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Effectiveness of Japanese Candlestick Chart Patterns in Borsa Istanbul 30 Index

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Japon Mum Çubukları Grafiklerinin Borsa İstanbul 30 Endeksinde Geçerliliği

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ABSTRACT

The objective of this study is to evaluate the estimation competence of the ancient form technical analysis, the candle charting, to find out if there is evidence against market inefficiency. Although many analysts and academicians argue that the estimation power of candlesticks is inconsistent with the market efficiency, many market participants still implement this art of technical analysis as a tool for estimating the price trends and supporting their trading decisions.

The candlestick charting assumes that single forms to multiple combinations of candlesticks may give an estimation about the current mood/psychology of the market and several hints about its future price behavior. The candlestick analyses practitioners even claim these forms of market data in fact only containing open, close, high and low prices can originate profitable trading strategies.

Efficient Market Hypothesis argues with any technical analysis methodology including Japanese Candlesticks can help investors to beat the market. In this study the prediction power (or lack of it) of candlesticks will be tested on Borsa Istanbul 30 Index and on its component, equities is tested.

Key Words: Japanese Candlesticks, Technical Analysis, Market Efficiency Hypothesis, Market Trend Prediction, Borsa Istanbul Equity Market

ÖZET

Bu tez çalışmasının amacı, Teknik analiz formlarının en eskisi olan Japon mum çubuklarının tahmin yetkinliğinin ölçümlenmesi ve bunun Etkin Piyasalar Hipotezine aykırı olduğuna dair bir kanıt olup olmadığınının bulunmasıdır. Bir çok analist ve akademisyen Japon mum çubuklarının piyasa verimliliği hipotezine aykırı olduğunu kabul etse de, bir o kadar piyasa katılımcısı bu tekniği fiyat eğilimllerinin tahmini ve alım satım kararlarının desteği olarak kullanıyor. Japon mum çubukları analiz tekniğin savı , tekil yahut birbirden çoğunun biraraya gelmesi ile oluşan kombinasyonları ile piyasaların anlık mod ve psikolijisi hakkında bir fikir vermek ve gelecekteki fiyat eğilimleri ile ilgili ipuçları sunmaktır. Bu tekniğin uygulayıcıları , sadece piyasanın açılış,kapanış,en yüksek ve en düşük fiyat bilgilerini içeren bu çubukların oluşturduğu formların karlı alım satım stratejileri üretebildiğini iddia ederler.

Etkin Piyasalar Hipotezini hiçbir Teknik analiz yönteminin,Teknik analiz bazlı işlem yapan yatırımcıların piyasadan daha iyi getiri sağlayamacağını söyler. Bu çalışmada Japon mum çubuklarını analizi Borsa İstanbul 30 Endeksi ve onu oluşturan 30 hisse senedi üzerinde denenmiştir.

Anahtar Kelimeler: Japon Mum Çubukları, Teknik Analiz, Etkin Piyasalar Hipotezi, Piyasa Eğilimi Tahmini, Borsa İstanbul Pay Piyasası

1 INTRODUCTION

The objective of this study is to evaluate the economic significance of the ancient form technical analysis, the candle charting, to find out if there is evidence against market inefficiency. Although many analysts and academicians argue that the estimation power of candlesticks is inconsistent with the market efficiency, many market participants still implement this art of technical analysis as a tool for estimating the price trends and supporting their trading decisions. The creator of Japanese candlestick charting is created by a legendary commodity trader Munelusa Homma. Homma, as a rice trader in Osaka Exchange, achieved a big fortune with his candlestick trading algorithm.

The candlestick analysis was lately discovered in western trading world in early 1990' with several books. Steve Nison's ''Japanese Candlestick Charting Techniques: A Contemporary Guide to the Ancient Investment Techniques of the Far East'' (Nison, 1991). With following books published, this technique became one of the prevalent analysis and one of the major financial data providers Reuters launched in its technical analysis platforms candlestick analysis. The western trading world widely credited candlestick analysis and the candlestick charts became available in almost every technical analysis software or online platforms. (Nison, 2004, p. 22). Nison underlines that the candlestick analysis is originally created for commodity market's short-term price movement analysis and it should be implemented for a time horizon for around ten days. (Nison, 1991).

The candlestick charting assumes that single forms to multiple combinations of candlesticks may give an estimation about the current mood/psychology of the market and several hints about its future price behavior. The candlestick analyses practitioners even claim these forms of market data in fact only containing open, close, high and low prices can originate profitable trading strategies.

Like any form of technical analysis, the candlestick pattern techniques strongly conflict with market efficiency, which is the major backbone of academic finance. Malkiel (1981) defines this conflict as ‘‘anathema to the academic world’’.

The studies of Alexander (1964) and Fama and Blume (1966) are pioneers academic works about technical analysis. Their findings align with market efficiency and show that the profitability of technical analysis-based trading is undermined with trading costs.

The asset prices in an efficient market reflect all publicly available information. In an efficient market. To analyze the past prices for beating the market is a useless exercise (Jensen, 1978). Any information contained in past prices is therefore reflected in current prices, making the study of past prices a futile exercise.

Despite the worldwide disapproval of academic world, investors and investment advisors still rely on technical analysis, which is consistent with market efficiency. Billingsley and Chance (1996) state that computerized trading guidance is used by 60% of investment advisors in commodity trading area for their investment tips to clients.

The main motivation of this study is to provide more clearance and to serve to complete the gap in academic studies in testing the prediction power of candlesticks in the specific field of Turkish Equity Markets

In this study the prediction power (or lack of it) of more than eighty candlesticks will be tested on Borsa Istanbul, ISE 30 Index and on its component equities. The Q4 2020 components of ISE 30 Index were used. Since the index is a floating market capitalization based dynamic index the processed data goes back to January 1994 for old components like Ereğli Demir Çelik A.S. (EREGL) or Türkiye Garanti Bankası A.Ş. (GARAN). The relatively new members of ISE 30 like Pegasus Hava Taşımacılık A.Ş. data starts from 2013. The observed daily data exceeds 165,000 cases, containing open, high, low and close levels.

The candlesticks are analyzed under categories, basic, bullish and bearish ones, containing a single form to more complex combinations of them. The observation

frequency of forms, the price behavior after observation and back tests are presented in the final part of the study.

2 MARKET EFFICIENCY HYPOTHESIS

The major function of the capital markets is the allocation of the financial sources to the investable assets. The asset prices are the main indicators for the decision to invest, to hold or sell. In the optimum market, prices shall perfectly represent the value of the assets for allocating the financial sources.

The research and fundamentals of Efficient Market Hypothesis (EMH) can be dated back to the 16th century. The Italian mathematician, Girolama Cardano wrote in his book "Games of Chance Book" (Cardano, c. 1564): "Gambling's fundamental principle is all players operate in equal conditions. Regardless of the players, observers, money, situation and the dice." If one moves away from the equality, the irrational it gets.

Jules Regnault, a broker from France observed in 1863 that an investor's exposure to price variations derived from a security is relevant to the time interval of holding the asset. He observed that there is a direct proportional relationship of price deviation with the square root of time (Regnault, 1863). In 1880, Lord Rayleigh a physicist of United Kingdom whilst working on sound vibrations unveiled the notion of random walk (Rayleigh, 1880). George Gibson in 1889 published his book "Stock Markets of London, Paris and New York" (Gibson, 1889). Gibson explained the efficiency of the markets as the the reasoning of the best intelligence value the assets, while the public information is spreading in the open market. Eleven years later the French mathematician Louis Bachelier wrote his PhD thesis "Theory of the Speculation" (Bachelier, 1900). Bachelier stated that the speculator's mathematical expectation should be zero. Samuelson (1965) later expanded that with martingale concept. The famous economist John Maynard Keynes indicated as a consequence of Efficient Markets Hypothesis the investors do not differentiate on financial markets because of their ability to estimate the future behavior of the market, the differential comes from the levels of the risk they take. (Keynes, 1923). Keynes published his study General Theory of Employment, Interest, and Money (Keynes, 1936), after the biggest market crash in Wall Street

in history (October 1929). In his study, he defined the stock market in a sarcastic way as beauty contest. He claimed that the decisions of inverstors were derived by animalistic spirits. In the following years Cowles find out that professional investors are not beating the market (Cowles, 1944). Working claimed the impossibility of correct predictions for professional investors and analysts in futures markets (Working, 1949). Later in 1958, Working presented an anticipatory model for the markets. Working (1958). Two years later Larson published his new methodology for analyzing time series Larson (1960). He stated that the stock price change's distribution is converging to normal distribution located in the center for 80% of data however, extreme values exist. Alexander (1961) conducted the first test for nonlinear dependence. He found out that random walk model is the best fitting one. He observed leptokurtosis by the distribution of the returns.

Fama has been the pioneer to define an efficient market. With his epochal empirical analysis for stock prices the concluded the prices are following a random walk Fama (1965). His findings challenged the rooted views of both technical and fundamental analysts.

Efficient Market Hypothesis (EMH) asserts that equity prices have a rationale and logically determined, all available market data is reflected (Fama [1991, p. 1575]) and search for equilibrium. According to this hypothesis, financial market participants reassess markets rationally when new information emerges. There is no space for uncertainty for current valuations. However, the American Economist Alan Greenspan served as the Chair of Federal Reserve of United states between 1987 and 2006 said in 2003, "Uncertainty is not just an important feature of the monetary policy landscape; it is the defining characteristic of that landscape."

The efficiency of capital markets is measured by the level of the projection of the all-available information in to the asset prices. According to Fama, the efficiency level of the markets can be analyzed in three types. Strong, semi-strong and weak forms. The week form denotes the less efficient market, at which only past prices are public. By the market with a semi strong form, announcements like annual earnings, stock splits and similar major events are reflected in the prices and they

are public. The strongest form of the market, the third model do not allow certain group of investors or market makers to access any specific data in a monopolistic way. This type of market ensures all participants a frictionless environment, permitting all of them to reach all kind of relevant data freely and simultaneously. In a random walk interpretation, the next change in the price is very independent of all past price movements.

