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# Heiken Ashi Strategies: Development of HA stochastic

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## **Abstract:**

To trade effectively and profitably, we must understand the trend in the market. While a plethora of popular technical analysis indicators attempt to provide a greater understanding of the trend in the market, they are limited in signaling both trend generation and momentum. Based on the Japanese Heiken Ashi (HA) candles we develop the Heiken Ashi stochastic or HASTOC, which can reflect in a single number both the likelihood of trend generation and momentum in the market. We back test ten strategies using HA and HASTOC for three currencies, one index and one currency for three major time frame in each market. We find the strategies give consistent profits for these markets. The study contributes to economic literature as well as to practical trading scenario by the development of a new indicator, HASTOC which in a single number, gives the trend generation and momentum in the market.

Key Words: Technical analysis, Back testing, Heiken Ashi Stochastic

JEL codes:

## 1. INTRODUCTION

As always, there is the good news and the bad news. The good news, the one that you have heard ever since you begin trading, is that 'trend is your friend'. The bad news, the one you understood soon into the game, is that this illusory friend 'trend' is as difficult to catch. While trend following strategies have historically been in place and are proven to be profitable (Hurst et al., 2017), the challenge for the trader on the desk is to understand the trend early on. To be what Murphy (1999) calls for the astute trader (who understands the trend generation before others in the market) you have to be able to the proverbial early bird. The trader who understands the trend generation before others in the market is likely to make the major profits. The 'early trader who gets the trend, gets the profits'. So how to be the early trend catcher has remained a perennial question for traders. Trend following indicators are abundant but the problem remains that they are 'following'. The signals are generated later so that you miss a major portion of the market with such strategies. Can then momentum-based indicators work? The momentum-based indicators help to understand the trend earlier than others, the signals generated often turn out to reflect market vagaries or 'moods of the moment', rather than the general market trend. To be effective, indicators therefore should try to blend in an understanding of trend following with the momentum.

Heiken Ashi (HA), the variant of the Japanese candlestick bar, gives an indication of the trend in the market. Based on the study of trend reversals in HA charts, this paper develops an indicator, the HA Stochastic or HASTOC which can give a unique insight into the trend as well as momentum in the market. The HASTOC gives a numerical value to show if the trend is changing or about to change and how much is the momentum in the market. I further develop ten strategies using the HA candles and HASTOC and back test them on data from five markets: three currencies, GBP/USD, EUR/USD, USD/INR; one index, NIFTY 50<sup>1</sup>, and one equity, State Bank of India<sup>2</sup>. In each market, three time frames are taken to understand how well the strategies work during intraday and daily frames. We find three strategies which give consistent abnormal profits in all market and time frames.

The contribution of this study extends to the practical trading scenario as much to the literature on technical analysis. first, it gives a new indicator which is effective in understanding trend generation and momentum, and the strategies developed on the basis of this indicator is found to be effective in back tests involving major markets, across securities, involving popularly traded time frames. The findings also add to the literature on technical analysis in two ways. It extends the evidence on profitability of technical analysis through back testing of indicators. A host of empirical studies have shown that technical analysis generates excess returns, eschewing the academic distrust of it (Pinches, 1970, Menkoff & Taylor, 2007, Surajaras and Sweeney 1992; Menkhoff and Schlumberger 1995; Neely 1997; LeBaron 1999; Saacke, 2002). We add on to the existing evidence in this context, albeit with a new indicator.

## 2. WHAT DO WE KNOW ABOUT TECHNICAL ANALYSIS PROFITABILITY?

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<sup>1</sup> Nifty 50 is the National Stock Exchange of India ( NSE)'s index for the Indian equity market

<sup>2</sup> SBI is India's largest commercial bank

Technical analysis is the ability to forecast price movements based on qualitative and quantitative study of historical price data. Strategies developed either from visual analysis of graphs or statistical analyses of price patterns are used to forecast with reasonable accuracy future prices to generate profits.

Economic literature concedes that technical analysis serves as an important tool in the hands of market practitioners as they take their trading decisions (Pinches, 1970, Menkoff & Taylor, 2007, Surajaras and Sweeney 1992; Menkhoff and Schlumberger 1995; Pilbeam 1995; Neely 1997; LeBaron 1999; Saacke, 2002). The earliest empirical studies on profitability of technical analysis indicators centered on questioning the success of technical analysis strategies in the presence of random walk. Brock et al (1992) showed, using technical analysis based on filter techniques, that profit can be generated substantially in excess of buy and hold returns. Fama (1970) points out that efficient markets should eliminate the presence of excess returns, and in this context, many of the empirical studies have focused closely on whether technical analysis leads to generation of excess reruns as opposed to positive returns in general.

In popular parlance, profitability of technical analysis contradicts the random walk hypothesis. If random walk holds, consequential changes in prices are random, implying forecasting of prices cannot be done "in any meaningful way" (Fama & Blume 1966). If with new information coming the changes in prices behave in a random manner or is distributed independently as a random variable (Pinches 1970), the forecasting of future prices is ruled out. Following the seminal work of Messe and Rogoff (1983), it is strongly held that random walk exists in forex markets and fundamental forecasting has largely failed to beat random walks (Neely et al., 2000). However, if technical analysis success comes from under reaction or overreaction to information as sentiment sways the market, it may not in fact be violating market efficiency. For example, Fama & Blume (1998) points out that if overreaction to market is matched by under reaction in some of the time, it would suggest efficiency exists over longer run.

Is technicals then self-fulfilling (Murphy, 1999)? If traders are confident on the ability of technical analysis indicators in interpreting psychological biases, logical reasoning suggests the technical analysis will be self-fulfilling. This suggests same kind of signals will elicit the similar responses from traders so that herd behaviour ensues. However the wide variety of technical analysis rules often leads to non- uniform signals, rejecting the possibility of herd behaviour.

Why should technical analysis be profitable? Menkoff & Taylor (2007) points to the belief among traders that technical analysis can represent changes in market psychology. If fundamental factors cannot reflect changes or swings in sentiment, prices may not be reflecting all information. The reaction of prices to new information coming from random events is likely to generate new movement in the market. At the same time, as these prices do not reflect new information, the fundamental analysis may not help to predict prices. Technical analysis strategies do better in interpreting both the reaction to newer information and consequent generation of new trends.

What are these random events? Silber (1994), Andrew C. Szakmary and Mathur (1997), Neely (1998) show the presence of intervention is strongly associated with profits from technical analysis indicators. Le Baron (1999) points out that central bank intervention would introduce noticeable trends into the evolution of exchange rates making it possible for market participants to gain from trading.

The success of technical analysis indicators in the presence of any market event comes from the ability to recognize trend creation. This empirical evidence makes it utmost important for the trader at the desk to understand trend generation. The basic premise of technical analysis is that market move in trends which can be recognized through suitable indicators (Murphy, 1999). A majority of technical analysis indicators are trend following trying to recognize trend creation or turn in the market. Indicators based on moving averages try to understand the start of a new trend by comparing the present price movement to longer term averages.

However, as any trader knows, the onset of trend and the reversal of trend remain difficult to predict even with a wide variety of technical analysis indicators. While trend following indicators have long been used and are profitable (Hurst, et al, 2017), the interpretation of such signals to take positions in live trading is far from easy. This explain the wide variety of indicators used by traders, from moving averages which give lagged signals, to momentum indicators, which give fast signals. In live trading the trader is often confused when with small correction in an uptrend, the momentum indicator goes negative, suggesting a change in position. This is shown in the Exhibit 1. A trader would like to get the entire uptrend market, between points 1 & 3, in the chart. However, with moving average crossover the signal would come at 2, which would make the trader lose half the market move. The downtrend that states at point 3, also gets the signal much later at 4.

