosis
FKLI	-0.03	13.97	'-0.0024	14.97

Table 2. Daily FCPO Returns Distribution from 2/1/1995 to 31/12/2008.

Contract	Mean	Standard deviation	Skewness	Kurtosis
FCPO	1.04	41.42	'-0.31	6.73

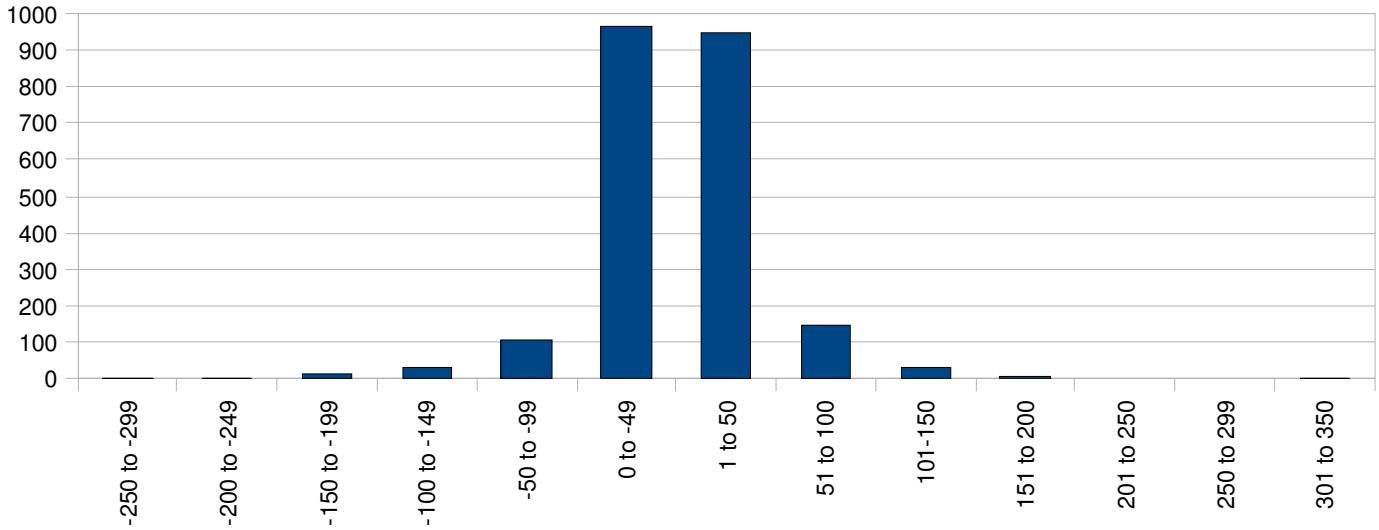

Figure 2. Daily FCPO returns distribution from 2/1/2002 to 31/12/2008.

therefore, it cannot be inferred that the returns are random. FCPO daily returns also show long tails.

METHODS

This research proposes to use the area between around one standard deviation bands to define range and any price above or below around one standard deviation bands to define potential uptrend or downtrend respectively. Note that in Figures 3 and 4, the large uptrends seem to begin after prices rise above the upper +1 standard deviation band and the downtrends seem to begin after prices fall below the lower -1 standard deviation band. When prices are moving out of the trading range, then trend trading technique will apply. The trend trading technique is to buy after it breaks out of resistance area in an uptrend and to sell after it breaks down of support area in a downtrend.

To avoid some of the whipsaws, we propose to use long term moving average and its relatively larger standard deviation in a ranging market. When market is ranging, long term moving average is used because it takes the average and view of the longer term and thus avoid some short term whipsaws. Using long term standard deviation from this moving average also generally gives a larger area between the bands. This also helps to prevent some unnecessary whipsaws.

To capture a new trend early, short term moving average and its relatively smaller standard deviation in a trending market are more suitable. When market starts to trend, a short term moving average is used because it allows earlier entry into a new trend. Using short term standard deviation from this moving average generally gives a narrower area between the bands. This also helps to ensure an earlier entry into the new trend.