2.1 Trends or Random Walks (Alexander 1961)

Professional investors mainly believe that there are certain solid facts forming trends for asset prices. These solid facts are at some degree knowable today. The investors who can correctly read them today will be able to make profits with this data set. The main notion about these facts and data is that they generate price trends for mid to long term. The dynamics behind is step by step and systematically spread of the facts and data to the investor society and markets.

Professional investors or better called the analyst are divided into two main schools. On one side the fundamentalist and on the other one the technicians. These two groups use different tools for gaining the related data and knowledge for successful investments before others gather them.

The investors focusing to fundamental techniques seek this early knowledge via researching the external factors lying under the dynamics of price changes. A fundamental analyst studying the commodity markets models the supply demand balance of near future. When it comes to equity markets, he or she analyses the general business environment, social and business dynamics, growth, profitability trends of several industries. With this data set, the successful firms in favorable conditions can be picked up.

Technical analysts rely on the assumption that, the facts and data available today will penetrate to the prices at some moment or period in the future. Technician leaves the fundamental analyst's studies aside and detects the signals of penetration of others knowledge to the prices. The short-term price changes studied by technician as indicators for showing possible future price movements.

Both type of analysts reckon the existence of price trends formed by the fractional understanding of the valuable information by markets. Do these trends really exist or can the best investment decisions be taken just by tossing one or multiple coins? If there are no trends existing, the best way to interpret is to name them as a random walk.

Alexander summarizes his study with the statement that, over time those prices in speculative market follow a random walk. However, if a price moves once commence incline to sustain. If equity prices increase x%, it is likely to increase another x% before the prices come down by x%. His proposition is for x to vary between 30% and 5%. His study is not covering price changes below 5%.

2.2 Behavioral Models of Under-Reaction and Over-Reaction

DeBondt and Thaler (1985) studied the overreaction of the investors. They state that the average investor overestimates the importance and role of the past performance of listed companies in the exchange. They attribute investors for paying too much importance to historical yields and state that investors are forgetting the performance of stocks are mean reverting. Such a long-term performance anomaly they found is, when they line up the stocks according to their three to five-year historical yields. Past winning firms are the potential future losers, and the opposite is valid for past losers.

Lakonishok et al. (1994) argue that and show in their study, historically weak performing equities have a higher potential return for future. Similarly, the stellar past performers have low potential for future. Fundamental analysis categorizes relatively lower valued equities with their low prices compared to their earnings, dividends, asset valuation etc. As per market consensus, the so-called value stocks are expected to bring more returns. Their article demonstrates the value stocks bring higher returns not because they are riskier, the rationale behind is these strategies take advantage of the suboptimal behavior of average investors. (Alexander, 1961)

3 TECHNICAL ANALYSIS

Investor and fund managers dedicate valuable time and resources to technical analysis and invest money to the trading signals derived from such analysis. These practitioners consider technical analysis as a viable way of interpreting mass-market behavior, explore support and resistance levels for opening new positions or liquidate existing ones.

To understand and quantify the price trends is an essential objective of technical analysis. Trend is defined by Chen,James (2010) as the general price direction of an asset. To detect any changes in the momentum and directional behavior of the trend is essential for traders for buying and selling decisions. However, price is the main important component; volume is seen as an essential confirmation of price confirmation. The price movement in the trend direction shall come along with high volume. The price movements opposite to the trend should have substantial lower volume. To be able a price movement as a trend the volume confirmation in this manner is vital. Relatively high volume in trend direction may indicate the trend is strong and existing.

3.1 Performance Test of Technical Analysis

Brock et al. (1992) measured the performance of technical analysis with a bootstrap methodology on Dow Jones Industrial Index. The finding was range of trading breaks and moving averages of the index points were generating abnormal returns in comparison to four benchmarking models. Bessembinder and Chan (1995) found out that in equity markets of Asia their technical indicators created abnormal results. The deviation of returns versus the benchmarking model for developing Asian equity markets were far higher than the developed ones. They pointed out that the trading fees, commissions, imperfect trading timing deteriorates the outperformance of their technical indicators, and they underlined that the Efficient Market Hypothesis (EMH) cannot be rejected.

The bootstrap methodology created by White (White 2000) decreases the negative impact of biases resulted by data snooping. Sullivan et al. (1999) implementing the methodology of White outperformed their benchmarks with their trading algorithm based on technical analysis rules. Hansen's Test (Hansen 2005) focusing in ability of prediction of technical indicators was implemented by Neuhierl and Schlusche (2012). Neuhierl and Schlusche's trading methodology is a combination of fundamental research and technical analysis. Hansen's Test showed outperformance of fundamental and technical analysis combination. The US equity market focused Shynkevich (2012) study created no profitable results technical analysis based trading.

3.2 Standard Bar Charts

Bar charts consist of single bars showing the price behavior for a specified period. These time periods can be as short as a tick representing a short as a second or as long as a month or a quarter of a year. The general practice is to stick a trading day period. A daily open high low close (OHLC) bar consists of a vertical line representing the high and low range of the trading day pricing and two small tick marks extending one left and second right sides of the bar. The one extending to left refers to the opening price of the trading day. The right tick mark stans for the daily closing price. Many bar chats are accompanied with a volume histogram residing at the bottom.

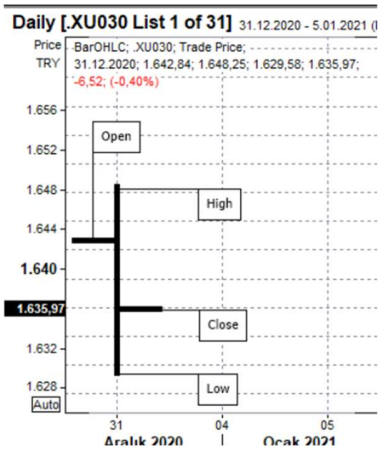

Figure 1: BIST 30 Index Decemver 31st 2020, Daily OHCL Bar,Source:Thomson Reuters Eikon

3.3 Japanese Candlesticks

Japanese candlesticks and candle pattern analysis are a dimension of technical analysis. This technic is nothing else than a visual demonstration of actual market data. The candle sticks practitioners claim that it gives a quick insight into the psychology of the market, which may have an effect in pricing during the coming trading periods.

Every candlestick displays these four elements:

- OP=opening price
- HP=highest price;
- LP=lowest price;
- CP=closing price

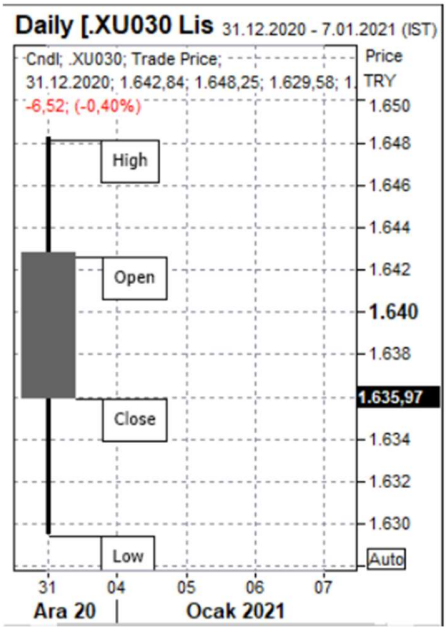

Figure 2: BIST 30 Index December 31st 2020, Daily Candlestick. Source: Thomson Reuters Eikon

Body of the Candle is the difference between Open and Low prices the height of the body is the absolute value of the difference between Open and Close Prices. Formula: ABS. (OP - CP)

Long Body, absolute value of (OP-CP) is 3/2 times more than the body height average of last 15 observation's, formula: ABS. (OP - CP) > 3 * AV. (ABS. (OP - CP), 15) / 2.

Short Body, absolute value of (OP-CP) is less than half of the body height average of last 15 observations', formula: ABS. (OP - CP) < AV. (ABS.(OP - CP), 15) / 2.

Upper Tail is the difference between High price and Open or Close Prices (whichever is higher). Formula: H-max (OP, CP)

Lower Tail is the difference between Low price and Open or Close Prices (whichever is lower) formula: min (OP, CP)-LP

Black Candle, Close is lower than the Open price. Formula: CP < OP

White Candle, Close is higher than Open price. Formula: CP > OP

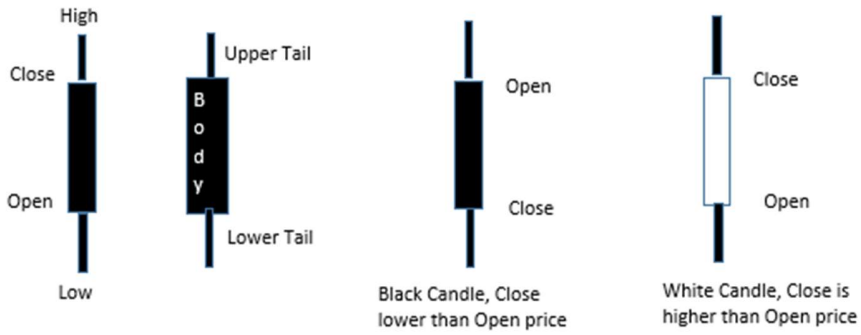

Figure 3: General Anatomy of Candlestick; Body, Tail and Color

If a Candlestick pattern contains more than one candle, then the numbers following the (OP, HP, LP, CP) show their ranking in the formation. E.g., CP is the last candle, C P n is the first, C P n-1 is the second in the formation. A four candle formations respective Closing prices from first candle to last are: CP3, CP2, CP1, CP.

AV. (ABS. (OP - CP), N): the average body height of the last n observation. E.g. AV. (ABS. (OP - CP), 15) is the average body height of Candles Last Candle to Candle 14 HP=MAX.HPn the candle' body height shall be the max of last n observation e.g. HP=MAX.HP10 the candle' height must be the max of last 10 observations Candle CP and Candle CP9

HP=MAX.HPn the candle' body height shall be the max of last n observation e.g. HP=MAX.HP10 the candle' height must be the max of last 10 observations Candle CP and Candle CP9

3.3.1 Basic Candle Stick Formations

The single candle lines are essential building blocks for analysis. They can be used solely by their selves and in combination with others. In this study, 18 of these formations were defined as Basic Candlesticks Formations and they consist of single lines. Marubozu (Black, Closing, Opening), Doji (Perfect, Dragonfly) are displayed in detail in the below section. The formulas of all other single candle lines can be found in the appendix as Basic Candlestick Formulas.