The second panel in Exhibit 1 shows Relative Strength Index (RSI)<sup>3</sup>, a popular momentum indicator. As can be seen RSI gives the signal for trend generation early. RSI going up and above 50 can be taken as a buy signal and RSI going down and below 50 as a sell signal. As is seen by points B and D, the trend reversal may not captured by above 50 move. RSI moves up and down too often as market corrects for us to stay with the trend. Even if we enter market at point A or C, as RSI starts moving up (down) from oversold (overbought) range, the frequent sharp moves in RSI and points like C would be confusing to trader. Traders frequently use two or more indicators therefore to form the trading view. Is it possible to combine trend generation and momentum identification in a single indicator? Effective trading in live markets requires an indicator can predict the trend generation, the high points with big momentum in the market as well as next reversal. Heiken Ashi Stochastic developed in the next segment addresses this gap in technical analysis by providing an indicator which expresses in a single number both the likelihood of trend generation as well as the momentum in the market.

The paper adds to the existing literature of technical analysis by development of a new indicator, HASTOC, and presenting of empirical evidence on the profitability of strategies based on the HASTOC through back testing. For practitioners, the paper presents a new indicator effective in live trading.

### 3. DEVELOPMENT OF HA BASED INDICATOR: HASTOC

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<sup>3</sup> Relative Strength Index (RSI) indicator forms the basis of the next three strategies. RSI, like any other momentum indicator, gives the strength in the market. It is given by

$$RSI_{\alpha} = 100 - \frac{100}{1 + RS} \dots \dots \dots (12)$$

Where RS= Up closes/ Down closes over a period of  $\alpha$  days

Commonly values of RSI over 70 are interpreted as overbought condition in the market, giving a sell signal. Values of RSI below 30 are represented as oversold conditions in the market, giving a buy signal. Further, RSI going above (below) 50 is taken as a buy (sell) signal.

## Construct of HA candles

Heiken Ashi is a variant of the very popular Japanese candlestick technique. Candlesticks reflect the Japanese bar charting technique and similar to a bar construct, it also records the four important information that technical analysis traders are seeking namely, open, high, close, low. On the candlestick chart, the open and close is reflected in the broad portion of the bar of the candle. The high and close for the day is reflected in the shadows or the wicks of the candle. Let us look at figure 1 to understand the candlestick technique. The wide portion shows the body of the candle, with the upper and lower lines reflecting either the open or close for the day. If the close is on the higher side as compared to the open, the shaded area is shown in blue or white. If the close is on the lower side as compared to the open, the shaded area or the candle is shown as red or black. The wicks of the candle show the high and low as shown in the Exhibit 2.

Heinken Ashi uses a form of averaging to smooth out the movement in the market. As with the traditional candlestick pattern, Heinken Ashi also uses the open, high, low, close prices. However, in the Heinken Ashi candlesticks, this information is reflected in a different way. The calculation formula for Heinken Ashi candle is as follows (Kuepper, J, nd), demonstrated in Exhibit 3. For EUR/USD data, Table 1 gives a sample HA candle calculation from raw data.

$$\text{Close} = (\text{Open Price} + \text{High} + \text{Low} + \text{Close}) / 4$$

$$\text{Open} = \text{Average of Open Price and Close Price of the previous HA candle}$$

$$\text{High} = \text{Maximum value of the (High of the Day, Open of HA, Close of HA)}$$

$$\text{Low} = \text{Minimum value of the (Low of the Day, Open of HA, Close of HA)}$$

The formula above tells us that each price in the Heinken Ashi candlestick is a derived one. The open of the Heinken Ashi candlestick is the average of the open price and close price of the previous HA candle, which implies that it reflects the average movement that the price has taken priorly. The close of the Heinken Ashi is average of the entire price movement during the day. As HA Open of each period requires knowledge of the prior period HA Open and Close, for the initial period we assume, HA Open = Open for the first period.

The Heiken Ashi open would be greater than the Heiken Ashi close (resulting in a HA blue candle) only when prior period HA open and HA close average exceeds the average for the current period, or if prices on the average have been rising. Denoting  $HAC_t$  as the Heiken Ashi Close in period t and  $HAO_t$  as the Heiken Ashi Open of period t, we can write for a bull candle,

$$HAC_t - HAO_t > 0 \dots \dots (1)$$

$$HAC_t - \{(HAO_{t-1} + HAC_{t-1})/2\} > 0 \dots \dots (1a),$$

$$HAC_t > \{(HAO_{t-2} + HAC_{t-2})/4\} + HAC_{t-1}/2 \dots \dots (1b)$$

$$HAC_t > \{(HAO_{t-3} + HAC_{t-3})/8\} + \frac{HAC_{t-2}}{4} + HAC_{t-1}/2 \dots \dots (1c) \text{ and so on}$$

So for a t=5,

$$HAC_5 > \frac{HAO_1}{16} + \frac{HAC_1}{16} + \frac{HAC_2}{8} + \frac{HAC_3}{4} + \frac{HAC_4}{2} \dots \dots \dots (2),$$

Where  $HAO_1 = \text{Open}_1$  for period 1

Generalising for  $t=n$ ,

$$HAC_n > \frac{HAO_1}{2^{n-1}} + \sum_{t=1}^{n-1} \frac{HAC_t}{2^{n-t}} \dots \dots \dots (3)$$

This implies that for any period a bull candle to show, the average prices of any period will exceed on the average the prior period's prices, implying an uptrend.

Similarly, a bear candle in HA can be expressed as

$$HAC_n < \frac{HAO_1}{2^{n-1}} + \sum_{t=1}^{n-1} \frac{HAC_t}{2^{n-t}} \dots \dots \dots (4)$$

For bear candle to show, prices must on a downtrend. Thus the HA candle sticks can help to identify the general market movement and aid in trend analysis. The HA candles would show bull candles with no lower shadow if the momentum is high in the market. No upper shadow means the open of the HA is also the lowest the prices have reached in that period, which in HA parlance implies that the low of the period has exceeded the average of HA open and close of the previous period. Similarly a big bear with no upper shadow represents that the open of the period is also the highest of the period, which in HA parlance would mean that the high of the period is lower than the average of the previous HA open and close.

**HASTOC: Conception and Methodology**

As discussed earlier, technical analysis works in understanding the present trend in the market and in identifying the trend reversal. The trader who identifies reversal earliest in the market through use of technical analysis will be able to get the maximum advantage out of the positions. Looking at the Heiken Ashi charts from five markets over three different time frames, the following patterns for trend reversal emerge, as detailed in Table 2. For each market and time frame, ten reversal points have been noted. These reversal points are either confirmed by moving average crossover or visual chart analysis. Visual chart analysis is used where the crossover has not given a signal in spite of a prominent trend reversal. The observation on the Heiken Ashi Candle and the wick length is given. For a majority of reversal, the following points were noted:

1. Trend reversal is marked by small body
2. The shadows generally tend to be smaller just prior to a reversal
3. The candles are big and shadows long in a strong uptrend or downtrend.

This means that HA candle length as well as the wick sizes can be a good indicator of reversal. We use the difference between the candle open and closed predict the reversal pattern.



Similarly the reduced length of the shadow is an excellent indicator of indecision in the market before the change. We note that the difference between the candles can be good as indicator for the chartists in the market and reversal can be predicted and trades taken accordingly on the basis of the difference between the candles narrowing down.

