



Best Candlesticks Pattern to Trade Stocks

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ABSTRACT

This research examines whether candlesticks patterns can predict trends swings. Our results indicate that well known 2 days “Engulfing” pattern have failed to produce a positive gain while the “Harami” pattern has barely succeeded to do so. A more complex patterns known as the “Kicker” barley achieved a positive average gain and was also outperform by the simple Buy and Hold (B&H) strategy. We found that the “Stairs” pattern developed here, has achieved a positive gain for all twenty examined stock and has outperformed the B&H strategy for sixteen out of the twenty stocks.

Keywords: Candlesticks Patterns, Trends, Algorithmic Trading, Stocks Investing

JEL Classifications: C1, M2

1. INTRODUCTION

One of the most important clues that most traders want is when a market is ending one trend and starting another so they can get on the new trend early. For this reason, traders use candlesticks patterns of different time frames and ranges. However, their efficiency to signal a real trend shift is debated by academics. Marshall et al. (2006) found that candlestick trading strategies do not have value for Dow Jones Industrial Average stocks. In their opinion, this is an evidence that this market is informationally efficient. Marshall et al. (2008) analyzing the Japanese stock market by dividing 100 stocks listed on the Tokyo Stock Exchange into three 10-year sub-periods. They find that candlesticks have no value for traders in the Japan stock market. Horton (2009) observes nine candlestick patterns for 349 stocks listed in the S&P 500 index and finds that the use of candlesticks patterns in trading individual stocks is not recommended. Fock et al. (2005) examined the predictive power of candlesticks by employing intraday rather than daily data. Their data are from the index futures on the German stock index and the futures on German government bonds. They investigate 19 patterns and find negative results. Furthermore, they find that the forecasting power of candlesticks can be improved by combining oscillators based technical analysis methods.

Tsung et al. (2012) investigated six 2-day reversal patterns in candlestick charting by using the Taiwan 50 component stocks. Out of six reversal patterns, they found that the bullish reversal patterns generally are more profitable than the bearish reversal patterns. Caginalp and Laurent (1998) argued that candlestick analysis has several advantages such as precise definitions of patterns and fixed time intervals of analysis. They found that most of the 3-day candlestick reversal patterns tested, appear to generate large profits. Nison (1991) and Pring (2002) stated that candlestick reversal patterns are notable when they occur in high-price or low-price areas. Shiu and Lu (2011) employed daily data on Taiwan 69 electronic securities and found that the Bearish “Harami” pattern possesses genuine predictive power. Goo et al. (2007) compared average returns of various patterns and holding days and find that investors can gain an average return of 9.99% by using the Bullish “Harami” pattern for a 10-day holding period. Meanwhile, the performance of candlesticks seems to be improved by implementing stop0loss strategies. Other researchers have confirmed that candlesticks patterns work better combined with other technical tools (Fock et al., 2005).

Because of the uncertainty implicit from the above literature, we used a different approach in the following research. First, we

used 10 years of daily data which is much longer period of time than previous researches and second, we programmed the tested candlestick patterns and developed algorithmic trading system that buy and sell according to the examined candlestick pattern. Using this methodology, enables us to examine whether trend shifts occur and are ongoing until a reversal pattern appears. Our data consists of daily open and close prices of twenty randomly selected popular U.S stocks. We started with two candlesticks (bars) pattern and then proceed to a more complex patterns using three to 5 days of trading. Our results show that well-known reversal pattern fail to predict trend shifts and provide evidence that a new pattern that was called here the “Stairs” patterns was successful in predicting prices shifts.

2. RESEARCH DESIGN AND RESULTS

We start by testing simple 2 days well known reversal patterns and then continue to more complex patterns. The results of our algorithmic trading results are presented as follows: (1) Net profit (NP) is the NP for all trades generated by the trading system. (2) Profit factor (PF) is defined as gross profit divided by gross losses, giving a reading as to the difference between the system’s gains and losses. For example: If the PF is equal to 1.2, it means that the system generated 20% more profits than losses. (3) Percent of profitable (PP) provides the information about the percentage of profitable trades in relation to all trades. If the PP is above 50%, more winning than losing trades have been generated by the trading system. However, this does not mean the NP of all trades is positive and vice versa a <50% PP does not mean that the trading system is losing money. Although it seems that the three profit indicators (PP, PF and NP) move together, in fact in real life systems they can vary dramatically and therefore may confuse investors and algorithmic trading planners. Our system will provide reversal information that it will be used automatically to buy or sell one stock at a time. In order to be able to evaluate the merits of the candlesticks patterns, we also calculate Buy and Hold (B&H) strategy for the entire period of the system trades.