3.3.1.1 Marubozu

Marubozu has no tails extending from both bottom and top. Marubozu can be either black or white.

3.3.1.1.1 Black Marubozu

Definition:

Black Marubozu reflects extreme bearishness, major sell-off with loss of price sensitivity. It is characterized by a long black body having no tails on both ends.

Figure 4: Black Marubozu

Recognition criteria:

- Long black body, the body height shall be %50 taller than the average body height of the last 15 observations
- No upper and lower tails
- Formula: HP - LP = OP - CP AND OP - CP > 3 * AV. (ABS. (OP - CP), 15) / 2

Expected future price movement(s), conjectural state of market:

It is generally interpreted as bearish. Sellers dominated most of the trading session If it is a component of a bullish trend may show a downward reversal suggesting that upward trends reached a resistance. As a component of a downward trend. It may be a sign for panic sales or capitulation. In some cases, it can show a final sell off attempt trend before bulls capture market control.

3.3.1.1.2 White Marubozu

Definition:

White Marubozu stand for extreme bullishness. It Is characterized by a long white body having no tails on both ends.

Figure 5: White Marubozu

Recognition criteria:

- Long white body, the body height shall be %50 taller than the average body height of the last 15 observations
- No upper and lower tails
- Formula: HP - LP = CP - OP AND CP - OP > 3 * AV. (ABS. (OP - CP), 15) / 2

Expected future price movement(s), conjectural state of market:

It is generally interpreted as bullish that buyers dominated most of the trading session. As a component of downward price trend, may be interpreted as the prices touched support level and give notice of a fresh bullish trend. If observed during a bullish trend can be a sign of excessive bullishness and prices are at dangerous highs.

3.3.1.1.3 Closing Marubozu

Definition:

Closing Marubozu has no tail extending from the end of its body showing the closing level. The upper tail lacks at the white body closing Marubozu. The lower tail does not exist at black closing Maubozu.

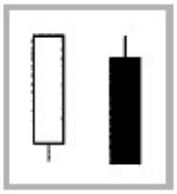

Figure 6: Closing Marubozu, in black and white colors

Recognition criteria:

- Long body, either black or white. The body height shall be %50 taller than the average body height of the last 15 observations
- White body doesn't have upper tail, HP > OP AND CP = LP
- Black body doesn't have lower tail, : HP = CP AND OP > LP
- Black Body formula: HP > OP AND CP = LP AND OP - CP > 3 * AV. (ABS. (OP - CP), 15) / 2
- White Body formula: HP = CP AND OP > LP AND CP - OP > 3 * AV. (ABS. (OP - CP), 15) / 2

Expected future price movement(s), conjectural state of market:

White Closing Marubozu refers to buyers-controlled day, except during a specific period of the trading where intraday pricing goes below the opening level. However, prices eventually rise and and trading closes at a daily peak.

Smilar like white Marubozu, it is generally interpreted as bullish that buyers dominated most of the trading session. Creates more potential risks for excessive bullishness and assessed with danger for prices to be at fragile high levels

A Black Closing Marubozu indicates that sellers controlled the trading day except a specific bullish period, but bears regain control and closing price settles at daily low. Similar like black Marubozu it is generally bearish with slightly less aggressive.

3.3.1.1.4 Opening Marubozu

Definition:

Opening Marubozu has no tail extending from the open price of its body showing. The lower tail lacks at the white body opening Marubozu. The upper tail does not exist at black opening Marubozu.

Figure 7: Opening Marubozu, in black

Recognition criteria:

- Long, black body, body height shall be %50 taller than the average body height of the last 15 observations
- Black body doesn't have upper tail HP = OP AND CP > LP
- Black Body formula: HP = OP AND CP > LP AND OP - CP > 3 * AV. (ABS. (OP - CP), 15) / 2

Expected future price movement(s), conjectural state of market:

A White Opening Marubozu is similar to white Marubozu with a solely difference that during the closing of the session the bullish market loses steam and closing settles slightly lower than the day high.

3.3.1.2 Doji (Perfect)

Definition:

The day opening price and the closure prices shall be equal. The body has a small body with overlapping open and close prices. The length of the upper and lower shadows may vary.

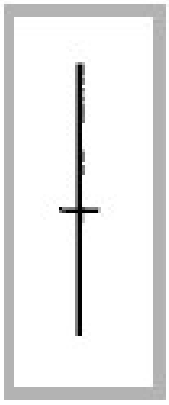

Figure 8: Doji

Recognition criteria:

- Body length is zero or miniscule with overlapping open and close prices
- If Open and close prices do not overlap, it can has both colors.
- Can have both upper and lower tails with any length or just one of them
- 20 * ABS. (OP - CP) <= HP – LP or OP = CP

Expected future price movement(s), conjectural state of market:

Doji is considered to be an important agent giving messages that the market be on cliff edge and major volatility and trend change may come.

3.3.1.2.1 The Dragonfly Doji

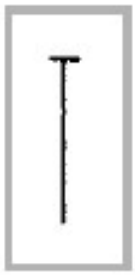

Figure 9: The Dragonfly Doji

Recognition criteria:

- No body

- No upper tail and long lower one
- Formula: ABS.(OP-CP) <=0.02*(HP-LP) AND (HP-CP) <=0.3*(HP-LP) AND (HP-LP)>=(AV.HP10-AV.LP10) AND (HP>LP) AND (LP=MINLP10)

3.3.2 Multiple Candlestick Formations

68 of 86 candlestick patters consist of multiple candles. 32 of them were by definition bullish and the remaining 36 were bearish (Morris, G., Litchtfield, R.; 2006.). A multiple pattern can be having both bullish and bearish versions with different formulas. In the following part the multiple candlestick pattern Breakaway is shown with its two different versions. All detailed formulas of the multiple candlestick patterns are displayed in the appendix section.

3.3.2.1 Breakaway (Bullish) Multiple Candlestick Formation

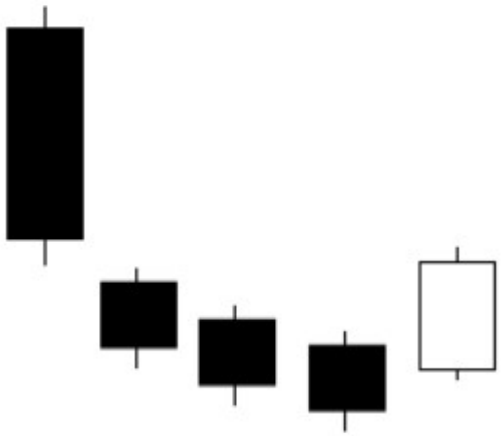

Figure 10: Breakaway (Bullish)

Recognition criteria:

- A long white body candle followed by 4 black candles.
- The first long black candle (candle #4) has a bigger low price than the second candle's (candle #3) high price, third candle's (candle #2) close price should be

smaller than the second candle's close price, the fourth candle's (candle #1) close price should be smaller than the prior candle's close price. The last candle should be a long white candle with a close price bigger than the second candle's (candle # 3) high price

- Formula: CP4 < OP4 AND ABS. (CP4 - OP4) > 0,5 * (HP4 - LP4) AND CP3 < OP3 AND HP3 < LP4 AND CP2 < CP3 AND CP1 < CP2 AND ABS. (CP - OP) > 0,6 * (HP - LP) AND CP > OP AND CP > HP3

3.3.2.2 Breakaway (Bearish) Multiple Candlestick Formation

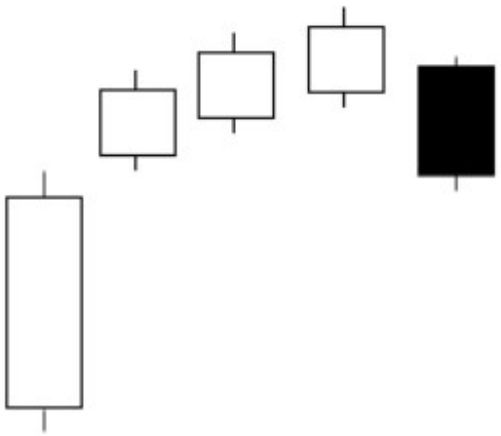

Figure 11: Breakaway (Bearish)

- A long black body candle followed by 4 white candles.
- The first long white candle (candle #4) has a smaller high price than the second candle's (candle #3) low price, third candle's (candle #2) close price should be bigger than the second candle's close price, the fourth candle's (candle #1) close price should be bigger than the prior candle's close price. The last candle should be a long black candle with a close price smaller than the first candle's (candle # 4) high price and high price of last candle shall be bigger than the second candle's (candle #3) low price

- Formula: ABS. (CP4 - OP4) > 0,5 * (HP4 - LP4) AND CP4 > OP4 AND CP3 > OP3 AND LP3 > HP4 AND CP2 > CP3 AND CP1 > CP2 AND CP < OP AND LP < HP4 AND HP > LP3

4 METHODOLOGY

169,228 Daily price data set, consisting of Open, High, Close and Low data for Borsa Istanbul 30 Index and its latest 30 components were scanned to find the 86 formations of Candlesticks.

18 of these formations were defined as Basic Candlesticks Formations; the remainder 68 were defined as either bullish or bearish. (Morris, G., Litchtfield, R.; 2006.) The labeling of the candlestick formations was based on historic views on them rather than scientifically measured past performance. This study took the traditional bullish/bearish labelling of the candlestick formations as a preliminary input and they were all tested rich data pool of Borsa Istanbul 30 index and its components.

The price of the observation day of the Candlestick Pattern is the comparison of the observation day's closing price versus the average of the following 3 days closing prices average. If at a day d a single candlestick or multiple candlestick pattern is observed, the daily closing price of the closing session is taken as the formations closing price into consideration. The assumption behind is the closing session of Borsa Istanbul is traded with a single settlement price and the investor can buy or sell the related asset with this price under the light of an observed Candlestick pattern. For closing the position, the investor is assumed to spread the action into three days and each day 1/3 of the position was closed. All transaction cost, financial costs and fees are ignored.

