FLEXIBILITY IN PERFORMANCE MEASUREMENT OF TRADING SYSTEM: A QUANTITATIVE ANALYSIS OF JAPANESE CANDLESTICK CHARTS

Dr. B. K. R. Naik [1]& Niranjan Thilak [2]

Abstract: *Japanese candlestick analysis is a form of technical analysis which is carried out by analyzing the graphs including the open, close, high and low prices of an equity or commodity index. There are more than 200 patterns with expected behavior to follow after the occurrence of the pattern in the market. This study analyses the effect of certain number of candle patterns in the indices of NIFTY and BANKNIFTY and analyses their efficiency in the success rate and frequency of occurrence in the market. The efficiency in the performance of the candlestick pattern was found to be largely dependent on the accurate recognition of pattern. Though certain patterns showed entirely opposite or flat movement, even they were dependent on the trends needed for the pattern. Hence, utilizing the candlestick patterns with the appropriate confirmation signals can give assured profits.*

Keywords: Candlestick, Technical analysis, India, Market timing

Introduction

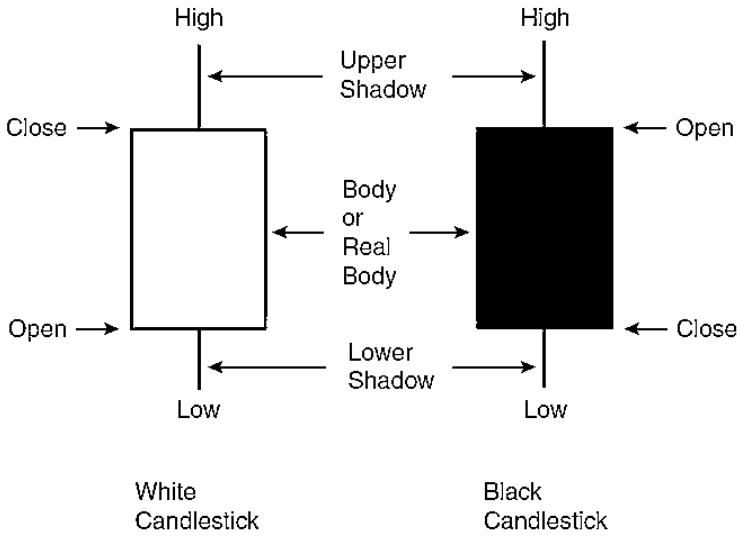
Candlestick charts are one among the popular charting methods used in indicating the price movement of equity, derivative or fore market for a period of time. It is actually a combination of line-chart and a bar-chart. Each candlestick represents the range of movement

[1] Assistant Professor, Department of Management Studies, National Institute of Technology Trichy, Tamil Nadu – 620 015, India

[2] Student, Department of Management Studies, National Institute of Technology Trichy, Tamil Nadu – 620 015, India

of price in given time period. It is mostly used in technical analysis of equity and currency price patterns.

Figure 1: Structure of white candlestick & black candlestick.



Candlesticks are depicted using a pair of colors, either black & white or green & red. Upward candlestick is usually given white or green color whereas the downward candlestick is given black or red color. Furthermore, a candlestick depicts four types of information through a single stick. Opening price of the period is shown by the thicker part of figure (i.e., candle body) in combination with the color of the candlestick. In an upward candlestick, the opening price is shown by the bottom of the wide part of candlestick. In the case of a downward candlestick, it's the top of the candle. In short, opening price is the first price traded in that particular time frame. Similarly, the closing price is indicated by the top part of candle in an upward candle and bottom part in a downward candle.

Another aspect of the candlestick is the 'wick' or stick of the candle. The high price is the highest price at which the trade occurred in the time frame. They are shown by the top and bottom of the wick of the candle respectively. The range of the candlestick is the length of the wick of the candle .Range of the candle represents the volatility of the price during the given time period.