To adjust the length of the moving average and standard deviation, a long term parameter is used in range market and a short term parameter is used in trend market. Efficacy Ratio is a new technical indicator created for this research.

$$\text{Efficacy ratio} = \frac{\text{Long term standard deviation}}{\text{Short term standard deviation}} \quad (1)$$

When market is ranging, Efficacy Ratio is a larger parameter. This larger Efficacy Ratio is used to determine the longer moving average length and generally wider standard deviation bands (a longer moving average length and wider standard deviations will result in less whipsaws in range trading), whereas during trending market, Efficacy Ratio is a smaller parameter. This smaller Efficacy Ratio is used to determine the shorter moving average length and generally narrower standard deviation bands (a shorter moving average length and narrower standard deviations will result in early entry into a new trend at a more favourable price). Therefore, the length of the moving average and standard deviations will automatically

Figure 3. Chart of FKLI, 21 moving average, +1 standard deviation upper band and -1 standard deviation lower band.

adjust, adapting to the Efficacy Ratio. This adaptability potentially addresses one of the common problems encountered by traders in gauging whether the market is ranging or beginning to trend.

ABZ' trades only outside the 0.8 standard deviation bands. 0.8 is arbitrarily chosen because in the optimisation tests for BBZ, 0.8 is deemed to be the most optimal parameter for the bands. This study ascertains that a trend begins when the price is above 0.8 (or below -0.8) standard deviation from the moving average. As ABZ' is a mechanical trading system, a set of trading rules can be programmed for it. The set of trading rules on when to buy and when to sell are presented in Table 3.

The purpose of running empirical tests on mechanical technical trading systems is to ascertain that:

i. Prices are not random.
ii. Mechanical technical trading systems can capture abnormal returns in excess of the passive buy-and-hold policy.
iii. ABZ' generates more returns than the moving averages systems tested, for FKLI, FCPO, Soyoil and Corn Futures for results greater than the passive buy-and-hold policy.

For comparison purpose, this research also includes testing of other technical trading rules specified by Brock et al. (1992) as well as other popular technical trading rules. Brock et al. (1992) test 12 technical trading rules and this research attempts to do the same. The technical trading rules specified by Brock et al. (1992) include Variable-Length-Moving-Average technical rules, Fixed-Length-Moving Average rules and 6 Trading-Range-Break rules. Besides moving averages and breakout of range trading rules specified by Brock et al. (1992), other popularly tested technical trading rules in literature review like stochastics, Alexander's Filter Rules, MACD are also tested. However, some popular trading systems frequently quoted by retail investors and newspapers, like RSI, are tested but not reported because the results are negative. The 12 common trading systems selected then are:

1. Simple 21 Days Moving Average (MA)
2. 3 and 21 Days Moving Average Crossover (MAC)
3. Kaufman Adaptive Moving Average (KAMA)
4. Bollinger Bands Z-T-Statistics (BBZ)
5. Optimised BBZ (Opt BBZ)
6. Adjustable Bands Z-Tests Statistics (ABZ')
7. Moving Average Envelopes of 1% (MAE)
8. Trading Rule Breakout
9. Alexander's Filter Rules
10. Moving Average Convergence Divergence (MACD)
11. Stochastics
12. Chande Market Oscillator (CMO)

The most common mechanical trend trading system is the simple moving average which Brock et al. (1992) refers to as Variable Moving Average (1,21,0%). 1 refers to the closing price, 21 refers to 21 periods moving average and 0%

Figure 4. Chart of FCPO, 21 moving average, +1 standard deviation upper band and -1 standard deviation lower band.

Table 3. ABZ' Set of trading rules.

1.	**Buy (enter long)**	when prices are **more** than around 0.8 standard deviation (P>Upper Band)
2.	**Sell (exit long)**	when prices are **less** than around 0.8 standard deviation (P<Upper Band)
3.	**Sell (enter short)**	when prices are **less** than around -0.8 standard deviation (P<Lower Band)
4.	**Buy (exit short**)	when prices are **more** than around -0.8 standard deviation (P>Lower Band)

refers to 0% from the simple moving average. The method to construct this simple moving average trading system is to calculate the average of 21 daily closes and compare that to the current close. If the current close is above the 21 day moving average, then the signal is to buy. If the current close is below the 21 day moving average, then the signal is to sell. Another common mechanical trend trading system is the moving averages crossover which Brock et al. (1992) refers to as Variable Moving Average (3,21,0%). 3 refers to the 3 periods moving average, 21 refers to 21 periods moving average and 0% refers to 0% from the averages. The method to construct this moving averages crossover trading system is to calculate the average of 3 daily closes and the average of 21 daily closes. If the 3 day moving average is above the longer 21 day moving average, then the signal is to buy. If the 3 day moving average is below the 21 day moving average, then the signal is to sell. Both the previous moving average(s) systems are fixed length moving average(s) and the lengths, 3 and 21 are arbitrary chosen.