The test on following 3 days price performance for Candlesticks gives us the:

- Number of the signal observed
- Number of the cases with price increase (Closing Price of Day n is smaller than the average of the Closing Prices of Days n+1, n+2 and n+3)
- Number of the cases with price decrease (Closing Price of Day n is bigger than the average of the Closing Prices of Days n+1, n+2 and n+3)
- The ratio of price increase cases

- The ratio of price decrease cases

The price change averages for all observations refer to bullish cases and they are all equal figures. The back test of the Candles was performed according to the assumptions that the investor opens a long position (buys the asset) with the observation day's closing price. The back test is a long only one, irrelevant from the bullish or bearish signal creation performance of the candlestick formation the investor buys three shares of the asset (three lots) during the observation day's closing session settlement price. After opening the long position, the investor sells the asset in equal 3 portions during the 3 days following the candlesticks observation day. (One share per day) The back test is implemented only to the 30 members of the BIST 30 index. The BIST 30 index itself was excluded from the return calculations because of its incomparable high nominal value compared to equity prices. The exclusion of BIST 30 index should be kept in mind in interpreting the results. By rarely observed candlestick formations like Breakaway (Bullish) the formation was observed 3 times and 2 of them was followed by price increase. Since the remaining one bearish observation was in the BIST 30 index, the monetary result was excluded in the back test.

The back test gives us the following information set:

- Total price change is the average of the accumulated result of 30 Index member equities trades. For every single equity with the n observation of the candlestick for this equity, n long positions are opened and closed with the above-mentioned rules. The average of the accumulated results for a specific candlestick pattern is displayed.
- Max price change is the average of max observed price change of 30 index member equities. In other words, the average of max returns observed for a single trade for each equity.

- Min price change is the average of per equity observed single trade max losses. It is the average of worst one-time losses of 30 equities for the whole trades done after every observation of the specific candlestick pattern.
- Cumsum Min is the lowest level of cumulated return of the trades done for the mentioned candlestick pattern. In other words, the lowest level of the portfolio continuously invested after every observation of the mentioned candlestick pattern.
- Cumsum Max is the highest level of cumulated return of the trades done for the mentioned candlestick pattern. In other words, the highest level of the portfolio continuously invested after every observation of the mentioned candlestick pattern.

5 RESULTS

5.1 Basic Candlestick Results

Under 169,227 observations, for BIST 30 index itself and its thirty components, 407,085 basic candlestick formations were defined. The number of formations is 2.4 times higher than the number of the data since overlapping definitions of them. For example, almost all candlesticks (except some Doji's with no body) are either white or black. A long black candle is counted for a min of three times as itself, as a long candlestick and as a black candlestick.

On average, these 18 basic candlesticks created 22,616 signals and on average 51% of them showed price increase and 49% price decrease. The average result for long only trades, explained in the Methodology, back-test section created a 4,91 TL positive result, the average of maximum price changes of 1,55TL, a min of -1,49TL and a total cumulated minimum portfolio value change of -2,27TL and a max of 8,42TL

Table 1 Basic Candlesticks, Created Signs and Price Direction

Basic Candlestick Patterns	Number of Signal	Number of Price Increase	Number of Price Increase	% Price Increase	% Price Decrease
Black Candle	79208	40597	38611	51.3%	48.7%
Black Closing Marubozu Candle	3694	2024	1670	54.8%	45.2%
Black Marubozu Candle	11611	5899	5712	50.8%	49.2%
Black Opening Marubozu Candle	5318	2566	2752	48.3%	51.7%
Closing Marubozu Candle	8584	4430	4154	51.6%	48.4%

Doji Candle	20159	10263	9896	50.9%	49.1%
Long Candle	39167	19985	19182	51.0%	49.0%
Long Black Candle	19528	9909	9619	50.7%	49.3%
Long White Candle	19639	10076	9563	51.3%	48.7%
Marubozu Candle	5892	3069	2823	52.1%	47.9%
Opening Marubozu Candle	10090	5147	4943	51.0%	49.0%
Short Candle	52747	26918	25829	51.0%	49.0%
Short Black Candle	17764	9060	8704	51.0%	49.0%
Short White Candle	15571	7962	7609	51.1%	48.9%
True Doji Candle	19466	9923	9543	51.0%	49.0%
White Candle	70460	35833	34627	50.9%	49.1%
White Closing Marubozu Candle	4890	2406	2484	49.2%	50.8%
White Marubozu Candle	3297	1625	1672	49.3%	50.7%
Average	22616	11538	11077	51.0%	49.0%

Table 2 Basic Candlesticks Back Test

Basic Candlestick Patterns	Total Price Change	Max Price Change	Min Price Change	Cumsum Min	Cumsum Max
Black Candle	16.16	2.35	-2.23	-4.08	26.26
Black Closing Marubozu Candle	0.75	0.90	-1.05	-1.45	2.91
Black Marubozu Candle	0.80	1.56	-1.62	-3.23	5.83

Black Opening Marubozu Candle	-0.57	0.93	-1.00	-2.62	1.60
Closing Marubozu Candle	0.63	1.36	-1.28	-2.69	3.78
Doji Candle	3.60	1.32	-1.18	-0.96	5.68
Long Candle	4.92	2.22	-2.07	-3.70	12.07
Long Black Candle	0.07	1.60	-1.66	-4.72	6.42
Long White Candle	4.85	2.16	-1.97	-1.85	8.89
Marubozu Candle	-0.05	1.03	-1.32	-1.64	1.69
Opening Marubozu Candle	1.37	1.14	-1.42	-2.83	4.32
Short Candle	18.16	2.19	-1.68	-1.83	20.30
Short Black Candle	8.91	1.81	-1.57	-2.17	11.37
Short White Candle	6.48	1.79	-1.46	-2.34	8.38
True Doji Candle	2.76	0.96	-0.86	-0.70	4.19
White Candle	19.54	2.44	-2.43	-0.82	24.21
White Closing Marubozu Candle	-0.12	1.29	-1.06	-2.25	2.20
White Marubozu Candle	0.11	0.86	-0.95	-1.04	1.49
Average	4.91	1.55	-1.49	-2.27	8.42

Out of 18 basic candlesticks two were able to create positive price increase only by 54,8% and 52,1%, on the down side just three of them created price decrease signals which are in the interval of 51,7%and 50,7%. Considering the average results of 51% price increase and 49% price decrease, it can be easily said that the basic candlesticks cannot give reliable signals for short-term market direction.

Table 3 Basic Candlesticks Remarkable Sign Creators.

Basic Candlestick Formulas	Number of Signal	Number of Price Increase	Number of Price Increase	% Price Increase	% Price Decrease	Total Price Change
Black Closing Marubozu Candle	3694	2024	1670	54.8%	45.2%	0.75
Marubozu Candle	5892	3069	2823	52.1%	47.9%	-0.05
White Marubozu Candle	3297	1625	1672	49.3%	50.7%	0.11
White Closing Marubozu Candle	4890	2406	2484	49.2%	50.8%	-0.12
Black Opening Marubozu Candle	5318	2566	2752	48.3%	51.7%	-0.57

The average result for a long only trade, explained created a 4,91 TL positive result. 6 out of 18 basic candlesticks performed above the average TL result. The top-ranking candlestick formations are the very basic ones. The straight forward, but with any days closing price and close the position in 3 equal portion methodology seems to be working in an emerging equity market Istanbul Stock exchange.

Table 4 Basic Candlesticks Remarkable Back-test results

Basic Candlestick Formulas	Number of Signal	Number of Price Increase	Number of Price Increase	% Price Increase	% Price Decrease	Total Price Change
White Candle	70460	35833	34627	50.9%	49.1%	19.54
Short Black Candle	17764	9060	8704	51.0%	49.0%	18.16
Black Candle	79208	40597	38611	51.3%	48.7%	16.16
Short Candle	52747	26918	25829	51.0%	49.0%	8.91
Short White Candle	15571	7962	7609	51.1%	48.9%	6.48
Long Black Candle	19528	9909	9619	50.7%	49.3%	4.92
Average	**22616**	**11538**	**11077**	**51.0%**	**49.0%**	**4.91**

5.2 Bullish Candlesticks Results

Out of 32 bullish candlesticks, 23 were observed in the sample data universe consisting 169,227 observations. On average per candlestick observation was 807,5 and 51% of them observed before a price increase, and 49% was followed by a price decrease. The so-called bullish formations on average do not give reliable signals for short-term market direction.

The average result for a long only trade, explained in the Methodology, back-test section created a 0,27 TL positive result, the average of maximum price changes of

0,39TL, a min of -0,43TL and a total cumulated minimum portfolio value change of -0,47TL and a max of 0,78TL.