Literature Review

Candlesticks were used in Japan more popularly than in the west and other parts of the world. By 80's it was popularized in the west by Steve Nison (Japanese Candlestick Charting

Techniques, 1991).They are a part of technical analysis tools used to analyse the market based on the price of securities and its fluctuations. Technical analysis is closely related to the momentum literature which Fama (1998) describes as being an open puzzle. Candlesticks provide the same information as expected from a western bar chart, but due to graphical way of representing it, it emphasizes on the change in closing and opening prices. "The power of the candles is that they are easy to construct but very revealing" Says Nison. Also, for each pattern, a confirmation signal has to be seen in the market .This usually appears in two to three days. For example, in the case of reversal patterns "Candlesticks really shine for getting reversals in just two or three sessions ", says Nison. Both Nison and Zarembski encourage traders to use candlestick in conjunction with other indicators, such as Bollinger bands, the RSI index and moving averages (McMahon, Chris, 2007).

Another aspect about candlestick trading is that, it is more suitable for long term trading. Significantly more investors rely on technical analysis for trading decisions with horizons of up to one week than for longer term decision making (e.g., Carter and Van Auken 1990). Short-term technical analysis can be of more assistance than long-term technical analysis to investors, such as fund managers, who have to rebalance their portfolios for other reasons (e.g., Corrado and Lee 1992). Recent works done by Osler (2003) and Kavajck and Odders-White (2004) has identified that the order placement strategies of investors lead to phenomena in prices that are consistent with the propositions of technical analysis. For high probability trades generating consistent profits, it's necessary to identify the overall market condition, identify the sector strength and then identify the best individual market or stock by scanning the strongest sectors for best trades (Bigalow, Stephen W, 2003).

Several researchers (e.g., Olson 2004) show the profitability of technical analysis has been eroded over time. Whereas Marshall et al. (2006) only consider the 1992–2002 period. Candlestick technical trading was found to be unprofitable on DJIA stocks in the 1990–2002 periods (Ben R. Marshall, Martin R. Young, Rochester Cahan, 2007).Also they found that they were not giving consistent results in all markets. So the performance depended on the market scenario, the trend of the particular equity or stock as well. Also, the results obtained from particular market are not supposed to be valid in other markets. This is important as Jorion and Goeztmann (1999) highlight that results documented using U.S. equity market data are not necessarily transferable to other markets.

Objectives & Methodology

The main objective of the study to find the actual effect of the Japanese candlestick patterns in the Indian market. Each candlestick pattern, which can last from a single day to a couple of days, has its own significance. This also largely depends on the market's historical behavior. By measuring the actual significance of the patterns on the equity market, it's possible to predict the future movements of the market with more accuracy. The effect of the patterns greatly varies with each market and the type of security as well. So the study was constrained to the main indices of the Indian stock market.

For studying the performance of candlestick patterns, their influence on the market or equity had to be tested against past data. For this, BANKNIFTY and S&P NIFTY data was collected from NSE. Since the patterns have unique influence on each index and each security, the future will largely depend on its past performance. Hence the statistics generated was limited the NIFTY index and BANKNIFTY index, which are among the most active indices in India. The patterns were studied on the past data using Back-testing, by using the available historical price sheets for past 15 years in the case of NIFTY and 7 years in the case of BANKNIFTY index. The occurrences of the patterns were then studied for the expected behavior and its success rate as well as the gain obtained from the indices .This data was mathematically analyzed to determine the actual behavior of the patterns in the market.

S&P NIFTY Index

S&P CNX Nifty is a well diversified 50 stock index accounting for 24 sectors of the economy. It is used for a variety of purposes such as benchmarking fund portfolios, index based derivatives and index funds. Nifty stocks represent about 63.94% of the Free Float Market Capitalization as on June 30, 2011 (NSE, 2011).

CNX Bank Index

CNX Bank Index is an index comprised of the most liquid and large capitalized Indian Banking stocks. It provides investors and market intermediaries with a benchmark that captures the capital market performance of Indian Banks. The index will have 12 stocks from the banking sector which trade on the National Stock Exchange, CNX Bank Index represent about 14.66% of the free float market capitalization of the stocks listed on NSE and 84.66% of the free float market capitalization of the stocks in the banking (NSE, 2011).

Selection of the Candlestick Patterns

Out of more than 100 candlestick patterns available, the more relevant ones are very limited in number for each (Japanese Candlestick Charting Techniques – Steve Nison , 1991) .By considering this fact, a set of 15 patterns were selected after analyzing the number of occurrences of each pattern in the market indices selected for the study.