We start our analysis with two well-known patterns that are based on two trading days that are called “Engulfing” and “Harami.”

2.1. Engulfing

A bullish “Engulfing” occurs when a large green bar¹ covers a previous red² bar and a bearish “Engulfing” occur when a large red bar covers a previous green bar, as demonstrated in Figures 1 and 2 and the results of running our algorithmic system described in Table 1.

Table 1 shows that the average PF is 0.89 which means that on average this strategy does not hold water as a reversal pattern. Moreover, out of the twenty stocks examines, for only four stocks the PF was above one and for only two stock (QCOM and C) our algorithmic trading system out performed a simple B&H strategy. Next, we are testing the famous “Harami” reversal pattern.

- 1 A green bar is formed when the daily closing price is higher than the opening price.
- 2 A red bar is formed when the daily opening price is higher than the close price.

2.2. Harami

Like the “Engulfing” pattern, an “Harami” pattern is also a 2 days pattern. A bullish “Harami” also occurs when a green bar follow a red bar. However, this time the red bar body covers entirely the following green bar. A bearish “Harami” folds when a small red bar follows a large green bar that cover its body entirely. The pattern is drawn in Figures 3 and 4, and the results of our simulations are summarized in Table 2.

Figure 1: Bullish engulfing

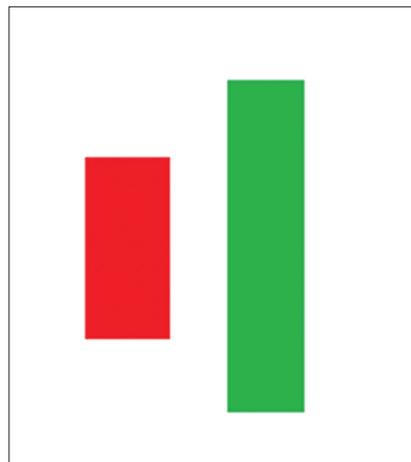


Figure 2: Bearish engulfing

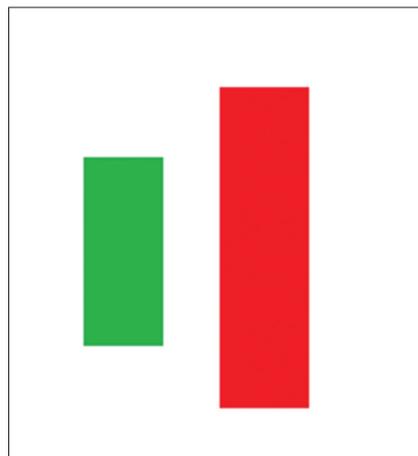


Figure 3: Bullish Harami

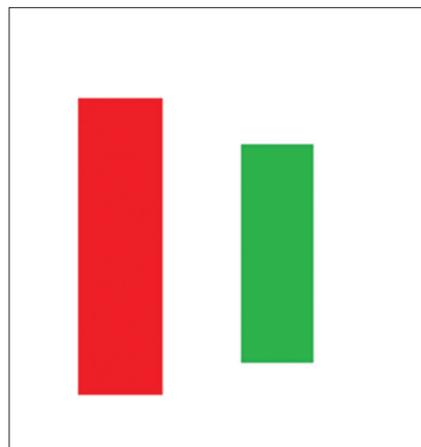


Table 1: Bullish and bearish “Engulfing” strategy versus B&H

Symbol	NP	PF	PP	N	FPD	B&H	NP-B&H
AAPL	43.20	1.16	39.42	274	30.1.09	202.67	-159.47
AMD	-9.40	0.95	48.53	204	2.1.09	13.45	-22.85
AMZN	134.26	1.07	44.30	228	22.1.09	1889.16	-1754.9
FB	-116.89	0.53	42.19	64	24.5.12	103.33	-220.22
INTC	-100.04	0.63	44.09	254	9.1.09	33.31	-133.35
MSFT	-94.57	0.66	39.30	257	9.1.09	90.53	-185.1
WMT	-89.04	0.71	39.83	241	12.2.12	46.27	-135.31
NFLX	11.87	1.02	49.45	182	12.1.09	326.40	-314.53
TSLA	-123.38	0.82	50.56	89	27.7.10	319.14	-442.52
BAC	-52.98	0.75	42.86	196	9.4.09	20.84	-73.82
C	605.69	1.52	44.26	183	26.1.09	37.38	568.31
GS	-261.35	0.74	45.14	175	24.2.09	156.97	-418.32
KO	-17.95	0.86	42.4	217	5.2.09	24.89	-42.84
QCOM	52.24	1.16	44.44	252	28.1.09	36.08	16.16
PFE	-13.86	0.91	46.73	214	16.1.09	26.51	-40.37
MCD	-77.13	0.76	39.71	204	15.5.09	114.88	-192.01
MRK	-54.66	0.84	45.21	292	20.3.09	43.75	-98.41
XOM	-31.55	0.88	43.56	202	7.1.09	4.69	-36.24
AXP	-14.05	0.95	44.86	214	3.2.09	88.7	-102.75
MA	-8.99	0.95	45.9	122	18.3.09	183	-191.99
Average	-10.929	0.8935	44.137	203.2		188.0975	-199.02
ST. D	166.21	0.22	3.19	58.01		411.58	418.60