Table 5 Bullish Candlesticks Created Signs and Price Direction

Bullish Candlestick Pattern	Number of Signal	Number of Price Increase	Number of Price Decrease	% Price Increase	% Price Decrease
Breakaway	3	2	1	66.7%	33.3%
Concealing Baby Swallow	0	0	0	0.0%	0.0%
Doji (Dragonfly)	910	419	491	46.0%	54.0%
Doji Star (Unconfirmed Bullish Morning Doji Star)	149	77	72	51.7%	48.3%
Engulfing	0	0	0	0.0%	0.0%
Hammer/Dragonfly Doji	0	0	0	0.0%	0.0%
Harami	1576	763	813	48.4%	51.6%
Harami Cross	62	29	33	46.8%	53.2%
Homing Pigeon	1	0	1	0.0%	100.0%
Inverted Hammer	383	189	194	49.3%	50.7%
Kicking	0	0	0	0.0%	0.0%

Ladder Bottom	172	95	77	55.2%	44.8%
Mat Hold	21	12	9	57.1%	42.9%
Matching Low	105	60	45	57.1%	42.9%
Meeting Lines	982	492	490	50.1%	49.9%
Morning Doji Star (Bullish Morning Star Variant)	8	4	4	50.0%	50.0%
Morning Star	434	210	224	48.4%	51.6%
Piercing Line	563	282	281	50.1%	49.9%
Rising Three Method	0	0	0	0.0%	0.0%
Separating Lines	11150	5701	5449	51.1%	48.9%
Side by Side White Lines	274	151	123	55.1%	44.9%
Stick Sandwich	340	165	175	48.5%	51.5%
Three Inside Up (Confirmed Bullish Harami)	30	15	15	50.0%	50.0%
Three Line Strike	155	85	70	54.8%	45.2%
Three Outside Up (Confirmed Bullish Engulfing)	32	12	20	37.5%	62.5%
Three Stars in the South	0	0	0	0.0%	0.0%

Three White Soldiers	0	0	0	0.0%	0.0%
Tri Star	0	0	0	0.0%	0.0%
Tweezer Bottom	69	32	37	46.4%	53.6%
Unique Three River Bottom	0	0	0	0.0%	0.0%
Upside Gap Three Methods	1084	583	501	53.8%	46.2%
Upside Tasuki Gap	0	0	0	0.0%	0.0%
Average	807.5	409.6	397.9	0.51	0.49

Table 6 Bullish Candlesticks Back-test results

Bullish Candlestick Pattern	Total Price Change	Max Price Change	Min Price Change	Cumsum Min	Cumsum Max
Breakaway	0.17	0.17	0.17	0.17	0.17
Concealing Baby Swallow	0.00	0.00	0.00	0.00	0.00
Doji (Dragonfly)	-0.80	0.62	-0.91	-1.40	0.54
Doji Star (Unconfirmed Bullish Morning Doji Star)	-0.08	0.12	-0.22	-0.17	0.10

Engulfing	0.00	0.00	0.00	0.00	0.00
Hammer/Dragonfly Doji	0.00	0.00	0.00	0.00	0.00
Harami	0.47	0.97	-0.86	-1.29	2.03
Harami Cross	0.04	0.22	-0.22	-0.05	0.28
Homing Pigeon	-0.08	-0.08	-0.08	-0.08	-0.08
Inverted Hammer	0.42	0.90	-0.55	-0.62	0.97
Kicking					
Ladder Bottom	0.39	0.50	-0.34	-0.23	0.68
Mat Hold	-0.82	-0.20	-0.76	-0.89	-0.32
Matching Low	0.04	0.43	-0.37	-0.42	0.45
Meeting Lines	0.08	0.68	-0.67	-0.74	0.93
Morning Doji Star (Bullish Morning Star Variant)	-0.08	-0.06	-0.07	-0.08	-0.07
Morning Star	0.10	0.46	-0.46	-0.53	0.64
Piercing Line	-0.30	0.47	-0.77	-0.88	0.56
Rising Three Method					
Separating Lines	6.40	1.55	-1.45	-1.33	8.39
Side by Side White Lines	0.26	0.40	-0.34	-0.21	0.58
Stick Sandwich	-0.42	0.38	-0.58	-0.68	0.34
Three Inside Up (Confirmed Bullish Harami)	-0.05	0.04	-0.11	-0.11	0.01
Three Line Strike	0.15	0.29	-0.22	-0.19	0.35

Three Outside Up (Confirmed Bullish Engulfing)	-0.03	0.14	-0.13	-0.11	0.08
Three Stars in the South	0.00	0.00	0.00	0.00	0.00
Three White Soldiers	0.00	0.00	0.00	0.00	0.00
Tri Star	0.00	0.00	0.00	0.00	0.00
Tweezer Bottom	0.00	0.07	-0.04	-0.04	0.05
Unique Three River Bottom	0.00	0.00	0.00	0.00	0.00
Upside Gap Three Methods	0.39	0.95	-0.71	-0.91	1.39
Upside Tasuki Gap	0.00	0.00	0.00	0.00	0.00
Average	**0.27**	**0.39**	**0.43**	**-0.47**	**0.78**

Only 5 out of 23 bullish candlesticks created higher TL results than the average of the sample. As can be seen in the below Table Separating Lines, Ladder Bottom and Upside Gap Three Methods showed relatively higher TL results with matching price

Table 7 Bullish Candlesticks Remarkable Back-test results

Bullish Candlestick Pattern	Number of Signal	% Price Increase	% Price Decrease	Total Price Change
Separating Lines	11150	0.51	0.49	6.40
Harami	1576	0.48	0.52	0.47
Inverted Hammer	383	0.49	0.51	0.42
Ladder Bottom	172	0.55	0.45	0.39

Upside Gap Three Methods	1084	0.54	0.46	0.39
Average	**807.5**	**0.51**	0.49	**0.27**

5.3 Bearish Candlesticks Results

Out of 36 bearish candlesticks, 29 were observed in the sample data universe consisting 169,227 observations. On average per candlestick observation was 335 and 51,8 % of them observed before a price increase, and 48,2 % was followed by a price decrease. The so-called bearish formations on average do not give reliable signals for short-term market direction.

The average result for a long only trade, explained in the Methodology, back-test section created a 0,173 TL positive result, the average of maximum price changes of 0,281TL, a min of -0,231TL and a total cumulated minimum portfolio value change of -0,219 TL and a max of 0,42TL

Table 8 Bearish Candlesticks Created Signs and Price Direction

Bearish Candlestick Pattern	Number of Signal	Number of Price Increase	Number of Price Decrease	% Price Increase	% Price Decrease
Abandoned Baby	0	0	0	0.00%	0.00%
Advance Block	0	0	0	0.00%	0.00%
Belt Hold	19	6	13	31.58%	68.42%
Breakaway	178	93	85	52.25%	47.75%
Dark Cloud Cover	494	266	228	53.85%	46.15%
Deliberation	362	183	179	50.55%	49.45%

Downside Gap Three Methods	67	32	35	47.76%	52.24%
Downside Tasuki Gap	23	14	9	60.87%	39.13%
Doji Star	21	9	12	42.86%	57.14%
Doji (Gravestone)	84	57	27	67.86%	32.14%
Dragonfly Doji/Hanging Man	302	148	154	49.01%	50.99%
Engulfing	1327	693	634	52.22%	47.78%
Evening Doji Star	0	0	0	0.00%	0.00%
Evening Star	18	9	9	50.00%	50.00%
Falling Three Methods	21	12	9	57.14%	42.86%
Grave Stone Doji/Shooting Star	0	0	0	0.00%	0.00%
Hanging Man	0	0	0	0.00%	0.00%
Harami (Bearish Harami Variant)	778	413	365	53.08%	46.92%
Harami Cross	89	34	55	38.20%	61.80%
Identical Three Crows	682	362	320	53.08%	46.92%
In Neck	1646	832	814	50.55%	49.45%
Kicking	1	0	1	0.00%	100.00%
Meeting Lines	38	24	14	63.16%	36.84%
On Neck	351	196	155	55.84%	44.16%
Separating Lines	1213	618	595	50.95%	49.05%
Shooting Star	1	1	0	100.00%	0.00%
Side-by-side White Lines	3	2	1	66.67%	33.33%
Three Black Crows	605	318	287	52.56%	47.44%

Three Inside Down	0	0	0	0.00%	0.00%
Three Line Strike	235	128	107	54.47%	45.53%
Three Outside Down (Confirmed Bearish Engulfing)	0	0	0	0.00%	0.00%
Thrusting	701	343	358	48.93%	51.07%
Tri Star	1	1	0	100.00%	0.00%
Tweezer Top	66	36	30	54.55%	45.45%
Two Crows	0	0	0	0.00%	0.00%
Upside Gap Two Crows	66	36	30	54.55%	45.45%
Average	**335**	**174**	**162**	**51.81%**	**48.19%**

Table 9 Bearish Candlesticks Back-test results

Bearish Candlestick Pattern	Total Price Change	Max Price Change	Min Price Change	Cumsum Min	Cumsum Max
Abandoned Baby	0.00	0.00	0.00	0.00	0.00
Advance Block	0.00	0.00	0.00	0.00	0.00
Belt Hold	-0.03	-0.02	-0.05	-0.03	-0.02
Breakaway	0.21	0.36	-0.26	-0.25	0.44
Dark Cloud Cover	0.53	0.51	-0.45	-0.18	0.88
Deliberation	0.37	0.55	-0.43	-0.51	0.69
Downside Gap Three Methods	0.03	0.21	-0.13	-0.03	0.19

Downside Tasuki Gap	0.08	0.13	0.04	0.08	0.13
Doji Star	-0.02	0.03	-0.04	-0.02	0.02
Doji (Gravestone)	0.06	0.04	-0.02	-0.02	0.07
Dragonfly Doji/Hanging Man	0.04	0.20	-0.24	-0.21	0.32
Engulfing	-0.01	0.91	-0.95	-1.21	1.16
Evening Doji Star	0.00	0.00	0.00	0.00	0.00
Evening Star	-0.06	-0.07	-0.12	-0.11	-0.06
Falling Three Methods	0.09	0.11	0.05	0.09	0.11
Grave Stone Doji/Shooting Star	0.00	0.00	0.00	0.00	0.00
Hanging Man	0.00	0.00	0.00	0.00	0.00
Harami (Bearish Harami Variant)	0.35	0.75	-0.52	-0.53	0.99
Harami Cross	-0.12	0.09	-0.22	-0.22	0.07
Identical Three Crows	0.33	0.41	-0.35	-0.22	0.66
In Neck	1.32	0.85	-0.69	-0.68	2.08
Kicking	-0.11	-0.11	-0.11	-0.11	-0.11
Meeting Lines	0.04	0.06	0.03	0.03	0.06
On Neck	0.40	0.47	-0.16	-0.12	0.55
Separating Lines	-0.23	0.35	-0.38	-0.64	0.45
Shooting Star	0.01	0.01	0.01	0.01	0.01

Side-by-side White Lines	0.04	0.04	0.04	0.04	0.04
Three Black Crows	0.82	0.74	-0.51	-0.48	1.38
Three Inside Down	0.00	0.00	0.00	0.00	0.00
Three Line Strike	0.37	0.49	-0.37	-0.23	0.60
Three Outside Down (Confirmed Bearish Engulfing)	0.00	0.00	0.00	0.00	0.00
Thrusting	0.37	0.69	-0.52	-0.49	0.95
Tri Star	0.00	0.00	0.00	0.00	0.00
Tweezer Top	0.00	0.04	-0.05	-0.03	0.06
Two Crows	0.00	0.00	0.00	0.00	0.00
Upside Gap Two Crows	0.00	0.04	-0.05	-0.03	0.06
Average	0.173	0.281	-0.231	-0.219	0.420

Only 10 out of 28 bearish candlesticks created higher TL results than the average of the sample. As can be seen in the below Table all 10 of them show either higher TL and or stronger signal power than the rest of the sample.