Mainly the candlestick patterns can be categorized into the following categories :(Japanese Candlestick Charting Techniques – Steve Nison, 1991)

- Bullish reversal patterns
- Bullish continuation patterns
- Bearish reversal patterns
- Bearish continuation patterns
- Neutral reversal patterns

Out of that, a total of 15 patterns with significant number of appearances were selected from each group they:

- Bearish Doji Star
- Bearish Engulfing
- Bearish Harami
- Bullish Doji Star
- Bullish Engulfing
- Bullish Harami
- Dark Cloud Cover
- Evening Star
- Hammer
- Hanging Man
- Inverted Hammer
- Morning Star
- Shooting Star
- Three Black Crows
- Three Inside Down
- Evening Doji Star
- Morning Doji Star

Method of Testing

After selecting a pattern, the patterns' definition was turned into a programming signal (Easy Language) so as to find out the exact occurrences of the pattern in the historical prices of the given indices & then to find out how the pattern performed in that period . This process is called back testing. A key element of backtesting that differentiates it from other forms of historical testing is that backtesting calculates how a strategy would have performed if it had actually been applied in the past.

The patterns were analyzed for a period of 15 days, 30 days and 45 days on NIFTY index and BANKNIFTY index. Each of the candlestick patterns were tested for breakouts for the same set of periods and the success rates as well as the average fall or rise was measured during the analysis. For identifying the patterns, Tradestation which supports a scripting language called was Easy Language was used. By making use of it, the patterns were traced on to their occurrences which were then used for measuring price changes. For each pattern, the identification required the previous trend to be analyzed. For this purpose, SMA 10 (Simple Moving Average of 10 days) was used; since the trends were usually short termed .This gave the flexibility in the movement of the chart's trend along with the actual candle movement along with elimination of randomness in the movement of the graph.

For determining whether the candle actually followed its expected behavior, the closing prices of the previously determined prices were taken into account and averaged out.

Performance of the Patterns

Out of the patterns considered for analysis, 10 were expected to have bearish reversals and 7 were to have bullish reversals. However, due to the nature of the considered indices, the behavior of patterns was found to have changed & in some cases, they went onto display the exact opposite trend than their expected behavior.

Limitations of the Study

Since the market is very volatile even after discounting for every fundamental aspect related to the price and since the speculator factors are very high in the recent past, the candlestick occurrences were at times badly beaten by the market giving out weak results from them. Also, some of the patterns had very limited number of occurrences to study upon. Hence the accuracy of their success/failure cannot be made accurate .Also, the future of the predicted

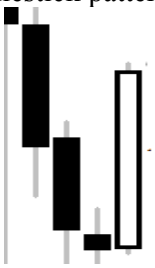
movement after a valid candlestick pattern is found can never be verified and only a calculated risk strategy can get profits from the market.

Candlestick charts provide many useful trading signals. They do not, however, provide price targets. There are other methods to forecast targets (such as prior support or resistance levels, retracements, swing objectives, and so on). Some Japanese candlestick practitioners place a trade based on a candlestick signal. And stay with that trade until another candlestick pattern tells them to offset. Candlestick patterns should always be viewed in the context as to what occurred before and in relation to other technical evidence.