NP: Net profit, PF: Profit factor, PP: Percent of profitable trends, FPD: First position entry date, B&H: Buy and hold net profit is calculated from the initial entry to a position until the end of the last close position, NP-B&H: The dollar value difference between the automated system result and B&H. AAPL: Apple, AMD: Advanced micro devices, AMZN: Amazon, FB: Facebook, INTC: Intel, MSFT: Microsoft, WMT: Walmart, NFLX: Netflix, TSLA: Tesla, BAC: Bank of America, C: Citigroup, GS: Goldman Sachs, KO: Coca Cola, QCOM: Qualcomm, PFE: Pfizer, MCD: McDonald's, MRK: Merck, XOM: Exxon Mobil, AXP: American express, MA: Mastercard

Table 2: Bullish and bearish Harami strategy versus B&H

Symbol	NP	PF	PP	N	FPD	B&H	NP-B&H
AAPL	45.08	1.18	51.05	286	30.1.09	202.67	-157.59
AMD	-118.96	0.54	43.81	194	2.1.09	13.54	-132.50
AMZN	35.73	1.02	51.79	251	8.1.09	1883.59	-1847.8
FB	-38.31	0.82	43.66	71	24.5.12	103.33	-141.64
INTC	44.81	1.20	58.27	278	9.1.09	33.31	11.50
MSFT	23.22	1.11	48.45	291	9.1.09	90.53	-67.31
WMT	-41.92	0.86	48.15	270	12.2.09	46.27	-88.19
NFLX	101.99	1.23	52.00	171	4.2.09	278.5	-176.51
TSLA	-335.74	0.64	52.94	85	25.8.10	245.45	-581.19
BAC	49.11	1.29	58.58	229	23.1.09	15.29	33.82
C	40.05	1.02	52.97	219	2.1.09	6.80	33.25
GS	125.49	1.13	50.89	224	5.1.09	115.54	9.95
KO	36.00	1.30	54.84	279	6.1.09	26.67	9.33
QCOM	-24.65	0.92	48.57	220	15.5.09	22.85	-47.5
PFE	-12.87	0.917	54.51	277	14.1.09	26.79	-39.66
MCD	115.11	1.46	58.70	276	26.2.09	128.44	-13.33
MRK	-9.62	0.97	50.00	306	12.2.09	39.96	-49.58
XOM	24.15	1.09	57.94	252	19.2.09	11.13	13.02
AXP	-11.14	0.96	49.66	296	10.2.09	92.87	-104.01
MA	40.16	1.24	53.85	117	23.3.09	191.12	-150.96
Average	4.38	1.04	52.03	229.6		178.73	-174.34
ST. D	98.27	0.23	4.41	69.83		409.69	416.32

NP: Net profit, PF: Profit factor, PP: Percent of profitable trends, FPD: First position entry date, B&H: Buy and hold net profit is calculated from the initial entry to a position until the end of the last close position, NP-B&H: The dollar value difference between the automated system result and B&H. AAPL: Apple, AMD: Advanced micro devices, AMZN: Amazon, FB: Facebook, INTC: Intel, MSFT: Microsoft, WMT: Walmart, NFLX: Netflix, TSLA: Tesla, BAC: Bank of America, C: Citigroup, GS: Goldman Sachs, KO: Coca Cola, QCOM: Qualcomm, PFE: Pfizer, MCD: McDonald's, MRK: Merck, XOM: Exxon Mobil, AXP: American express, MA: Mastercard

The results of our system set to trade according to the “Harami” reversal signal are better than the “Engulfing” results in terms of average PF, and NP. The PF of twelve out of twenty stocks is above one resulting in an average PF of 1.04. However, for only six stocks, our system generated higher gains than B&H strategy. Since most popular two bars have failed to predict trends scientifically enabling us to outperform the B&H strategy, we

turn to examine more complex pattern that are based on three till five candlesticks. One such reversal pattern is called by traders “Kicker” which is suppose to be able to predict trends shifts.