Mathematically this means trend reversal is given by the Difference between open and close of HA candle attaining minimum value.

Let the Difference of HA open and lose be denoted as  $D_t$ ,

$$D_t = HAC_t - HAO_t \dots \dots \dots (5)$$

$$\text{For the difference to be minimum we require, } HAC_t = HAO_t \dots \dots \dots (5a)$$

From equation 3 & 4, therefore we have for any  $t=n$ ,

$$HAC_n = \frac{HAO_1}{2^{n-1}} + \sum_{t=1}^{n-1} \frac{HAC_t}{2^{n-t}}$$

This implies if the difference between HAO and Close is to be minimum, the average price in the current period is the sum of open of the first period, exponentially reduced and average of previous period, again exponentially reduced.

However, the problem with using the difference between the HA candle open and close as an indicator for chart analysis is that are the absolute values tend to differ across securities and markets. In this case we have to have a standardised indicator with a definite range of values to get clear-cut quantitative signals out of the tool.

To address this issue we develop a Heiken Ashi stochastic, or the HASTOC which will take the values between 0 to 100%. Any value on the upper side of 70% is taken to be trend momentum while any value on the downside of 10% would be taken to be trend reversal. The stochastic tries to put the difference in the context of the average difference over a period of ten days.

$$HASTOC_t = \frac{D_t - \text{Min}(D_t)}{\text{Max}(D_t) - \text{Min}(D_t)},$$

Where  $D_t$ = Difference between HA Open and HA Close

We also calculate the wick length of HA candles and use it to derive a stochastic HASTOC (W), The wick length (WL) is given by the difference between the high and close (open) added to the difference between the low and open (close) for a bull (bear) candle. HASTOC (W) is given by

$$HASTOC(W)_t = \frac{WL_t - \text{Min}(WL_t)}{\text{Max}(WL_t) - \text{Min}(WL_t)}$$

A sample calculation of HASTOC and HASTOC (WL) is shown in Table 1 for USD/INR data on 5th January from

The following strategies are developed and back tested:

1. Strategy 1: If difference (Dt) is negative and HASTOC value falls below 10 %, "buy" decision is taken and if difference is positive and HASTOC value falls below 10%, "sell" decision is taken. Negative (Positive) Dt represents a downtrend (uptrend) and a fall of HASTOC below 10% shows a trend reversal from down (up) to up (down). The signal in a particular period are multiplied by returns in the next period to get profits (or losses).

2. Strategy 2: For the second strategy, we consider an exit strategy to the above and liquidate the position when HASTOC is above 50% representing a momentum. Similar to Strategy 1 above, signal in a particular period are multiplied by returns in the next period to get profits (or losses).

3. Strategy 3: The entry and exit strategy from 1 and 2 above is taken. The transaction price for each strategy is close price of the next period. The profits are calculated on the basis of the entry and exit transaction prices.

4. Strategy 4: Here we use simple methodology to differentiate between the up and down trend. If the difference of HA, HA (Dt) changes from positive (negative) to negative (positive), a downtrend (uptrend) is assumed to have started. In this case, we calculate the profits as an alternate buy and sell strategy.

5. Strategy 5: In this case we consider the trend for three prior periods for taking the trading decision. If the trend is down or up for three consecutive periods, and HASTOC is less than 10%, we buy or sell. This is done to differentiate between beginning-of-trend small HA candles and the end of period small HA candles. It is noted from chart analysis that as the trend turns for a few period initially the candles appear small. We thus give an additional condition of continuous candles, signifying the trend in one direction, on the first strategy. For exit we stipulate the condition as prior buy (or sell) decision and HASTOC above 50%, for a sell (or buy) decision.

6. Strategy 6: Strategy 6-9 revisits the conditions of Strategies 1-5, putting additional conditionalities in terms of the HA wick length. For Strategy 6, the condition imposed in 1 is remains and additionally we require the HASTOC (WL) to be less than 10% for a buy or sell decision.

7. Strategy 7 is the exit strategy for Strategy 6.

8. Strategy 8 takes transaction prices for the entry and exit strategies of 6 & 7 as the closing prices next period and accordingly calculates the profitability.

9. Strategy 9 imposes the same condition as Strategy 5 and additionally requires that HASTOC (WL) <10%. Strategy 9 therefore incorporates the prior trend as in Strategy 5.

10. Strategy 10 imposes an additional volume condition to Strategy 4, requiring the trend change to be confirmed by high volume. This is satisfied by the requirement that volume in that particular period should exceed the moving average volume of the previous ten periods.

The strategies attempt to utilise the ability of HASTOC to locate trend generation by a smaller value as well as the ability to identify big trend with values exceeding 50%. We incorporate the observation of small wick length for reversals in the latter strategies. Further, we keep the simplest one with HA difference and volume, which itself is effective in trend identification as well as predicting the next reversal.

#### **4. RESULTS AND ANALYSIS**

The strategies are tested on data from three currency markets GBP/USD, EUR/USD and USD/INR, one index NIFTY 50 and one stock, State Bank of India. The time frames taken for all markets is 30 minutes, 60 minutes and day. For both 30 minutes and 60 minutes the period from 16th August 2018 to 16th November, 2018, with some variation in timings, according to data availability.

For EUR and GBP, the 30 and 60 minutes data covers the period from 12.30 am on 16th August 2018 to 10.30 am on 16th November, 2018. For INR, the 30 and 60 minutes data covers the period from 9.30 am on 16th August 2018 to 10.30 am on 16th November, 2018. For Nifty 50 and SBI, the 30 and 60 minutes data covers the period from 9.30/10 am on 16th August 2018 to 10.30/11 am on 16th November, 2018. The daily data covers the period 2nd January 2017 to 16th November, 2018 for all markets.

The results presented in table 2. The profits from the ten strategies, detailed in the previous section, are compared with the average return of the series, taken to be strategy 11. Table 2 presents the number of entries signals, exit signals, average profits, standard deviation of profits, cumulative profits and annualised average profits for all the strategies, including the series. On GDP/USD we see that strategies for five and ten turn out to be most profitable. Comparing the average return of the series with the returns of these strategies, we find them to be higher for all timeframes. The highest profitability is noted for strategy ten. On EUR/USD, we note that other than the 30 minute time frame four, five and ten are again consistently profitable, recording higher average annualised profits than the average annualised profit for their entire series in all timeframes. The highest profits come from the strategy five and ten. On USD/INR, again strategies for five and ten are consistently profitable. The highest profits come from the strategy nine. On State Bank of India for five and ten and give consistent profits while eight and nine gives highest profits in the 60 and 30 minute time frame respectively. On Nifty 50 the same pattern of five and ten being most profitable emerges with one exception of Nifty in the 60 minute timeframe. The highest profits are given by strategy five in the 30 minute timeframe.

As can be seen from the above analysis, except for Euro in the 30 minute time frame, all markets and timeframes see the Heiken Ashi strategies giving higher average annualised profits than the average annualised returns for that particular market. On GBP, on the 60 minute timeframe six strategies are profitable while three each are profitable on 30 minute and daily timeframe. On Euro, four strategies are profitable in the 60 minute timeframe and five in the daily timeframe. On INR, the corresponding numbers are for six and five, for the 30 minute, 60 minute and daily

timeframe. For State Bank of India six, four and seven strategies are profitable in the 30 minute, 60 minute, daily timeframe and for Nifty 50 the corresponding numbers are six, three and four for these timeframes.

