A NEW TECHNICAL INDICATOR FOR OPTIMAL MARKETS DETECTION

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ABSTRACT

In this article i present a new technical indicator that aim to detect optimal markets, with optimal markets defined as markets allowing for profitable trades. The proposed indicator will then be used to construct an adaptive moving average that aim to adapt to market trend strength.

***K*eywords** Moving Average · Adaptive Moving Average · Trading · Optimal Markets · Trading Strategy · Profitability · Equity · Trend Trading

"You don't put sunscreen when there is no sun, you don't use an umbrella when there is no rain, you don't use a kite when there is no wind, so why would you use a trend following strategy when there is no trend ?"

1 Introduction

Winning trades and gaining profits in trading is not impossible, however having gross profits superior to gross losses is what make trading challenging, it is logical to think that it is better to open a position when the probability of winning the trade is high, such probability can't be measured with accuracy but a lot of metrics have been proposed in order to help determining when to open positions, technical analysis support the fact that a trending market is the best market condition for opening a position, which is logical when using a trend following strategy, therefore a long-term positive auto-correlated market is optimal for trading, this is why this paper present a new method for detecting optimal markets conditions in order to open a position.

2 Classical Trend Strength Metrics

2.1 Hurst Exponent

The Hurst exponent denoted H is used to measure the persistence of a time series, H lay in a $[0, 1]$ range, when $H > 0.5$ the time series is showing long-term positive auto-correlation, which can indicate a trend.

Various methods for the estimation of H have been proposed, the rescaled range method suggested by G. Hurst being the most commonly used.

2.2 Efficiency Ratio

The efficiency ratio *ER[1]* proposed by P. Kaufman and originally used as smoothing variable for exponential averaging is a measure of the current trend strength and lay in range of $[0, 1]$, higher values of ER indicate a trending market. The efficiency ratio is calculated as follows :

$$ER_t = \frac{\mid C_t - C_{t-p} \mid}{\sum_{i=0}^{p} \mid \Delta C_{t-i} \mid}$$

where C_t is the closing market price.

2.3 Vertical Horizontal Filter

The vertical horizontal filter *(VHF)* proposed by A.White is a technical indicator that aim to measure the market trend strength, its interpretation is similar to the efficiency ratio. The vertical horizontal filter is calculated as follows :

$$VHF_t = \frac{max(C_t, p) - min(C_t, p)}{\sum_{i=0}^{p} \mid \Delta C_{t-i} \mid}$$

where max and min are running maximum/minimum filters of span p.

2.4 Average Directional Movement Index

The average directional movement index *(ADX[2])* proposed by J. Welles Wilder is an indicator part of the directional movement indicator *(DMI)* from the same author, the *DMI* consist in three lines, two lines denoted *DI+* and *DI-* and the *ADX* which measure the trend strength, it is recommended to enter trades with the *DMI* system when the *ADX* line is above both *DI+/DI-* lines. The *ADX* is calculated as follows :

$$ADX_t = 100 \times rma_p(\frac{\mid DI(+)_t - DI(-)_t) \mid}{DI(+)_t + DI(-)_t})$$

where rma being the Wilder moving average of period p.

3 Proposed Indicator

The proposed indicator is based on the assumption that positive returns using a trend following strategy are a strong indication of trend strength, the proposed indicator is built from the conditions of a simple SMA_p cross trend following strategy, which are to go long when $C_t > SMA_p(C_t)$ and to go short when $C_t < SMA_p(C_t)$, therefore we quantify those conditions in χ_t as follows :

$$\chi_t = \begin{cases} 1 & if\ long \\ -1 & if\ short \\ 0 & if\ exit \end{cases}$$

which in this case give :

$$\chi_t = \begin{cases} 1 & if\ C_t > SMA_p(C_t) \\ -1 & if\ C_t < SMA_p(C_t) \end{cases}$$

or more simply :

$$\chi_t = sgn(C_t - SMA_p(C_t))$$

the equity of this strategy can then be calculated as follows :

$$EQ_t = \sum_{i=0}^{t} \Delta C_{t-i} \times \chi_{t-i-1}$$

In order to provide a more parametric approach we use the parameter p used to calculate the running equity Req_t defined as :

$$Req_t = \sum_{i=0}^{p} \Delta C_{t-i} \times \chi_{t-i-1}$$

When $Req_t > 0$ this indicate positives returns of the strategy thus possible optimal market conditions for entering a position.

3.1 Scaled Running Equity

Scaling the proposed indicator in a certain range would allow it to be used for exponential averaging in order to provide an adaptive moving average. The scaled running equity defined as α_t is based on the ratio of Req_t with the optimal equity of the strategy defined as $OPTeq_t$ and is calculated as follows :

$$\alpha_t = max(\frac{Req_t}{OPTeq_t}, 0)$$

with :

$$OPTeq_t = \sum_{i=0}^{t} \Delta C_{t-i} \times \chi_{t-i}$$

where $1 >= \alpha_t >= 0$.