Table 10 Bearish Candlesticks Remarkable Back-test results

Bearish Candlesticks	**Number of Signal**	**% Price Increase**	**% Price Decrease**	**Total Price Change**
In Neck	1646	0.51	0.49	1.32
Three Black Crows	605	0.53	0.47	0.82
Dark Cloud Cover	494	0.54	0.46	0.53

On Neck	351	0.56	0.44	0.40
Deliberation	362	0.51	0.49	0.37
Three Line Strike	235	0.54	0.46	0.37
Thrusting	701	0.49	0.51	0.37
Harami (Bearish Harami Variant)	778	0.53	0.47	0.35
Identical Three Crows	682	0.53	0.47	0.33
Breakaway	178	0.52	0.48	0.21
Average	**335**	**0.52**	**0.48**	**0.17**

5.4 Dummy Candlestick Back-test

On average the so called Bullish and Bearish Candlesticks create 548,3 signals for the 31 assets in the sample universe. With a rough calculation, it is 18 signal per asset. Ereğli Demir ve Çelik Fabrikaları T.A.Ş stock data was chosen to test the dummy candlestick performance. First 18 random dates were chosen and another 18 was added on the top of the first randomly created set. The randomly chosen dates were increased up to 72. Randomly 18-36-54-72 dates were chosen and 4 sets of signal dates was created. In line with the main back-test methodology, on signal day's the equity is assumed to be bought with closing price and it is sold in the following three trading days with each day's closing price with equal portions.

The dummy candle stick results below show us the the average of the price increase and decrease signals, 52% & 48 % are in line with real candlestick back-tests and the accumulated 1,361TL as the total result of the back-test is coherent with real candlesticks results.

Table 11 Dummy Candlestick Back-test Results

Number of Signal	Number of Price Increase	Number of Price Decrease	% Price Increase	% Price Decrease	Total Price Change
18	8	10	44%	56%	0.039
36	18	18	50%	50%	0.195
54	30	24	56%	44%	0.194
72	41	31	57%	43%	1.361
		Average	52%	48%	0.447

6 CONCLUSION

For the sake of good order and in line with candlestick analysts' practice, the patterns were divided into three sections as Basic, by definition Bullish and by definition bearish. In our universe of 169,228 Daily price data set derived from Istanbul 30 Index and its latest 30 components data a total of 86 candlestick formations were tested.

In evaluating the estimation power of the Basic Candlesticks Formations considering the 22,616 signals created, on average 51% of them showed price increase and 49% price decrease. Out of 18 basic candlesticks two were able to create positive price increase only by 54,8% and 52,1%, on the down side just three of them created price decrease signals which are in the interval of 51,7%and 50,7%. The study shows that the basic candlesticks cannot give reliable signals for short-term market direction.

The observation frequency for both Bullish and Bearish candlesticks were relatively low. Out of 32 bullish candlesticks, 23 were observed and out of 36 bearish candlesticks, 29 were observed in the sample data universe. For so-called Bullish formations 51% of them observed before a price increase, and 49% was followed by a price decrease. The market direction is very similar with so called Bearish ones, 51,8 % of them observed before a price increase, and 48,2 % was followed by a price decrease.

It can be easily said that, Basic, Bullish and Bearish candlesticks do not create reliable signals for market direction based on our test methodology of comparing the observations day closing price with the following three days average closing prices.

The average result for a long only trade, explained in the methodology, back-test section for Basic, Bullish and Bearish, created a 4,91 TL (Basic), 0,27 TL (Bullish) and 0,173 TL (Bearish) positive results. The Positive results may be considered under the fact that, the BIST 30 Index was in a bullish trend in the observation horizon. The year 2000 BIST 30 Index start was at 224,06 points, the 2010 closing

675,64 points and the 2020 closing was 1635,97. The study shows that a basic buy and sell in three days strategy delivers investors positive results in Turkish Lira terms.

Another back test based on random 18-36-54-72 dates like a dummy candlestick was observed, created, followed 52% price increase and 48 % price decrease and 72 dummy trades created 1,361TL positive result.

As a final summary study shows with the current practice, keeping that all trading costs are ignored in mind Japanese Candlesticks cannot have a positive impact to its practitioner in BIST 30 index and its current components. The candlestick analysis shows no material evidence in helping the investors beating the market and study generated strong evidence neither the so-called bullish and/or bearish candlestick formations can outperform a basic buy and hold investment approach. The Efficient Market Hypothesis (EMH) overrules it like many other technical analysis methodologies.

With this study using Candlestick analysis, it was impossible to prove that Borsa Istanbul's main 30 equities are informationally inefficient.

I believe that there is need for further studies to integrate the existing candlestick methodology with factors like resistance level, support level, stop-loss level and trading volume. (Brock et al., 1992), indicate that technical analysts are in continuous efforts to buy at relative bottom levels and sell at peaks. Nison (1991) and Pring (2002) assert that candlestick patterns are more worth to attention when they are observed in low price or high price areas. The trading volume which is a generally accepted indicator for the strength of price trend showing market participance can help to confirm the trend. The volume-integrated research for candlesticks will be more illuminating in efficiency checks.

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APPENDIX

Table 12 Basic Candlestick Formulas

Black Candle	CP < OP
Black Closing Marubozu Candle	HP > OP AND CP = LP AND OP - CP > 3 * AV.(ABS.(OP - CP), 15) / 2
Black Marubozu Candle	HP - LP = OP - CP AND OP - CP > 3 * AV.(ABS.(OP - CP), 15) / 2
Black Opening Marubozu Candle	HP = OP AND CP > LP AND OP - CP > 3 * AV.(ABS.(OP - CP), 15) / 2
Closing Marubozu Candle	(LP = CP OR. CP = HP) AND HP - LP > ABS.(OP - CP) AND ABS.(OP - CP) > 3 * AV.(ABS.(OP - CP), 15) / 2
Doji Candle	20 * ABS.(OP - CP) <= HP - LP
Long Candle	ABS.(OP - CP) > 3 * AV.(ABS.(OP - CP), 15) / 2
Long Black Candle	OP - CP > 3 * AV.(ABS.(OP - CP), 15) / 2

Long White Candle	CP - OP > 3 * AV.(ABS.(OP - CP), 15) / 2
Marubozu Candle	HP - LP = ABS.(OP - CP) AND HP - LP > 3 * AV.(ABS.(OP - CP), 15) / 2
Opening Marubozu Candle	(LP = OP OR. OP = HP) AND HP - LP > ABS.(OP - CP) AND ABS.(OP - CP) > 3 * AV.(ABS.(OP - CP), 15) / 2
Short Candle	ABS.(OP - CP) < AV.(ABS.(OP - CP), 15) / 2
Short Black Candle	CP < OP AND OP - CP < AV.(ABS.(OP - CP), 15) / 2
Short White Candle	OP < CP AND CP - OP < AV.(ABS.(OP - CP), 15) / 2
True Doji Candle	OP = CP
White Candle	OP < CP
White Closing Marubozu Candle	HP = CP AND OP > LP AND CP - OP > 3 * AV.(ABS.(OP - CP), 15) / 2
White Marubozu Candle	HP - LP = CP - OP AND CP - OP > 3 * AV.(ABS.(OP - CP), 15) / 2

Table 13 Bullish Candlestick Formulas

Breakaway	CP4 < OP4 AND ABS.(CP4 - OP4) > 0,5 * (HP4 - LP4) AND CP3 < OP3 AND HP3 < LP4 AND CP2 < CP3 AND CP1 < CP2 AND ABS.(CP - OP) > 0,6 * (HP - LP) AND CP > OP AND CP > HP3
Concealing Baby Swallow	OP3 = HP3 AND CP3 = LP3 AND OP2 = HP2 AND CP2 = LP2 AND CP1 < OP1 AND OP1 < CP2 AND HP1 > CP2 AND OP = HP AND CP = LP AND HP > HP1 AND LP < LP1
Doji (Dragonfly)	ABS.(OP-CP)<=.02*(HP-LP) AND (HP-CP)<=0,3*(HP-LP) AND (HP-LP)>=(AV.HP10-AV.LP10) AND (HP>LP) AND (LP=MIN.LP10)
Doji Star (Unconfirmed Bullish Morning Doji Star)	OP1 - CP1 >= 0,7 * (HP1 - LP1) AND HP1 - LP1 >= AV.HP10.1 - AV.LP10.1 AND CP < CP1 AND OP < CP1 AND ABS.(CP - OP) <= 0,05 * (HP - LP) AND LP = MIN.LP10 AND HP1 > LP1 AND HP > LP
Engulfing	OP1 > CP1 AND 10 * (CP - OP) >= 7 * (HP - LP) AND CP > OP1 AND CP1 > OP AND 10 * (HP - LP) >= 12 * (AV. HP10 - AV. LP10)
Hammer/Dragonfly Doji	ABS.(CP-OP)<=0,2*(HP-LP) AND ABS.(OP-CP)>=.1*(HP-LP) AND (OP-LP)>=0,5*(HP-LP) AND (CP-LP)>=0,5*(HP-LP) AND (HP-OP)<=0,05*(HP-LP) OR (HP-