In order to vary these moving averages according to market conditions, Kaufman (1998) proposes to apportion weights to the current data, and past smoothened data series according to Efficiency ratio, the formula is:

Table 4. Instructions using system tester for BBZ (21,1).

1)	Under System Tester, key in the name BBZ.
2)	(Program “Enter Buy” to be: “Close>BbandTop(Close, 21, Simple, 1) (Program “Exit Buy” to be: “Close<BbandTop(Close, 21, Simple,1) (Program “Enter Sell” to be: “Close<BbandBot(Close,21,Simple,1) (Program “Exit Sell” to be: “Close>BbandBot(Close,21,Simple,1)
3)	Run “Simulation Tests” on the data.
4)	View “Results” after the test to check for
a)	amount of profit,
b)	no of trades, profit versus unprofitable trades,
c)	average gain versus average loss per trade,
d)	maximum consecutive gains versus maximum consecutive losses.

Table 5. Instructions using system tester for optimised BBZ.

1)	Under System Tester, key in the name Opt BBZ.
2)	(Program “Enter Buy” to be: “Close>BbandTop(Close, Opt1, Simple, Opt2) (Program “Exit Buy” to be: “Close<BbandTop(Close, Opt1, Simple,Opt2) (Program “Enter Sell” to be: “Close<BbandBot(Close,Opt1,Simple,Opt2) (Program “Exit Sell” to be: “Close>BbandBot(Close,Opt1,Simple,Opt2)
3)	Run “Simulation Tests” on the data.
4)	View “Results” after the test to check for
a)	amount of profit,
b)	no of trades, profit versus unprofitable trades,
c)	average gain versus average loss per trade,
d)	maximum consecutive gains versus maximum consecutive losses.

KAMAt= a ER Ct + (1-a ER) KAMAt-1 where a=[(ER x (2/3-2/31))+2/31]^2 and ER = (Ct - Ct-n)/Absolute Sum of (Ct – Ct-1)

Ct is the most current close and Ct-1is the previous close. KAMA uses Efficiency ratio to determine the weight of the current data and past smoothened data series whereas ABZ adjusts the length of the moving average for each different period according to the prevailing Efficacy ratio.

However, these systems are turn and reverse systems, which mean that the trader trades all the time, even in range periods when the trader gets a lot of whipsaws.

To avoid trading unprofitably during range periods, part of this study proposes BBZ, (Chan and Azizan (2010) to trade when volatility increases, when the price moves above +1 or below -1 standard deviation band. The method to construct BBZ is to calculate the 21 day moving average and 1 standard deviation. The next step is to add 1 standard deviation to the 21 day moving average to get the upper band and to deduct 1 standard deviation from the 21 day moving average to get the lower band. If the close is above the upper band, then the signal is to buy and when the close is below the upper band, the signal is to exit long. If the close is below the lower band, then the signal is to sell and when the close is above the lower band, the signal is to exit short.

However, fixed length BBZ (21,1) produces result that only favours trends that begin when prices move beyond the 1 standard deviation bands from the 21 period simple moving average. For other periods, when market is moving very fast and not moving at all, 21 period and 1 standard deviation may not be the most optimal parameters to use. Therefore optimisation is done to find the optimised parameters that produce the best results. Optimisation is a series of simulations with different parameters with the intention of selecting the most optimal parameters that generate the most profit with the least number of consecutive losses. The system tester then generates the most optimized moving average and optimized standard deviation. In system tester, steps 1 to 4 are repeated, replacing 21 with “Opt1” and 1 with “Opt2”.

The most optimized parameters for FKLI and FCPO are 34 day moving average and 0.8 standard deviation bands from the moving average.