The analysis sheds light on the effectiveness of a HA strategies. In all but one time frame for one currency (Euro), we find the strategies giving higher than average profits, a clear pattern emerges with 5 and 10 as the most profitable strategies. Strategy five represents the incorporation of trend in the HASTOC strategy. We recognise trend generation through small body candles and confirm the presence of the trend for taking this entry position. For the exit position the momentum is reflected in HASTOC taking a value higher than 50%. The tenth strategy is a simple understanding of the trend behind the market, based on the difference between a HA candles or HA(Dt) which is further confirmed by higher volumes. In almost all timeframes, four or more strategies are profitable and in some the number goes up to 7. The profitability of HA strategies holds for all for all timeframes and currencies.

The implication of this study for literature on technical analysis is three fold. First the understanding of trend remains crucial to technical analysis profitability. Trend following strategies tend to be profitable and therefore the earlier the trader understands the trend generated in the market the more the chances of profits from trades. Any good indicator should therefore try to fathom the trend. The strategies developed here tries to understand this trend generation effectively and as can be seen from the results of back testing, the difference between the open and close of HA candles as well as the HASTOC is effective identifying trend generation is. Secondly, volume as was expounded by the Dow Theory remains a very good confirmation tool for technical analysis. Thirdly, HASTOC is also effective in recognising the momentum, and therefore strategy five which exits the position when HASTOC takes the value greater than 50% turns out to be effective in all markets and timeframes.

Our paper adds to the present literature in technical analysis in two distinct ways. First it adds on to the practical traders kitty of technical analysis tools, developing an indicator which can effectively show trend generation as well as the momentum in the market. To the best of our knowledge, there has been no such studies on development of an indicator based on the Heiken Ashi candles. Secondly it also adds to the literature on back testing of technical analysis strategies, by presenting evidence on ten new strategies developed on the basis of the indicator HASTOC and HA candles.

**Table 1: Calculation of HASTOC and HASTOC (W) for sample USD/INR data**

Timestamp	Open	High	Low	Close	HA open	HA close	HA high	HA low	HADIFF STOCHA STIC	WL STOCHAST IC
5/1/2018 0:30	66.48	66.48	66.42	66.42	66.4500	66.4500	66.48	66.42		
5/1/2018 2:30	66.44	66.45	66.44	66.45	66.45	66.445	66.45	66.44		
5/1/2018 10:30	66.45	66.45	66.45	66.45	66.4475	66.45	66.45	66.4475		
5/1/2018 12:30	66.44	66.44	66.44	66.44	66.44875	66.44	66.448	66.44		
5/1/2018 15:30	66.5	66.5	66.5	66.5	66.44438	66.5	66.5	66.44438		

5/1/2018 19:30	66.51	66.51	66.51	66.51	66.47219	66.51	66.51	66.47219		
5/1/2018 21:30	66.5	66.52	66.5	66.52	66.49109	66.51	66.52	66.49109		
5/1/2018 22:30	66.76	66.8	66.76	66.8	66.50055	66.78	66.8	66.50055		
5/1/2018 23:30	66.79	66.79	66.79	66.79	66.64027	66.79	66.79	66.64027		
5/2/2018 9:30	66.75	66.75	66.635	66.6775	66.71514	66.70313	66.75	66.635	100.000%	100.000%
5/2/2018 10:30	66.68	66.745	66.6775	66.7125	66.70913	66.70375	66.745	66.6775	97.725%	60.317%
5/2/2018 11:30	66.715	66.7725	66.715	66.7275	66.70644	66.7325	66.7725	66.70644	86.938%	38.839%
5/2/2018 12:30	66.725	66.75	66.635	66.6525	66.71947	66.69063	66.75	66.635	100.000%	83.655%
5/2/2018 13:30	66.655	66.685	66.64	66.66	66.70505	66.66	66.7050	66.64	100.000%	19.420%
5/2/2018 14:30	66.66	66.7	66.63	66.68	66.68252	66.6675	66.7	66.63	90.748%	53.381%
5/2/2018 15:30	66.6775	66.705	66.67	66.675	66.67501	66.68188	66.705	66.67	84.003%	27.320%
5/2/2018 16:30	66.6775	66.705	66.64	66.67	66.67844	66.67313	66.705	66.64	87.757%	57.950%

Raw Data Source: Thomson Reuters Eikon; Author's calculations

**Table 2: HA Chart analysis**

<b>A. GBP/USD</b>	<b>Date and/&amp; time</b>	<b>Confirmation</b>	<b>Observations on candle size</b>	<b>Observations on candle wick length</b>	<b>Any other observations</b>
Monthly	7/31/2008	Ma crossover	Small	Very short lower shadow	Three small candles before reversal
	3/31/2009	Ma crossover	Small	Long	
	12/31/2009	Ma crossover	Small	Long	
	7/31/2010	Visual	Small	Long	
	8/31/2011	Ma crossover	Small	Medium	Three small candles before reversal
	8/31/2012	Visual	Medium	Short upper shadow	
	5/31/2014	Ma crossover	Small	Medium	Three small candles before reversal
	5/31/2015	Visual	Small	Medium	Three small candles before reversal
	2/28/2017	Ma crossover	Small	Medium	Two small candles before reversal
	4/30/2018	Ma crossover	Small	Medium	Two small candles before reversal
Daily	4/6/2018	Ma crossover	Small	Medium	Two small candles
	4/19/2018	Ma crossover	Small	Medium	Two small candles
	5/31/2018	Visual	Medium	No lower shadow	
	13/6/2018	Visual	Medium	Medium	Two small candles
	6/22/2018	Visual	Medium	No lower shadow	
	6/28/2018	Visual	Medium	No upper shadow	
	8/1/2018	Ma crossover	Small	Short	
	8/16/2018	Ma crossover	Small	Short	
	9/26/2018	Ma crossover	Very small	Short	
	10/16/2018	Visual	Medium	No lower shadow	
Hourly	10/16/2018 15:00	Ma crossover	Small	Short to medium	Two small candles

10/22/2018 8:00	Ma crossover	Small	Only upper shadow	Series of small candles continue for entire prior trend
10/30/2018 22:00	Ma crossover	Doji	Medium	Series of small candles at reversal
11/5/2018 6:00	Visual	Very small	Short	One candle
11/7/2018 13:00	Ma crossover	Small	Short	Series of small candles after reversal
11/12/2018 23:00	Ma crossover	Very small	Short	Series of small candles
11/15/2018 7:00	Ma crossover	small	Only upper shadow	Two small candles
11/15/2018 19:00	Ma crossover	Medium	Lower shadow only	Series of small candles; just before trend reversal, one medium sized candle
11/20/2018 12:00	Ma crossover	Very small	Medium	Series of small candles; just before trend reversal
11/23/2018 6:00	Ma crossover	Very small	Very short	Series of small candles; just before trend reversal

<b>B. EUR/USD</b>	<b>Date and/&amp; time</b>	<b>Confirmation</b>	<b>Observations on candle size</b>	<b>Observations on candle wick length</b>	<b>Any other observations</b>
Monthly	7/31/2008	MA crossover	Small	Very short lower shadow	Three small candles before reversal
	3/31/2009	MA crossover	Small	Long	
	12/31/2009	MA crossover	Small	Long	
	7/31/2010	Visual	Small	Long	
	8/31/2011	MA crossover	Small	Medium	Three small candles before reversal
	8/31/2012	Visual	Medium	Short upper shadow	
	5/31/2014	MA crossover	Small	Medium	Three small candles before reversal
	5/31/2015	Visual	Small	Medium	Three small candles before reversal
	2/28/2017	MA crossover	Small	Medium	Two small candles before reversal
	4/30/2018	MA crossover	Small	Medium	Two small candles before reversal
Daily	4/6/2018	MA crossover	Small	Medium	Two small candles
	4/19/2018	MA crossover	Small	Medium	Two small candles
	5/31/2018	Visual	Medium	No lower shadow	
	13/6/2018	Visual	Medium	Medium	Two small candles
	6/22/2018	Visual	Medium	No lower shadow	
	6/28/2018	Visual	Medium	No upper shadow	
	8/1/2018	MA crossover	Small	Short	
	8/16/2018	MA crossover	Small	Short	
	9/26/2018	MA crossover	Very small	Short	
	10/16/2018	Visual	Medium	No lower shadow	
Hourly	10/22/2018 9:00	MA crossover	Small	Medium	One candle
	10/23/2018 23:00	Visual	Very small	Very short	Series to very small candles