	CP)<=0,05*(HP-LP) AND (HP-LP)>=.8*(AV.HP10-AV.LP10) AND (LP=MIN.LP5) AND (HP>LP)
Harami	OP1 - CP1 >= 0,7 * (HP1 - LP1) AND HP1 - LP1 >= AV.HP10.1 - AV.LP10.1 AND CP > OP AND OP > CP1 AND CP < OP1 AND CP - OP <= 0,6 * (OP1 - CP1)
Harami Cross	ABS.(CP1 - OP1) > 0,5 * (HP1 - LP1) AND CP1 < OP1 AND HP < OP1 AND LP > CP1 AND (CP + OP) / 2 - LP > .4 * (HP - LP) AND (CP + OP) / 2 - LP < 0,6 * (HP - LP) AND ABS.(CP - OP) < 0,2 * (HP - LP)
Homing Pigeon	CP1 < OP1 AND ABS.(CP - OP) >= 0,6 * (HP1 - LP1) AND ABS.(CP1 - OP1) >0,5 * (HP1 - LP1) AND HP < OP1 AND LP > CP1 AND CP < OP
Inverted Hammer	ABS.(OP-CP)<=0,2*(HP-LP) AND ABS.(OP-CP)>=.1*(HP-LP) AND (HP-OP)>=0,5*(HP-LP) AND (HP-CP)>=0,5*(HP-LP) AND (OP-LP)<=0,05*(HP-LP) OR (CP-LP)<=0,05*(HP-LP) AND (HP-LP)>=.8*(AV.HP10-AV.LP10) AND (OP<=(HP1-0,5*(HP1-LP1))) AND (CP<=(HP1-0,5*(HP1-LP1))) AND (LP=MIN.LP5) AND (HP>LP)
Kicking	OP3 - CP3 > 0,6 * (HP3 - LP3) AND OP2 - CP2 > 0,6 * (HP2 - LP2) AND OP1 - CP1 > 0,6 * (HP1 - LP1) AND CP3 < OP3

	AND CP2 < OP2 AND CP1 < OP1 AND CP > OP AND OP2 < CP3 AND OP1 < CP2 AND OP > OP1 AND CP - OP > 0,6 * (HP - LP)
Ladder Bottom	OP4 > CP4 AND OP3 < OP4 AND CP3 < CP4 AND OP2 < OP3 AND CP2 < CP3 AND CP1 < OP1 AND HP1 > OP1 AND CP > OP AND OP > OP1
Mat Hold	CP4 > OP4 AND ABS.(CP4 - OP4) > 0,5 * (HP4 - LP4) AND CP3 < HP4 AND CP2 < HP4 AND CP1 < HP4 AND CP3 > LP4 AND CP2 > LP4 AND CP1 > LP4 AND CP > CP4 AND CP > OP AND HP - LP > AV.HP21 - AV.LP21 AND CP2 < CP3 AND CP1 < CP2 AND ABS.(CP3 - OP3) <= 0,75 * ABS.(CP4 - OP4) AND ABS.(CP2 - OP2) <= 0,75 * ABS.(CP4 - OP4) AND ABS.(CP2 - OP2) <= 0,75 * ABS.(CP4 - OP4)
Matching Low	CP1 < OP1 AND ABS.(CP1 - OP1) > 0,5 * (HP1 - LP1) AND CP < OP AND ABS.(CP / CP1 -1) < 0,01
Meeting Lines	CP1 < OP1 AND HP1 - LP1 > AV.HP21.1 - AV.LP21.1 AND OP1 < MIN.LP30,3 AND CP > OP AND ABS.(CP / CP1 - 1) < 0,01
Morning Doji Star (Bullish Morning Star Variant)	(OP2-CP2)>=0,7*(HP2-LP2) AND (HP2-LP2)>=(AV.HP100,2-AV.LP100,2) AND (CP1=(AV.HP10-AV.LP10) AND (CP-OP)>=0,7*(HP-LP) AND (OP>CP1) AND (OP>OP1)

Morning Star	OP2 > CP2 AND OP2 - CP2 > 0,6 * (HP2 - LP2) AND CP2 > OP1 AND ABS.(OP1 - CP1) < 0,5 * ABS.(OP2 - CP2) AND HP1 - LP1 > 3 * (CP1 - OP1) AND CP > OP AND OP > OP1 AND OP > CP1
Piercing Line	OP1 > CP1 AND HP1 - LP1 >= AV.HP10.1 - AV.LP10.1 AND OP < CP1 AND CP > CP1 + 0,5 * (OP1 - CP1) AND CP < OP1
Rising Three Method	(CP4-OP4)>=0,7*(HP4-LP4) AND (HP4-LP4)>=(AV.HP20-AV.LP20) AND (HP4=MAXHP10.4) AND (CP3=OP4+0,5*(HP4-LP4)) AND (OP2OP4) AND (OP>OP4) AND OP<=LP4+0,6*(HP4-LP4) AND (CP>CP4)
Separating Lines	CP1 < OP1 AND CP > OP AND ABS.(OP / OP1 - 1) < 0,01
Side by Side White Lines	CP2 > OP2 AND CP1 > OP1 AND LP1 > HP2 AND ABS.(CP / CP1 - 1) < .1 AND ABS.(ABS.(CP - OP) / ABS.(CP1 - OP1) - 1) < .15
Stick Sandwich	CP2 < OP2 AND CP1 > OP1 AND LP1 > CP2 AND CP < OP AND ABS.(CP / CP2 - 1) < .02
Three Inside Up (Confirmed Bullish Harami)	OP2 - CP2 >= 0,7 * (HP2 - LP2) AND (HP2 - LP2) >= AV.HP100,2 - AV.LP100,2 AND CP1 > OP1 AND OP1 > CP2 AND CP1 < OP2 AND CP1 - OP1 <= 0,6 * (OP2 - CP2) AND OP > OP1

	AND OP < CP1 AND CP > CP1 AND CP - OP >= 0,7 * (HP - LP)
Three Line Strike	CP2 > CP3 AND CP1 > CP2 AND HP3 - LP3 > AV.HP210,3 - AV.LP210,3 AND HP2 - LP2 > AV.HP21,2 - AV.LP21,2 AND HP1 - LP1 > AV.HP21.1 - AV.LP21.1 AND OP > OP3 AND CP < OP3
Three Outside Up (Confirmed Bullish Engulfing)	OP2 > CP2 AND CP1 - OP1 >= 0,7 * (HP1 - LP1) AND CP1 > OP2 AND OP1 < CP2 AND (HP1 - LP1) >= 1,2 * (AV.HP10.1 - AV.LP10.1) AND OP > OP1 AND OP < CP1 AND CP > CP1 AND CP - OP >= 0,7 * (HP - LP)
Three Stars in the South	CP2 < OP2 AND ABS.(CP2 - OP2) > 0,5 * (HP2 - LP2) AND CP2 - LP2 > OP2 - CP2 AND CP1 < OP1 AND ABS.(CP1 - OP1) > 0,5 * (HP1 - LP1) AND CP1 - LP1 > OP1 - CP1 AND HP1 - LP1 < HP2 - LP2 AND LP1 > LP2 AND OP = HP AND CP = LP AND HP < HP1 AND LP > LP1
Three White Soldiers	CP > CP1 AND CP1 > CP2 AND CP > OP AND CP1 > OP1 AND CP2 > OP2 AND ABS.(CP2 - OP2) > 0,5 * (HP2 - LP2) AND ABS.(CP1 - OP1) > 0,5 * (HP1 - LP1) AND HP - LP > AV.HP21 - AV.LP21 AND OP > OP1 AND OP < CP1 AND OP1 > OP2 AND OP1 < CP2 AND OP2 > OP3 AND OP2 < CP3 AND CP >

	.85 * HP AND CP1 > .85 * HP1 AND CP2 > .85 * HP2
Tri Star	ABS.(CP - OP) <= 0,05 * (HP - LP) AND (CP + OP) / 2 - LP >= .4 * (HP - LP) AND (CP + OP) / 2 - LP <= 0,6 * (HP - LP) AND ABS.(CP1 - OP1) <= 0,05 * (HP1 - LP1) AND (CP1 + OP1) / 2 - LP1 >= .4 * (HP1 - LP1) AND (CP1 + OP1) / 2 - LP1 <= 0,6 * (HP1 - LP1) AND ABS.(CP2 - OP2) <= 0,05 * (HP2 - LP2) AND (CP2 + OP2) / 2 - LP2 >= .4 * (HP2 - LP2) AND (CP2 + OP2) / 2 -LP2 <= 0,6 * (HP2 - LP2) AND HP1 < LP3 AND HP1 < LP1
Tweezer Bottom	LP = LP1 AND ABS.(CP - OP) < 0,2 * ABS.(CP1 - OP1) AND ABS.(CP1 - OP1) >= .9 * (HP1 - LP1) AND HP1 - LP1 >= 10,3 * (AV.HP20 - AV.LP20)
Unique Three River Bottom	ABS.(CP2 - OP2) >= 0,7 * (HP2 - LP2) AND ABS.(CP2 - OP2) > 0,5 * (HP2 - LP2) AND CP1 < OP1 AND OP1 < OP2 AND CP1 > CP2 AND LP1 = MIN.LP5.1 AND CP > OP AND CP < CP1
Upside Gap Three Methods	ABS.(CP2 - OP2) > 0,5 * (HP2 - LP2) AND ABS.(CP1 - OP1) > 0,5 * (HP1 - LP1) AND LP1 > HP2 AND CP < CP2 AND OP > OP1
Upside Tasuki Gap	ABS.(CP2 - OP2) > 0,5 * (HP2 - LP2) AND ABS.(CP1 - OP1) > 0,5 * (HP1 -

	LP1) AND LP1 > HP2 AND CP < OP AND CP < OP1 AND CP > CP2

Table 14 Bearish Candlestick Formulas

Abandoned Baby	ABS.(CP2 - OP2) > .5 * (HP2 - LP2) AND CP2 > OP2 AND ABS.(CP1 - OP1) <= 0,05 * (HP1 - LP1) AND (CP1 + OP1) / 2 - LP1 >= 0,4 * (HP1 - LP1) AND (CP1 + OP1) / 2 - LP1 <= 0,6 * (HP1 - LP1) AND LP1 > HP2 AND CP < OP AND HP < LP1 AND OP > CP2 AND (LP > OP2 OR CP < LP2)
Advance Block	HP - LP > AV.HP21 - AV.LP21 AND ABS.(CP1 - OP1) > 0,5 * (HP1 - LP1) AND ABS.(CP2 - OP2) > 0,5 * (HP2 - LP2) AND CP > CP1 AND CP1 > CP2 AND OP1 > OP2 AND OP1 < CP2 AND OP > OP1 AND OP < CP1 AND HP - LP < .8 * (HP1 - LP1) AND HP1 - LP1 < .8 * (HP2 - LP2) AND HP - CP > OP - LP AND HP1 - CP1 > OP1 - LP1
Belt Hold	OP = MAX.OP10 AND OP > HP1 AND OP - CP >= 0,7 * (HP - LP) AND HP - LP >= 1,2 * (AVG.HP10 - AVG.LP10) AND HP - OP <= 0,01 * (HP - LP) AND CP >= HP1 - 0,5 * (HP1 - LP1) AND HP1 > LP1 AND HP > LP AND CP1 > CP2 AND CP2 < CP3