However, optimisation can only be performed on past data, after the event. Before the event, it is necessary to predict the optimal moving average and standard deviation to use. So from the range of results from optimized BBZ, ABZ' is designed to variate to the optimal moving average and 0.8 standard deviation from parameters around √34 to 34 according to market conditions. If the market is ranging, that is Efficacy Ratio is large, then a long term moving average and standard deviation are used. This is to prevent some unnecessary whipsaws that are characteristics of short term moving average. If the market is starting to trend, that is Efficacy Ratio is small, then a shorter term moving average and standard deviation are used. This is to permit earlier entry into the new trend at more favourable price. ABZ' = MA' + Stdev' where MA' and Stdev' are the moving average and standard deviation according to the prevailing Efficacy Ratio.

Moving Average Envelope (1.01) is the 1% bands above and below the moving average. The trading technique is to buy long above the upper band, sell short below the lower band and not trade within the bands. A 20 day trading rule breakout is to buy on

Table 6. Test results for trading systems for 2/1/2008-31/12/2008.

Contract	Buy-Hold	MA	MAC	KAMA	BBZ	Opt BBZ	ABZ'	MAE 1.01	Trading rule breakout	Alexander filter rule	MACD	Stochastics	CMO
FKLI	-562	433.5	378	498.5	213.5	366	316	246.5	288	327	278.5	406	165
FCPO	-1387	820	948	-456	672	1119	690	444	6	1466	-874	592	-150
Soyoil futures	-16.49	19.69	29.22	29.64	14.41	27	30.6	21.21	-4.89	10.68	-4.14	24.82	3.6
Corn futures	-49.2	134.6	52.8	-31.6	121	328	230	209	206.2	55.2	276.4	68.2	132.4
Wheat futures	-289	216.8	283.2	-194.6	-159.8	327	484	251	-175.8	399	-124	-264.4	-534.8

breakup above the last 20 days trading range and to sell on breakdown below the last 20 days trading range. If the market price is higher than any other prices in the last 20 days, the signal is to buy. If the market price is lower than any other prices in the last 20 days, the signal is to sell. Alexander Filter Rule of 3% is to buy when the close is 3% above the lowest low within the last 20 days and to sell when the close is 3% below the highest high within the last 20 days.

Exponential moving averages are used to construct momentum oscillator called moving average convergence divergence (MACD) by taking the difference between 12 days Exponential Moving Average (EMA12) and EMA26. The MACD signal line can be constructed in the following way by computing the simple 9 periods moving average for EMA12-EMA26. When the MACD is above the signal line, then the trading technique is to buy. When the MACD line is below the signal line, then the trading technique is to sell.

Stochastic is a leading indicator that compares the difference between the current close to the low in a given period to the absolute price range in this given period. This is called %K.

$$\%K = 100 \times (C - L)/(H - L)$$

where C = current close, H = high in N period and L = low in N period; %D takes the average of %K (Default is 3 days):

$$\%D = \frac{\sum (3\ period\ \ \%K)}{3}$$

Any stochastic value below 20 is considered oversold and the trading technique is to look for a place and also other confirmation signals to buy. Any stochastic value above 80 is considered overbought and the trading technique is to look for a place and other confirmation signals to sell. Chande Market Oscillator (CMO) is a leading momentum indicator that uses the difference of the up days and down days over the sum of both up and down days as follows:

$$CMO\ t = \frac{S_u - S_d}{S_u + S_d} \times 100$$

Where S_u is the sum of the difference between today's close and yesterday's close on up days; and S_d is the absolute value of the sum of the difference between today's close and yesterday's close on down days. Anything over 50 is considered overbought and below 50, oversold.

RESULTS AND DISCUSSIONS

The results confirm the hypotheses. The histogram of daily price changes shows that the distribution for the entire sample from 2nd January 2002 to 31st December 2008 has fat tailes denoting large changes that happen more frequently than in a normal distribution. In these simulations, the empirical results show that the mechanical algorithm trading systems generate the abnormal returns that are above the benchmark buy-and-hold policy for all contracts tested. The results are summarized in Table 6.

In Table 6, all trading systems are better than buy-and-hold policy for 2008. In 2008, all the trading rules report profits for most of the contracts except for Stochastics and CMO. Stochastics is a leading technical indicator. The best 4 are simple moving average, moving averagecrossover, optimised BBZ and ABZ'. The limitations of back-testing are that test results cannot account for intra-day movements which give earlier entry signals which may result in more profits or more losses and any slippage (which is usually not a factor to be concerned with in liquid markets).