2.3. Kicker

Consecutive green candlesticks are usually a symbol of a positive price momentum while a consecutive red candlestick symbolizes

a negative price momentum. If a positive price momentum is followed by a red bar, it usually suggests that a down trend is beginning (bearish “kicker”). On the other hand, if a negative price momentum is followed by a green bar, a positive trend should begin (bullish “kicker”). Figures 5 and 6 demonstrates those trends shifts using four candlesticks.

When testing a complex pattern like “kicker,” we programed our system to use various number of bars to characterize this pattern and compared the results. Our system followed Equations 1 and 2 in order to generate buy and sell signals. A buy signal will be generated when:

$$C_{i=1...4} < O_{i=1...4} \text{ followed by } O_{i+1} < C_{i+1} \quad (1)$$

C=daily close price, O=daily open price and i=daily bar number.

A sell signal will be generated when:

$$C_{i=1...4} > O_{i=1...4} \text{ followed by } O_{i+1} > C_{i+1} \quad (2)$$

C=daily close price, O=daily open price and i=daily bar number.

Table 3 summarizes the results of our system for four bars bullish and bearish “Kickers.” It is important to note that using three or five bars did not improved the pattern performances.

The results of the four bars “kicker” based system have achieved a PF of 1.05 which is very close to the 1.04 achieved by the two bars “Harami” pattern. This means that the extra two bars did not add a predictive information to our system. Moreover, our system has outperformed the B&H strategy for only five stocks out of twenty. Not satisfied from the system results we have developed a pattern that we called the “stairs” because of its graphic images.

2.4. Stairs

In our view, when a green bar is followed by a number of a red bars, an uptrend swing should follow. On the other hand, when a red bar followed by a number of a green bars, it signals investors that a down trend will soon begin after the uptrend is exhausted. Our “Stairs” configuration is different from the above “Kicker” pattern in terms of the starting bar which signals that a turn around is on the horizon. Figures 7 and 8 show a three bars bullish and bearish “Stairs” patterns.

The buy and sell signals are based on Equations 3 and 4 and the results of three bars based algorithmic trading is summarized in Table 4. A buy signal will be generated when:

$$C_1 > O_1 \text{ followed by } C_{2...5} < O_{2...5} \quad (3)$$

C=daily close price, O=daily open price and i=daily bar number.