3.2 Adaptive Moving Average Based On The Proposed Indicator

α_t can be used as smoothing variable for exponential averaging thus providing a moving average adapting to market trend strength. This adaptive moving average defined as $EQma_t$ is calculated as follows :

$$EQma_t = \alpha_t C_t + (1 - \alpha_t) EQma_{t-1}$$

Where $EQma_1 = C_1$. When Req_t is closer to the optimal equity $OPTeq_t$ (α_t closer to 1) this would mean that market price allow for positive returns under the χ_t conditions and thus does not need to be filtered.

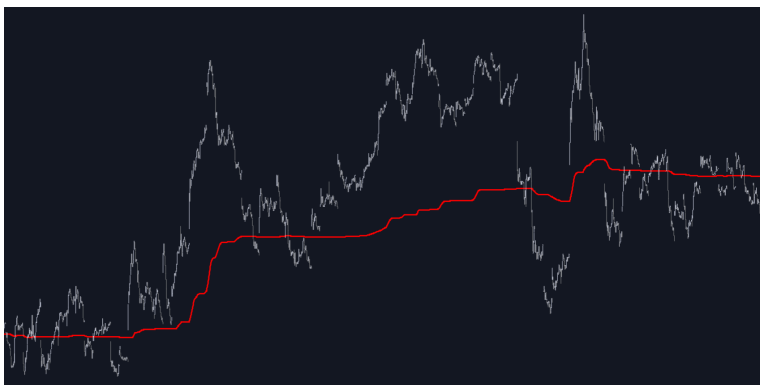

Figure 1: $EQma_t$ with $p = 14$

It can seen from figure 1 that $EQma_t$ is more reactive when price is showing variations of larger amplitudes. However reactivity is lacking, which is due to low values of α_t, therefore α_t can be replaced by $\sqrt{\alpha_t}$ in order to allow for a better fit with C_t.

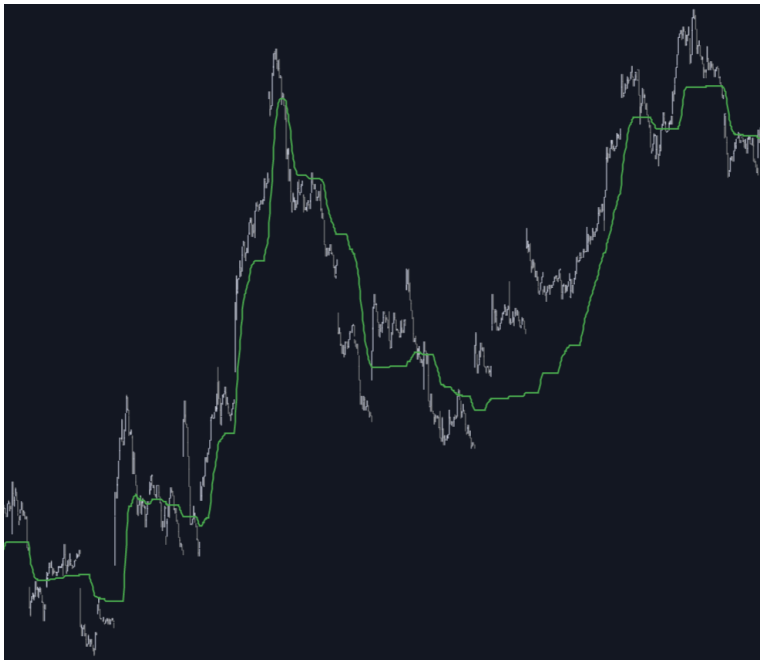

Figure 2: $EQma_t$ with period $p = 14$ using $\sqrt{\alpha_t}$

In order to reduce computation time a more efficient method can be proposed by modifying χ_t with :

$$\chi_t = sgn(C_t - EQma_t)$$

where $EQma_1 = 0$.

4 Conclusion

I presented a new indicator for the detection of optimal markets based on a running equity, then the proposed indicator has been used for the calculation of a new adaptive moving average. I hope both indicators may find applications in technical analysis and help investors get pertinent outputs from them.

5 Pinescript Codes

5.1 Running Equity

```
//@version=4
study("Running Equity")
length = input(14)
//----
src = close
X = sign(src - sma(src,length))
Req = sum(change(src)*X[1],length)
//----
plot(Req,color=#FF0000,transp=0)
```

5.2 Scaled Running Equity and EQma

```
//@version=4
study("EQma",overlay=true)
length = input(14)
//----
src = close
X = sign(src - sma(src,length))
Req = sum(change(src)*X[1],length)
OPTeq = cum(change(src)*X)
//----
ma = 0.
alpha = max(Req/OPTeq,0)
ma := alpha*src+(1-alpha)*nz(ma[1],src)
//----
plot(ma,color=#FF0000,transp=0)
```

References

[1] P. Kaufman, Trading Systems and Methods, John Wiley & Sons, Third Edition (2008).

[2] J. Welles Wilder, Jr. (June 1978). New Concepts in Technical Trading Systems. Greensboro, NC: Trend Research. ISBN 978-0894590276.