For the period 2/1/2008 to 31/12/2008, ABZ' shows profit of 316 index points for FKLI compared to the buy-and-hold policy which yield a negative return of -562 index points and 690 for FCPO compared to a negative return of -1,387 points. For other comparison purpose, the risk free rate, the rate of return of a 10 year Malaysian Government Securities at the closing of 30 June 2008 is 4.770%. The chart for ABZ' from 2/1/2008 to 31/12/2008 for FKLI is in Figure 5 and for FCPO is in Figure 6.

Conclusion

To sum up, the most important feature of an algorithm trading system is its ability to adapt quickly and be robust in different markets and across different time frames. In designing the new algorithm trading system, the technical indicator used

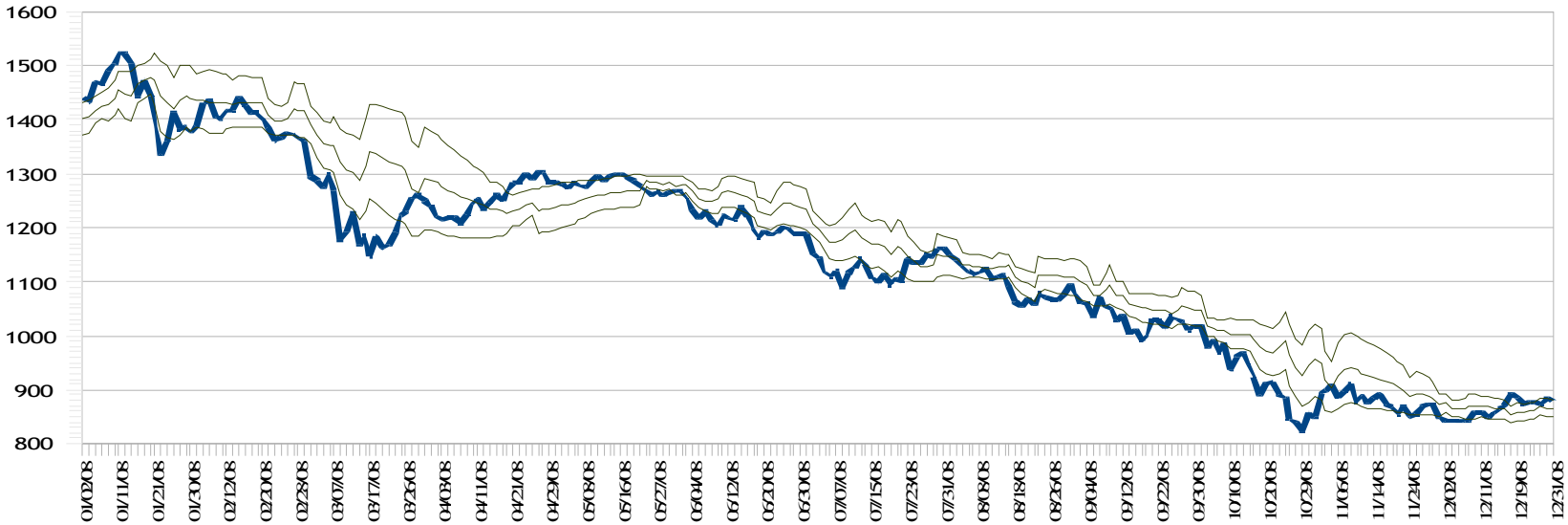

Figure 5. Adjustable bands Z-test-statistics' on FKLI for 2/1/2008-31/12/2008.