10/28/2018 19:00	MA crossover	Small	Long	Two candles
11/2/2018 0:00	MA crossover	Small to very small	Medium	Series of small to very small candles
11/5/2018 14:00	MA crossover	Medium	Only upper shadow	One candle
11/7/2018 13:00	MA crossover	Very small	Short	Two small candles
11/13/2018 0:00	MA crossover	Small	Lower shadow only	Two small candles
11/20/2018 9:00	MA crossover	Very small	Medium	Series of small candles; just before trend reversal, one medium sized candle
11/20/2018 23:00	Visual	Very small	Medium	Three very small candles
11/23/2018 9:00	MA crossover	Small	Medium	Two small candles

<b>C. USD/INR</b>	<b>Date and/&amp; time</b>	<b>Confirmation</b>	<b>Observations on candle size</b>	<b>Observations on candle wick length</b>	<b>Any other observations</b>
Monthly	2/28/1998	Visual	Very small	Small	Three candles
	2/29/2000	Visual	Very small	Small	Three candles
	6/30/2002	Ma crossover	Very small	Small	Three candles
	4/3/2004	Visual	Medium	Long lower shadow	One candle
	9/30/2004	Visual	Very small	Small	One candle
	6/30/2005	Visual	Doji	Small	Three candles
	3/31/2006	Ma crossover	Very small	Small	One candle
	9/30/2006	Ma crossover	Very small	Small	One candle
	10/31/2008	Ma crossover	Very small	Small	Three small candles before reversal
	6/30/2011	Ma crossover	Very small	Small	Four small candles before reversal
Daily	4/6/2018	Ma crossover	Small	Medium	Two small candles
	4/19/2018	Ma crossover	Small	Medium	Two small candles
	5/31/2018	Visual	Medium	No lower shadow	
	13/6/2018	Visual	Medium	Medium	Two small candles
	6/22/2018	Visual	Medium	No lower shadow	
	6/28/2018	Visual	Medium	No upper shadow	
	8/1/2018	Ma crossover	Small	Small	
	8/16/2018	Ma crossover	Small	Small	
	6/6/2018	Ma crossover	small	Only lower shadow	
	11/1/2018	Ma crossover	Small	Medium	One small candle
Hourly	10/16/2018 15:00	Ma crossover	Small	Short to medium	Two small candles
	10/22/2018 8:00	Ma crossover	Small	Only upper shadow	Series of small candles continue for entire prior trend

10/30/2018 22:00	Ma crossover	Doji	Medium	Series of small candles at reversal
11/5/2018 6:00	Visual	Very small	Short	One candle
11/7/2018 13:00	Ma crossover	Small	Short	Series of small candles after reversal
11/12/2018 23:00	Ma crossover	Very small	Small	Series of small candles
11/15/2018 7:00	Ma crossover	small	Only upper shadow	Two small candles
11/15/2018 19:00	Ma crossover	Medium	Lower shadow only	Series of small candles; just before trend reversal, one medium sized candle
11/20/2018 12:00	Ma crossover	Very small	Medium	Series of small candles; just before trend reversal
11/28/2018 0:30	Ma crossover	Very small	Very short	Series of small candles; just before trend reversal

<b>D. SBI</b>	<b>Date and/&amp; time</b>	<b>Confirmation</b>	<b>Observations on candle size</b>	<b>Observations on candle wick length</b>	<b>Any other observations</b>
Monthly	4/2/2007	Visual	Very small	Very short	One candle
	1/1/2008	Visual	Small	Medium	Two small candles
	3/2/2009	MA crossover	Small	Lower shadow	One candle
	11/1/2010	Visual	Medium	Medium	One candle
	2/1/2012	MA crossover	Very small	Large	One candle
	2/1/2013	MA crossover	Small	Medium	One candle
	2/3/2014	MA crossover	Small	Medium	Four candles
	2/2/2015	MA crossover	Very small	Medium	One candle
	4/1/2016	MA crossover	Very small	Short	Two small candles
	1/1/2018	Visual	Very small	Short	One candle
Daily	10/26/2018	MA crossover	Medium	Medium	One candle
	12/26/2017	MA crossover	Very small	Short	One candle
	1/25/2018	MA crossover	Medium	Long	One candle
	3/26/2018	Visual	Very small	Long	One candle
	4/11/2018	Visual	Very small	Medium	One candle
	4/27/2018	Visual	Very small	Long	One candle
	5/21/2018	MA crossover	Very small	Short	One one candle
	6/14/2018	MA crossover	Medium	Upper shadow only	One candle
	7/17/2018	MA crossover	Medium	Large	One candle
	8/30/2018	MA crossover	Very small	Medium	One candle
Hourly	11/26/2018 11.30	MA crossover	Small	Medium	One candle
	11/21/2018 13.30	MA crossover	Very small	Medium	One candle
	11/20/2018 15.30	MA crossover	Medium	Lower shadow only	One candle
	11/19/2018 8.30	Visual	Medium	Upper shadow only	One candle
	11/15/2018 12.30	Visual	Very small	Medium	One candle



11/13/2015 11.30	MA crossover	Very small	Only upper shadow	One candle
11/6/2018 8.30	MA crossover	Small	Long	One candle
10/26/2018 15.30	MA crossover	Very small	Only lower shadow	Series of small candles
10/17/2018 9.30	MA crossover	Very small	Medium	One candle
10/15/2018 14.30	MA crossover	Very small	Short	One candle

<b>E. Nifty 50</b>	<b>Date and/ &amp; time</b>	<b>Confirmation</b>	<b>Observations on candle size</b>	<b>Observations on candle wick length</b>	<b>Any other observations</b>
Monthly	12/1/2017	Visual	Small	Short	One candle
	2/1/2016	Visual	Big	Small lower shadow only	One candle
	2/2/2015	Visual	Small	Short	One candle
	9/2/2013	Visual	Small	Upper shadow only	One candle
	8/1/2012	Visual	Very small	Very short	One candle
	10/1/2010	Visual	Very small	Very short	One candle
	1/1/2009	Ma crossover	Very small	Very short	One candle
	3/12/2007	Ma crossover	Small	Short	Two candles
	3/1/2007	Visual	Small	Short	One candle
	6/1/2006	Visual	Small	Lower shadow	One candle
Daily	10/25/2018	Visual	Very small	Short	One candle
	8/28/2018	Ma crossover	Doji	Short	One candle
	6/28/2018	Ma crossover	Small	Short	One candle
	6/13/2018	Visual	Small	Very short	One candle
	5/23/2018	Visual	Big	Very short	One candle
	5/15/2018	Visual	Very small	Long	Two candles
	3/23/2018	Ma crossover	Small	Short	One candle
	1/29/2018	Ma crossover	Small	Short	One candle
	6/12/2017	Ma crossover	Small	Short	One candle
	11/27/2017	Visual	Small	Short	One candle
Hourly	11/26/2018	Ma crossover	Medium	Upper shadow only	One candle
	11/19/2018 5:00	Ma crossover	Small	No	One candle
	10/26/2018 6:00	Ma crossover	Small	No	One candle
	10/16/2018 23:00	Ma crossover	Medium	Short	One candle
	10/10/2016 23:00	Ma crossover	Medium	Short	One candle
	8/31/2018	Ma crossover	Very small	Short	Series of small candles
	8/16/2018 6:00	Ma crossover	Small	No	Series of small candles
	8/9/2018 0:00	Ma crossover	Small	Short	One candle