Figure 4: Bearish Harami

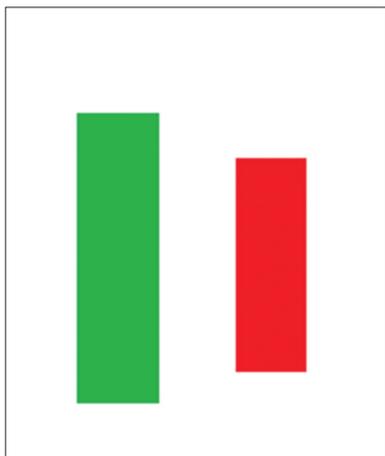


Figure 5: Four bars bullish kicker

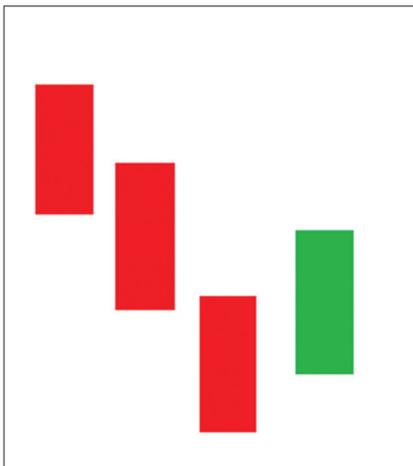


Figure 6: Four bars bearish kicker

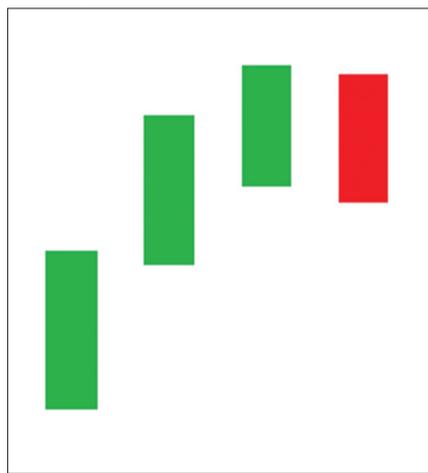
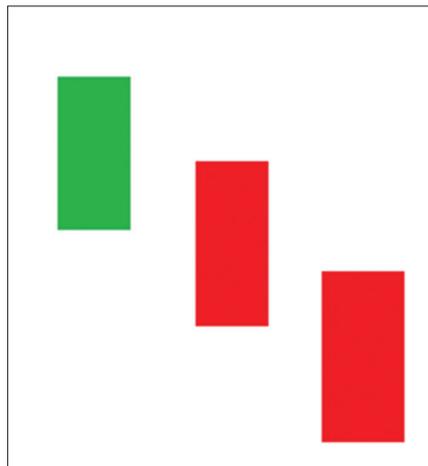


Figure 7: Three bars bullish stairs



A sell signal will be generated when:

$$C_1 < O_1 \text{ followed by } C_{2...5} > O_{2...5} \quad (4)$$

C=daily close price, O=daily open price and i=daily bar number.

Table 4 show that the system generated a PF of 1.31 which is much higher than the previous tested strategies with above one

PF for all examined twenty stocks. This means that all stocks were traded profitably by our system. The average NP of 10 years of algorithmic trading was 258.86\$³ while B&H strategy has generated an average profit of 163.6\$ during the same period of time. Moreover, our system has failed to outperform the B&H strategy for only four stocks (AAPL, AMZN, NFLX and MA).

3 The net profit presented here is based on one stock traded at a time.

Table 3: Four bars bullish and bearish kickers strategy versus B&H

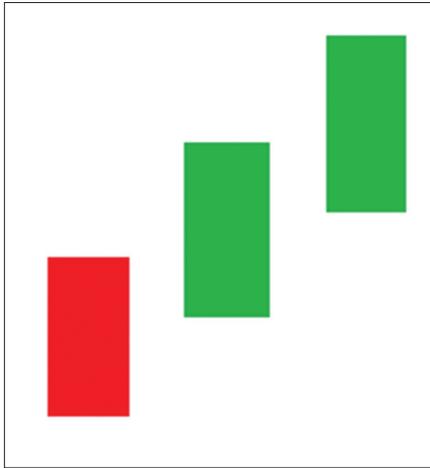
Symbol	NP	PF	PP	N	FPD	B&H	NP-B&H
AAPL	-176.75	0.63	56.69	208	30.1.09	167.06	-343.81
AMD	-74.79	0.79	58.16	221	8.1.09	17.48	-92.27
AMZN	620.43	1.25	59.03	152	6.1.09	1602.7	-982.27
FB	58.32	1.25	54.05	111	24.5.12	104.68	-46.36
INTC	-46.21	0.85	60.77	180	13.2.09	34.28	-80.49
MSFT	-39.77	0.86	54.42	168	8.1.09	92.69	-132.46
WMT	-11.64	0.96	56.30	175	24.2.09	45.47	-57.11
NFLX	-133.22	0.78	55.94	219	8.1.09	277.86	-411.08
TSLA	17.50	1.02	57.14	161	9.7.10	315.58	-298.08
BAC	-32.32	0.88	57.61	212	6.1.09	9.99	-42.31
C	-316.37	0.86	57.14	151	8.5.09	12.95	-329.32
GS	313.15	1.32	62.82	148	22.1.09	123.28	189.87
KO	39.91	1.22	58.73	193	6.1.09	26.38	13.53
QCOM	54.93	1.14	58.11	217	14.1.09	21.31	33.62
PFE	54.40	1.28	58.84	272	6.1.09	25.18	29.22
MCD	51.07	1.14	61.59	238	13.1.09	128.03	-76.96
MRK	10.83	1.23	59.47	221	6.1.09	47.17	-36.34
XOM	111.74	1.33	66.67	197	7.1.9	-2.53	114.27
AXP	37.18	1.09	59.97	216	8.1.09	87.97	-50.79
MA	39.15	1.18	59.57	175	2.1.09	182.18	-143.03
Average	28.88	1.05	58.65	191.75		165.99	-137.11
ST. D	185.71	0.21	2.90	37.59		349.60	250.75