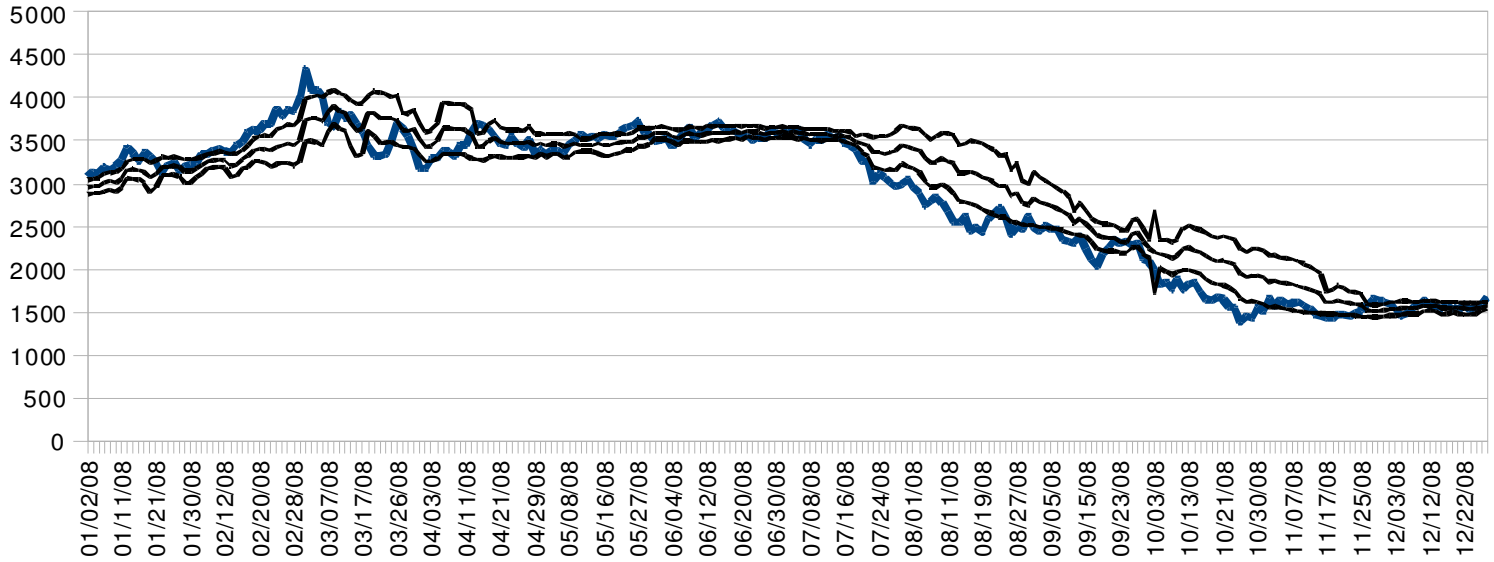

Figure 6. Adjustable bands Z-test-statistics' on FCPO for 2/1/2008-31/12/2008.

should show this ability. Conceptually, Efficacy Ratio, the product of this research, is designed to adjust to both the different market conditions, range market and trend market.

ABZ' is designed to address some of the common problems encountered by most trend trading systems like being triggered by floods of orders generated by common trading systems (like simple moving average), being whipsawed in range market and inability to capture the trend by entering the trend too late and exiting the trend too early. In selecting the most ideal algorithm trading system, factors to take into consideration are that the trading system should not encounter large losses, or show net large loss in any of the years. The algorithm trading system should work well in practice as in testing and that it can adjust automatically to the parameter shifts. Of course, in testing, slippage should be taken into consideration.

In summary, this paper demonstrates that: the prices of FKLI, FCPO and other futures contracts tested are not random; mechanical algorithm trading systems like moving averages; BBZ and ABZ' can be used to capture the abnormal returns arising from trending behaviour; ABZ' and Efficacy Ratio can be used to adjust the moving average and standard deviation to suit either ranging or trending market condition.

This conclusion supports Mandelbrot and Hudson (2004)'s claims that price changes are not random but move in trends. This research finds the newly innovated adaptive algorithm trading system, ABZ', a very useful technical analysis tool that adjusts automatically to the different market conditions. ABZ' employs Efficacy Ratio , a new technical term devised in this research to determine the variable length of standard deviation to gain earlier entry into a new trend and avoid whipsaws in range. ABZ' is a robust systems as it generates abnormal returns above the buy-and-hold policy across FKLI, FCPO, Soyoil Futures, Corn Futures and Wheat Futures. The possible implications from this work are that large bonuses need not be given out to outperforming traders to the detriment of a nation, nor large trading losses of financial institutions be part of tomorrow's financial news. The main product of this research is ABZ' which can be applied immediately on any professional model trading desk.

However, it should be noted that there is still much to be done for future further research to find specific algorithms to automatically determine the length of the long and short term standard deviations, the preset width of the bands from the moving average and the maximum parameter for the bands.

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