Breakaway	ABS.(CP4 - OP4) > 0,5 * (HP4 - LP4) AND CP4 > OP4 AND CP3 > OP3 AND LP3 > HP4 AND CP2 > CP3 AND CP1 > CP2 AND CP < OP AND LP < HP4 AND HP > LP3
Dark Cloud Cover	CP1 - OP1 >= 0,7 * (HP1 - LP1) AND HP1 - LP1 >= AV.HP10.1 - AV.LP10.1 AND OP > CP1 AND CP < CP1 - 0,5 * (CP1 - OP1) AND CP > OP1
Deliberation	ABS.(CP2-OP2) > 0,5 * (HP2 - LP2) AND ABS.(CP1 - OP1) > 0,5 * (HP1 - LP1) AND CP1 > CP2 AND CP2 > OP2 AND CP1 > OP1 AND OP > HP1 AND (CP + OP) / 2 - LP > 0,4 * (HP - LP) AND (CP + OP) / 2 - LP < 0,6 * (HP - LP) AND ABS.(CP - OP) < 0,6 * (HP - LP)
Downside Gap Three Methods	ABS.(CP2-OP2) > 0,5 * (HP2 - LP2) AND ABS.(CP1 - OP1) > 0,5 * (HP1 - LP1) AND CP2 < OP2 AND CP1 < OP1 AND HP1 < LP2 AND LP < HP1 AND HP > LP2 AND CP > OP
Downside Tasuki Gap	CP2 < OP2 AND CP1 < OP1 AND HP1 < LP2 AND OP > CP1 AND OP < OP1 AND CP > HP1 AND CP < LP2
Doji Star	ABS.(CP1 - OP1) > 0,5 * (HP1 - LP1) AND OP > CP1 AND ABS.(CP - OP) < 0,05 * (HP - LP) AND HP - LP < 0,2 * (AV.HP21 - AV.LP21)
Doji (Gravestone)	ABS.(OP-CP)<=0,01*(HP-LP) AND (HP-CP)>=0,95*(HP-LP) AND (HP>LP) AND

	(HP=MAX.HP10) AND (HP-LP)>=(AVG.HP10-AVG.LP10)
Dragonfly Doji/Hanging Man	ABS.(OP-CP)<=.02*(HP-LP) AND (HP-CP)<=.3*(HP-LP) AND (HP-LP)>=(AV.HP10-AV.LP10) AND (HP>LP) AND (HP=MAX.HP10)
Engulfing	CP1 > OP1 AND OP - CP >= 0,7 * (HP - LP) AND CP < OP1 AND OP > CP1 AND HP - LP >= 1,2 * (AVG.HP10 - AVG.LP10)
Evening Doji Star	ABS.(CP2 - OP2) > 0,5 * (HP - LP) AND CP2 > OP2 AND ABS.(CP1 - OP1) < 0,05 * (HP1 - LP1) AND HP1 - LP1 < 0,2 * (AV.HP21.1 - AV.LP21.1) AND OP1 > CP2 AND CP < OP
Evening Star	CP2 - OP2 >= 0,7 * (HP2 - LP2) AND HP2 - LP2 >= AV.HP10.2 - AV.LP10.2 AND CP1 > CP2 AND OP1 > CP2 AND HP - LP >= AV.HP10 - AV.LP10 AND OP - CP >= 0,7 * (HP - LP) AND OP < OP1 AND OP < CP1
Falling Three Methods	ABS.(CP4 - OP4) > 0,5 * (HP4 - LP4) AND CP4 < OP4 AND ABS.(CP3 - OP3) < ABS.(CP4 - OP4) AND ABS.(CP2 - OP2) < ABS.(CP4 - OP4) AND ABS.(CP1 - OP1) < ABS.(CP4 - OP4) AND LP3 >= LP4 AND HP3 <= HP4 AND LP2 >= LP4 AND HP2 <= HP4 AND LP1 >= LP4 AND HP1 <= HP4 AND HP2 > HP3 AND HP1 > HP2 AND CP < OP AND CP < CP4

Grave Stone Doji/Shooting Star	ABS.(CP - OP) < (HP - LP) / 3 AND OP > CP1 AND (CP + OP) / 2 - LP < 0,4 * (HP - LP) AND HP = MAX.HP10
Hanging Man	ABS.(CP >= OP) * OP + ABS.(CP < OP) * CP - LP >= 2 * ABS.(CP - OP) AND (CP + OP) / 2 - LP > 2 * (HP - (CP + OP) / 2) AND ABS.(CP - OP) > .01
Harami (Bearish Harami Variant)	CP1 - OP1 >= 0,7 * (HP1 - LP1) AND HP1 - LP1 >= AV.HP10.1 - AV.LP10.1 AND CP < OP AND OP < CP1 AND CP > OP1 AND OP - CP <= 0,6 * (CP1 - OP1)
Harami Cross	ABS.(CP1 - OP1) > 0,5 * (HP - LP) AND CP1 > OP1 AND HP < CP1 AND LP > OP1 AND ABS.(CP - OP) < 0,2 * (HP - LP)
Identical Three Crows	CP2 < OP2 AND CP1 < OP1 AND CP < OP AND CP < LP1 AND CP1 < LP2 AND OP = CP1 AND OP1 = CP2
In Neck	ABS.(CP1 - OP1) >0,5 * (HP1 - LP1) AND CP1 < OP1 AND OP < LP1 AND CP >= CP1 AND CP < 10,05 * CP1
Kicking	CP = LP AND OP = HP AND HP > LP AND HP < LP1 AND CP1 = HP1 AND OP1 = LP1 AND HP1 > LP1
Meeting Lines	ABS.(CP1 - OP1) > 0,5 * (HP1 - LP1) AND CP1 > OP1 AND (CP1 + OP1) / 2 > HP2 AND ABS.(CP - OP) > 0,5 * (HP - LP) AND CP < OP AND (CP + OP) / 2 > HP1 AND CP = CP1

On Neck	ABS.(CP1 - OP1) > 0,5 * (HP1 - LP1) AND CP1 < OP1 AND OP < LP1 AND CP = LP1
Separating Lines	CP1 > OP1 AND CP < OP AND OP = OP1
Shooting Star	ABS.(OP-CP)<=0,2*(HP-LP) AND ABS.(OP-CP)>=.1*(HP-LP) AND (HP-OP)>=0,5*(HP-LP) AND (HP-CP)>=0,5*(HP-LP) AND (OP-LP)<=0,05*(HP-LP) OR (CP-LP)<=0,05*(HP-LP) AND (HP-LP)>=.8*(AV.HP10-AV.LP10) AND (OP>=(LP1+0,5*(HP1-LP1))) AND (CP>=(LP1+0,5*(HP1-LP1))) AND (HP=MAX.HP5) AND (HP>LP)
Side-by-side White Lines	CP2 < OP2 AND HP1 < LP2 AND CP1 > OP1 AND ABS.(CP1 - OP1) > 0,95 * ABS.(CP - OP) AND ABS.(CP1 - OP1) < 10,95 * ABS.(CP - OP) AND CP > OP AND CP = CP1
Three Black Crows	OP1 < OP2 AND OP1 > CP2 AND OP < OP1 AND OP > CP1 AND CP1 < LP2 AND CP < LP1 AND CP2 < 10,05 * LP2 AND CP1 < 10,05 * LP1 AND CP < 10,05 * LP
Three Inside Down	ABS.(CP2 - OP2) > 0,5 * (HP1 - LP1) AND CP2 > OP2 AND CP1 < OP1 AND HP1 < CP2 AND LP1 > OP2 AND CP < OP AND CP < CP1

Three Line Strike	CP3 < OP3 AND CP2 < OP2 AND CP2 < CP3 AND CP1 < OP1 AND CP1 < CP2 AND OP < CP1 AND CP > OP3
Three Outside Down (Confirmed Bearish Engulfing)	CP1 - OP1 >= 0,7 * (HP1 - LP1) AND HP1 - LP1 >= AV.HP10.1 - AV.LP10.1 AND CP < OP AND OP < CP1 AND CP > OP1 AND OP - CP <= 0,6 * (CP1 - OP1)
Thrusting	ABS.(CP1 - OP1) > 0,5 * (HP1 - LP1) AND CP1 < OP1 AND OP < LP1 AND CP > CP1 AND CP < (CP1 + OP1) / 2
Tri Star	ABS.(CP - OP) < 0,05 * (HP - LP) AND HP - L P< 0,2 * (AVG.HP21 - AVG.LP21) AND ABS.(CP1 - OP1) < 0,05 * (HP1 - LP1) AND HP1 - LP < 0,2 * (AVG.HP21.1-AVG.LP21.1) AND ABS.(CP2 - OP2) < 0,05 * (HP2 - LP2) AND HP2 - LP2 < 0,2 * (AVG.HP21.2 - AVG.LP21.2) AND LP2 > HP1 AND LP2 > HP
Tweezer Top	HP = HP1 AND ABS.(CP - OP) < 0,2 * ABS.(CP1 - OP1) AND ABS.(CP1 - OP1) >= 0,9 * (HP1 - LP1) AND HP1 - LP1 >= 1,3 * (AV.HP20 - AV.LP20)
Two Crows	ABS.(CP2 - OP2) > 0,5 * (HP2 - LP2) AND CP2 > OP2 AND LP1 > HP2 AND CP1 < OP1 AND OP > CP1 AND OP < OP1 AND CP < CP2 AND CP > OP2
Upside Gap Two Crows	ABS.(CP2 - OP2) > 0,5 * (HP2 - LP2) AND CP2 > OP2 AND LP1 > HP2 AND

	CP1 < OP1 AND OP > OP1 AND CP < CP1 AND CP > HP2