Results and Discussions

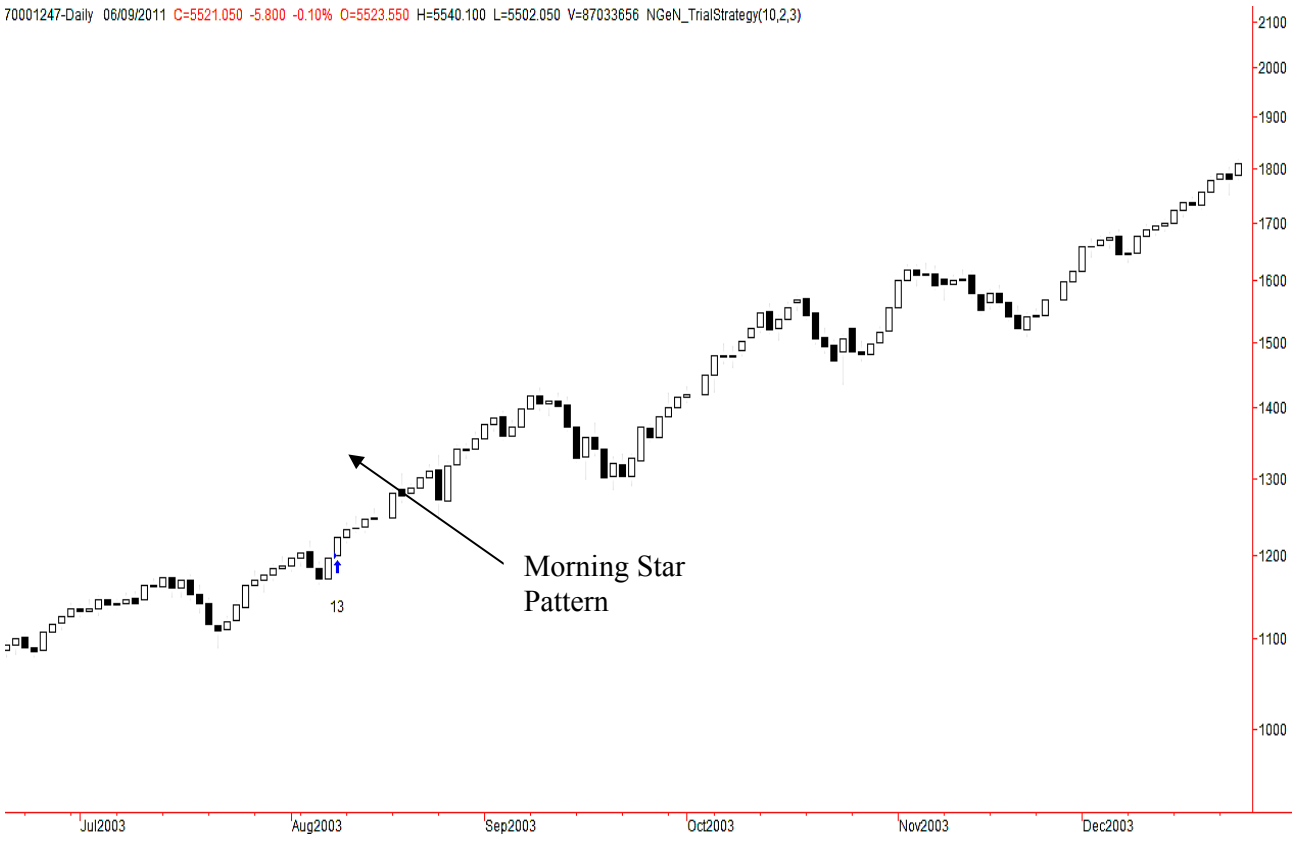
Morning star is a significant pattern in the NIFTY and BANKNIFTY movement. It has been observed that the success rate of this pattern is very high compared to the other patterns and that its movement is reliable up to a certain extent in comparison with other patterns

Figure 2: Morning Star Candlestick pattern (BANKNIFTY, June 2008)



This is a bottom reversal pattern which consists of three candlestick lines. The first day is a long black candlestick. Second day consists of a small white candlestick which gaps lower than the black candlestick. The third day consists of a white real body which moves into the first day's black real body. In an ideal morning star, the middle small white candlestick should gap from both the first and third day's candlestick.

Figure 3: Daily chart of NIFTY Jul – Dec 2003.



It's considered as a bullish reversal pattern in a general market. And in the case of NIFTY and BANKNIFTY, the success rate of it performing the reversal was comparatively higher and reliable.