9/19/2018 4:00	Ma crossover	Small	Short	One candle
7/2/2018	Ma crossover	Very small	Short	One candle

Chart Source: Thomson Reuters Eikon; Author's analysis

**Table 3: Signals generated and profits from different strategies**

**A. GBP/USD**

GBP_30 MINS	Strategy	1	2	3	4	5	6	7	8	9	10	11
	Entry signals	0	25	0	87	131	0	0	0	10	45	0
	Exit signals	0	15	40	87	81	0	0	0	11	47	0
	Average profits (%)	0.00	0.00	0.00	0.01	0.05	-0.01	0.00	0.00	0.00	0.06	0.00
	St Dev profits (%)	0.05	0.11	0.11	0.03	0.18	0.02	0.00	0.00	0.00	0.07	0.07
	Cumulative profits (%)	-0.11	0.00	0.00	8.89	2.16	-0.28	0.00	0.00	0.00	5.26	1.44
	Annualized average return (%)	-0.04	-0.01	0.01	<b>0.87</b>	<b>4.19</b>	-0.76	0.00	0.00	0.00	<b>5.13</b>	0.13
GBP_60 MINS	Strategy	1	2	3	4	5	6	7	8	9	10	11
	Entry signals	0	8	0	69	82	0	0	0	11		0
	Exit signals	0	10	18	68	42	0	1	1	10		0
	Average profits (%)	-0.01	-0.04	0.04	0.01	0.05	0.00	0.05	0.00	-0.28	0.06	0.01
	St Dev profits (%)	0.05	0.10	0.10	0.04	0.17	0.03	0.00	0.00	0.00	0.10	0.08
	Cumulative profits (%)	-1.21	-0.68	0.68	5.94	1.22	0.07	0.05	-0.05	-0.28	4.18	3.19
	Annualized Average return (%)	-0.66	-3.26	<b>3.37</b>	<b>0.93</b>	<b>4.21</b>	0.33	<b>4.12</b>	-0.01	-21.91	<b>5.70</b>	0.49
GBP_DAILY	Strategy	1	2	3	4	5	6	7	8	9	10	11
	Entry signals	0	9	0	55	49	0	0	0	1	27	0
	Exit signals	0	5	14	54	27	0	0	0	0	32	0
	Average profits (%)	-0.06	-0.03	0.03	0.04	-0.19	-0.08	0.00	0.00	0.00	0.19	0.01
	St Dev profits (%)	0.31	0.32	0.32	0.18	0.74	0.00	0.00	0.00	0.00	0.34	0.37
	Cumulative profits (%)	-5.62	-0.37	0.37	19.21	-3.18	-0.08	0.00	0.00	0.00	11.16	1.20
	Annualized Average return (%)	-0.20	-0.10	<b>0.10</b>	<b>0.16</b>	-0.68	-0.29	0.00	0.00	0.00	<b>0.70</b>	0.03

\* Figures in bold represent returns are greater than average returns

**B. EUR/USD**

Strategy	1	2	3	4	5	6	7	8	9	10	11
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EURO_30 MINS	Entry signals	0	22	0	101	117	0	1	0	9	41	0
	Exit signals	0	22	44	101	65	0	1	2	6	52	0
	Average profits (%)	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	St Dev profits (%)	0.07	0.07	0.07	0.03	0.12	0.04	0.00	0.00	0.00	0.07	0.06
	Cumulative profits (%)	-1.38	-0.02	0.02	1.09	-0.02	-0.03	0.04	-0.04	-0.09	0.13	2.06
	Annualized Average return (%)	-1.00	-0.08	0.08	0.21	-0.08	-0.21	0.01	0.00	0.00	0.24	0.41
EURO_60 MINS	Strategy	1	2	3	4	5	6	7	8	9	10	11
	Entry signals	0	9	0	72	71	0	0	0	1	38	0
	Exit signals	0	17	26	73	43	0	0	0	5	34	0
	Average profits (%)	0.00	-0.02	0.02	0.01	0.02	-0.01	0.00	0.00	0.00	0.03	0.00
	St Dev profits (%)	0.05	0.05	0.05	0.03	0.11	0.04	0.00	0.00	0.00	0.07	0.06
	Cumulative profits (%)	0.04	-0.63	0.63	3.77	0.56	-0.22	0.00	0.00	0.00	2.31	2.40
	Annualized Average return (%)	0.02	-2.11	<b>2.15</b>	<b>0.59</b>	<b>1.83</b>	-1.01	0.00	0.00	0.00	<b>2.85</b>	0.39
EURO_DAILY	Strategy	1	2	3	4	5	6	7	8	9	10	11
	Entry signals	0	7	0	43	55	0	0	0	1	22	0
	Exit signals	0	14	21	43	44	0	0	0	2	24	0
	Average profits (%)	-0.02	0.01	-0.01	0.03	0.27	0.07	0.00	0.00	0.00	0.14	-0.02
	St Dev profits (%)	0.33	0.42	0.42	0.15	0.92	0.13	0.00	0.00	0.00	0.29	0.33
	Cumulative profits (%)	-2.22	0.24	-0.22	12.41	6.81	0.35	0.00	0.00	0.00	6.28	-2.22
	Annualized Average return (%)	-0.09	<b>0.04</b>	-0.04	<b>0.10</b>	<b>1.00</b>	<b>0.25</b>	0.00	0.00	0.00	<b>0.50</b>	-0.09

\* Figures in bold represent returns are greater than average returns

### C. USD/INR

INR_30 MINS	Strategy	1	2	3	4	5	6	7	8	9	10	11
	Entry signals	0	20	0	121	114	0	2	0	9	60	0.00
	Exit signals	0	20	40	121	44	0	5	7	7	52	0
	Average profits ( )	0.00	0.02	-0.02	0.00	0.01	-0.02	0.00	0.01	-0.04	0.01	0.01
	St Dev profits ( )	0.12	0.12	0.12	0.05	0.17	0.16	0.01	0.06	0.11	0.08	0.11
	Cumulative profits ( )	-0.25	0.94	-0.95	-0.68	0.42	-0.82	-0.09	0.09	-0.32	0.81	4.36
	Annualized Average return ( )	-0.18	<b>4.22</b>	-4.06	-0.13	<b>2.31</b>	-3.02	-0.02	<b>2.25</b>	-6.76	<b>1.27</b>	0.90
Strategy	1	2	3	4	5	6	7	8	9	10	11	