Table 1: Performance of Candlesticks on NIFTY[1995-2011] & BANKNIFTY [2005-11]

NIFTY (15, 30 and 45 days)				**BANKNIFTY (15, 30 and 45 days)**			
Pattern	**Success Rate (%)**			**Pattern**	**Success Rate (%)**		
	15	**30**	**45**		**15**	**30**	**45**
Bearish Doji Star	54	42	71	Bearish Doji Star	50	50	
Bearish Engulfing	34	34	68	Bearish Engulfing	31	39	39
Bearish Harami	42	28	60	Bearish Harami	44	28	17
Bullish Doji Star	57	86	60	Bullish Engulfing	54	46	46
Bullish Engulfing	70	66	56	Bullish Harami	69	69	69
Bullish Harami	47	56	53	Dark Cloud Cover	40	70	60
Dark Cloud Cover	64	55	50	Evening Star	40	43	47

Evening Star	58	63	48	Hammer	53	60	57
Hammer	53	56	47	Hanging Man	50	33	33
Hanging Man	47	45	45	Inverted Hammer	80	73	73
Inverted Hammer	70	72	44	Morning Star	80	60	40
Morning Star	75	55	42	Shooting Star	38	36	32
Shooting Star	43	43	41	Three Inside Down	50	20	20
Three Black Crows	83	50	34				
Three Inside Down	29	24	33				

Table1 shows the results obtained by using the Trade station software to get the successful occurrences of the patterns and their success rates over the given period. From the results obtained by backtesting in NIFTY, it can be observed that Three Black Crows has the maximum success rate over the period of 15 days, However, This is due to the fact that there were very few occurrences of the particular pattern in the NIFTY history and hence the rate can be misleading. However, Morning Star pattern is having a healthy pattern as it has a stronger occurrence rate as well as success rate of 60+ in 15 days and 45 days period. In the case of BANKNIFTY , the Hammer pattern has a strong chance of repeating its success rate , this can be observed from the fact that it has a higher frequency rate of occurrence and thus, along with the high success rate , hints at the more probability of its success in the future occurrence.

Frequency Rankings

Each pattern may appear a different number of times in the given equity/market depending on Various market conditions and the scenarios related to that equity/market. Hence it's important that the patterns which occur most frequently is to be studied since the analysis will be closer to actual movements in price and the future movement can be predicted accurately.

Table2: The frequency of appearance of NIFTY patterns

Pattern	**BANKNIFTY**	**NIFTY**
Shooting Star	47	162
Bearish Engulfing	36	105
Hammer	30	90
Hanging Man	5	62
Inverted Hammer	15	60
Bullish Engulfing	14	50
Bearish Harami	18	36
Bullish Harami	16	32
Bearish Doji Star	8	24
Morning Star	5	20

Evening Star	30	19
Three Inside Down	10	17
Dark Cloud Cover	10	11
Bullish Doji Star	1	7
Three Black Crows	2	6

The successful occurrence can be tested with patterns having only a minimum number of occurrences. In NIFTY, Dark Cloud Cover, Three inside down and so on didn't have enough occurrences to statistically prove the efficiency of their success. Also, certain patterns which appeared in NIFTY didn't appear in the BANKNIFTY at all, Even though they are related through some securities.

Conclusion

The success of candlestick heavily depends on the prior trend and the existing market conditions as such. However, the success rate can indicate the probability up to which the candle can be expected to be successful in displaying its actual behavior. Also, certain markets can have their own ways of reacting to certain candles. This can be seen from the fact that an entirely different set of candle patterns are successful in NIFTY than BANKNIFTY.

The most profitable candlestick patterns in the NIFTY are Bullish Engulfing , Bearish Engulfing and Inverted Hammer .Among these , Bullish Engulfing is specifically successful in returning the market to the bearish trend after its occurrence with >70% possibility .This is achieved along with a return of over 10% from the successes in an average . Bearish Engulfing on the other hand has a peculiar behavior of behaving in the neutral manner , after the occurrence of this pattern Market tended to move flat by breaking the downwards trend but with no noticeable gain .This is to carefully analyzed with the market situations so as to enter short positions carefully. In the case of inverted hammer, the market trend irrevocably rose by around 10% in an average after a successfully occurrence of the pattern. However, confirmation signals had to be seen before entering a position after seeing this pattern in the market.

In the case of BANKNIFTY, Hammer pattern is the most prominent successful pattern with more than 70% probability of the market to move upwards after significant down trends. This chance can be improved after confirming this signal by waiting for two or three days. However it can be seen that Shooting Star pattern has an opposite behavior of letting the market move upwards instead of the predicted downward movement. Also, Hanging Man,

Bearish & Bullish Engulfing has very less significance in moving the market at their occurrence.

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