INR_60 MINS	Entry signals	0	17	0	70	70	0	0	0	6	0	0.00
	Exit signals	0	14	31	71	45	0	0	0	4	0	0.00
	Average profits ( )	0.00	0.01	-0.01	0.01	0.02	0.01	0.00	0.00	0.18	0.03	0.00
	St Dev profits ( )	0.09	0.13	0.13	0.05	0.20	0.09	0.00	0.00	0.00	0.10	0.10
	Cumulative profits ( )	-0.38	0.32	-0.32	3.63	0.56	0.24	0.00	0.00	0.18	2.01	0.77
	Annualized Average return ( )	-0.23	<b>0.92</b>	-0.91	<b>0.57</b>	<b>1.70</b>	<b>1.12</b>	0.00	0.00	<b>16.58</b>	<b>2.41</b>	0.13
INR_DAILY	Strategy	1	2	3	4	5	6	7	8	9	10	11
	Entry signals	0	11	0	68	48	0	0	0	4	43	0.00
	Exit signals	0	19	30	68	31	0	0	0	1	51	0.00
	Average profits ( )	0.03	-0.16	0.16	0.05	0.07	-0.06	-0.06	0.00	0.00	0.21	0.31
	St Dev profits ( )	0.33	0.29	0.29	0.20	0.51	0.16	0.16	0.00	0.00	0.36	-7.30
	Cumulative profits ( )	3.30	-4.80	4.80	21.15	1.41	-0.58	-0.58	0.00	0.00	19.88	100.00
	Annualized Average return ( )	<b>0.12</b>	-0.58	<b>0.59</b>	<b>0.17</b>	<b>0.25</b>	-0.23	-0.23	0.00	0.00	<b>0.77</b>	0.00

\* Figures in bold represent returns are greater than average returns

#### D. State Bank of India (SBI)

SBI_30 MINS	Strategy	1	2	3	4	5	6	7	8	9	10	11
	Entry signals	0	11	0	45	81	0	4	0	15	29	0
	Exit signals	0	11	22	45	49	0	5	9	11	24	0
	Average profits (%)	0.10	-0.02	0.02	0.01	-0.09	-0.14	0.00	-0.03	0.24	0.10	-0.01
	St Dev profits (%)	0.73	0.54	0.54	0.25	1.37	0.91	0.08	0.58	0.91	0.47	0.70
	Cumulative profits (%)	12.14	-0.44	0.44	4.27	-2.40	-4.93	0.29	-0.29	3.16	5.12	-3.52
	Annualized Average return (%)	<b>8.80</b>	-1.72	<b>1.75</b>	<b>0.78</b>	-7.22	-11.31	<b>0.05</b>	-2.76	<b>23.74</b>	<b>8.83</b>	-0.63
SBI_60 MINS	Strategy	1	2	3	4	5	6	7	8	9	10	11
	Entry signals	0	17	0	55	38	0	0	0	0	26	0
	Exit signals	0	10	27	55	30	0	0	0	0	20	0
	Average profits (%)	0.05	0.04	-0.04	0.01	0.22	0.54	0.54	0.00	0.00	0.13	0.06
	St Dev profits (%)	0.75	0.52	0.52	0.34	1.52	0.33	0.33	0.00	0.00	0.72	0.69
	Cumulative profits (%)	4.33	1.11	-1.12	6.02	4.72	2.15	2.15	0.00	0.00	6.04	23.98
	Annualized Average return (%)	0.18	0.15	-0.15	0.05	<b>0.82</b>	<b>1.98</b>	<b>1.98</b>	0.00	0.00	<b>0.48</b>	0.21
SBI_DAILY	Strategy	1	2	3	4	5	6	7	8	9	10	11

Entry signals	0	26	0	103	134	0	8	0	27	47	0	
Exit signals	0	25	51	104	85	0	10	18	18	45	0	
Average profits (%)	0.00	-0.10	0.10	0.01	0.06	0.05	0.00	0.07	0.12	0.07	0.00	
St Dev profits (%)	0.54	0.57	0.57	0.24	1.15	0.78	0.09	0.61	0.91	0.48	0.52	
Cumulative profits (%)	-0.72	-5.20	5.21	7.12	3.41	3.26	-	1.16	1.18	3.34	6.35	-4.04
Annualized Average return (%)	-0.46	-	<b>19.60</b>	<b>1.40</b>	<b>11.95</b>	<b>9.35</b>	-	<b>12.14</b>	<b>23.24</b>	<b>12.84</b>	-0.59	

\* Figures in bold represent returns are greater than average returns

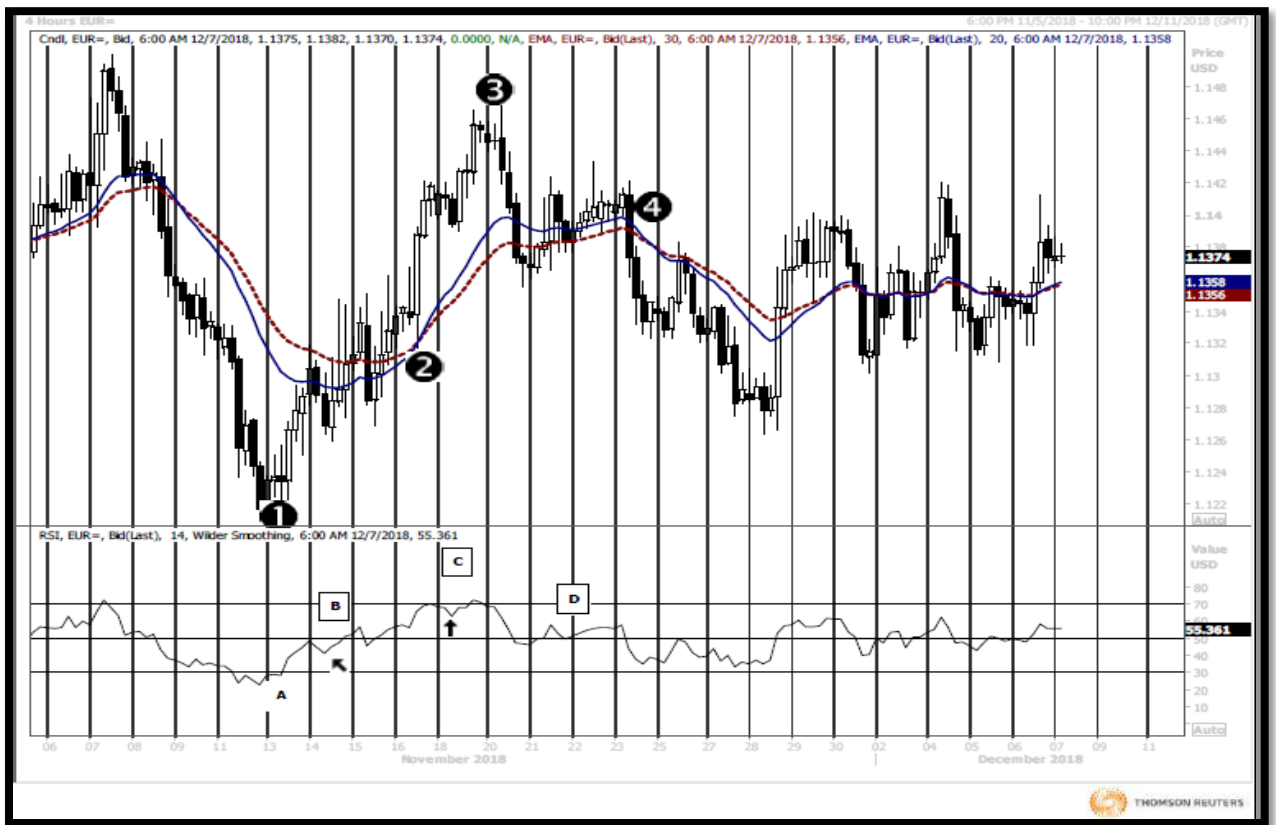
## E. NIFTY 50

NIFTY_30 MINS	Strategy	1	2	3	4	5	6	7	8	9	10	11
	Entry signals	0	0	0	0	0	0	8	0	15		0
	Exit signals	0	0	0	0	0	0	8	16	13		0
	Average profits (%)	-0.06	-0.04	0.04	0.00	0.17	-0.16	0.00	0.05	0.14	0.03	-0.01
	St Dev profits (%)	0.35	0.41	0.41	0.11	0.95	0.59	0.05	0.40	0.87	0.28	0.32
	Cumulative profits (%)	-7.72	-0.45	0.45	1.49	3.14	-3.66	-0.32	0.32	1.22	1.47	-2.64
	Annualized Average return (%)	-9.89	-6.36	<b>6.81</b>	<b>0.70</b>	<b>35.81</b>	-24.33	-0.12	<b>8.46</b>	<b>26.89</b>	<b>5.49</b>	-1.03
NIFTY_60 MINS	Strategy	1	2	3	4	5	6	7	8	9	10	11
	Entry signals	0	9	0	51	52	0	4	0	2	32	0
	Exit signals	0	10	19	51	31	0	2	6	5	27	0
	Average profits (%)	0.04	0.08	-0.08	-0.01	-0.08	0.24	0.00	0.09	-0.35	-0.03	-0.01
	St Dev profits (%)	0.46	0.24	0.24	0.16	0.64	0.89	0.02	0.14	0.23	0.28	0.35
	Cumulative profits (%)	4.45	1.49	-1.49	-4.45	-1.86	3.55	-0.52	0.52	-0.71	-1.70	-7.11
	Annualized Average return (%)	<b>3.51</b>	<b>7.11</b>	-6.65	-0.87	-6.82	<b>23.07</b>	-0.10	<b>7.94</b>	-26.65	-2.49	-1.27
NIFTY_DAILY	Strategy	1	2	3	4	5	6	7	8	9	10	11
	Entry signals	0	17	0	55	38	0	0	0	0	26	0
	Exit signals	0	10	27	55	30	0	0	0	0	20	0
	Average profits (%)	0.05	0.04	-0.04	0.01	0.22	0.54	0.54	0.00	0.00	0.13	0.06
	St Dev profits (%)	0.75	0.52	0.52	0.34	1.52	0.33	0.33	0.00	0.00	0.72	0.69
	Cumulative profits (%)	4.33	1.11	-1.12	6.02	4.72	2.15	2.15	0.00	0.00	6.04	23.98
	Annualized Average return (%)	0.18	0.15	-0.15	0.05	<b>0.82</b>	<b>1.98</b>	<b>1.98</b>	0.00	0.00	<b>0.48</b>	0.21

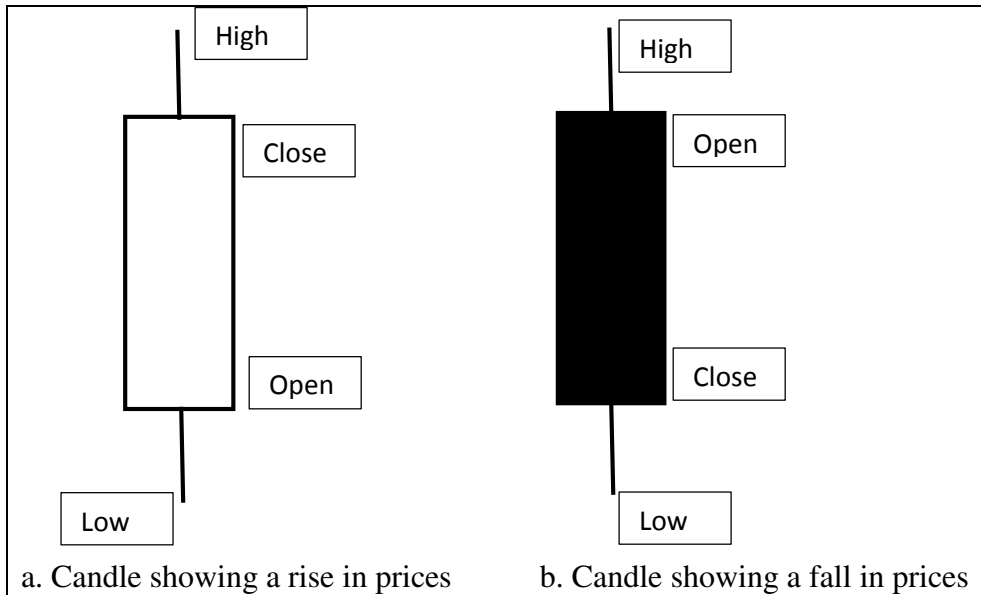
\* Figures in bold represent returns are greater than average returns

Raw Data Source: Thomson Reuters Eikon; Author's calculations

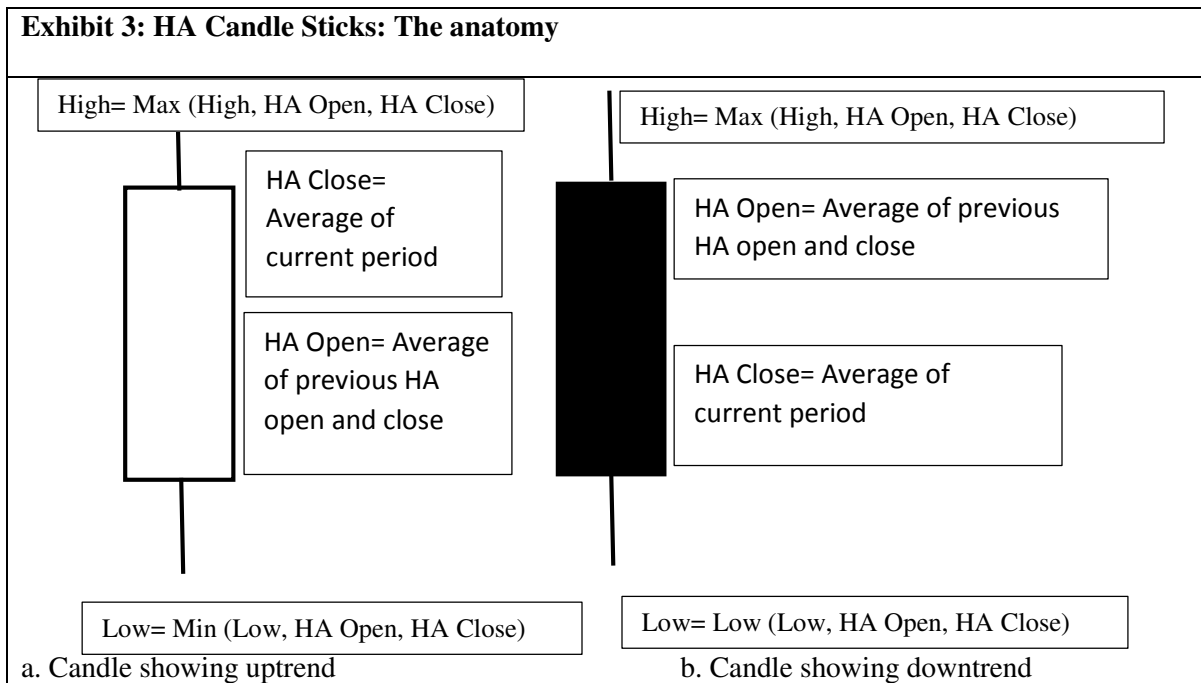
**Exhibit 1: Crossover and RSI signals on EUR/USD chart**



**Exhibit 2: Candle Sticks: The anatomy**



Source: Author's sketch



Source: Author's sketch

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