NP: Net profit, PF: Profit factor, PP: Percent of profitable trends, FPD: First position entry date, B&H: Buy and hold net profit is calculated from the initial entry to a position until the end of the last close position, NP-B&H: The dollar value difference between the automated system result and B&H. AAPL: Apple, AMD: Advanced micro devices, AMZN: Amazon, FB: Facebook, INTC: Intel, MSFT: Microsoft, WMT: Walmart, NFLX: Netflix, TSLA: Tesla, BAC: Bank of America, C: Citigroup, GS: Goldman Sachs, KO: Coca Cola, QCOM: Qualcomm, PFE: Pfizer, MCD: McDonald's, MRK: Merck, XOM: Exxon Mobil, AXP: American express, MA: Mastercard

Table 4: Three bars bullish and bearish stairs strategy versus B&H

Symbol	NP	PF	PP	N	FPD	B&H	NP-B&H
AAPL	32.42	1.05	60.43	382	6.1.09	170.75	-138.33
AMD	57.69	1.12	61.63	417	13.1.09	19.35	38.34
AMZN	739.20	1.19	62.6	522	2.1.09	1562	-822.8
FB	214.6	1.69	60.52	271	25.5.12	100.92	113.68
INTC	107	1.26	61.30	523	27.1.09	34.43	72.57
MSFT	129.6	1.33	61.13	396	2.1.09	86.29	43.31
WMT	283	1.58	59.65	445	7.1.09	39.01	243.99
NFLX	93.55	1.12	60.76	688	13.1.09	283.70	-190.15
TSLA	599.39	1.47	61.17	358	2.7.10	322.99	276.4
BAC	24.61	1.06	59.37	517	2.1.09	12.35	12.26
C	1165.84	1.40	62.37	487	9.2.09	18.79	1147.05
GS	426.10	1.26	62.27	315	8.1.09	97.81	328.29
KO	57.51	1.19	57.74	421	7.1.09	26.89	30.62
QCOM	182.53	1.31	61.59	274	9.1.09	20.30	162.23
PFE	121.41	1.38	59.08	298	7.1.09	26.9	94.51
MCD	146.35	1.26	59.22	326	8.1.09	121.91	24.44
MRK	192.59	1.31	59.31	568	2.1.09	47.37	145.22
XOM	289.45	1.54	62.48	518	8.1.09	8.12	281.33
AXP	223.26	1.36	62.34	425	2.1.09	87.07	136.19
MA	91.06	1.25	59.55	238	5.1.09	185.04	-93.98
Average	258.86	1.31	60.73	419.45		163.60	95.26
ST. D	283.42	0.17	1.39	116.11		341.06	347.65

NP: Net profit, PF: Profit factor, PP: Percent of profitable trends, FPD: First position entry date, B&H: Buy and hold net profit is calculated from the initial entry to a position until the end of the last close position, NP-B&H: The dollar value difference between the automated system result and B&H. AAPL: Apple, AMD: Advanced micro devices, AMZN: Amazon, FB: Facebook, INTC: Intel, MSFT: Microsoft, WMT: Walmart, NFLX: Netflix, TSLA: Tesla, BAC: Bank of America, C: Citigroup, GS: Goldman Sachs, KO: Coca Cola, QCOM: Qualcomm, PFE: Pfizer, MCD: McDonald's, MRK: Merck, XOM: Exxon Mobil, AXP: American express, MA: Mastercard

Figure 8: Three bars bearish stairs

Testing the “Stairs” pattern using four and five bars did not improve the above reported results.

3. CONCLUSIONS

This research is trying to give rest to long lived debated question, can candlesticks patterns predict trends swings. In order to do so, we computerized an algorithmic trading system that gets into position when the tested reversal signal appears. This methodology enables us to examine the continuation of a trend shift after the appearance of a swing signal in a manner that can be exploited by traders. Our data contains 10 years of open and close prices of twenty popular U.S stocks that were selected randomly.

Our results indicate that well known 2 days “Engulfing” pattern have failed to produce a positive gain while the “Harami” pattern has barely succeeded to do so. Both reversal pattern failed to

outperform the B&H strategy. We also tested more complex patterns that are based on three till five consecutive bars and found that the “Kicker” pattern barley achieved a positive average gain and was also outperformed by the simple B&H strategy. Seeking for a winner pattern we have developed tested the “Stairs” pattern. This pattern has achieved a positive gain for all twenty examined stock and has outperformed the B&H strategy for sixteen out of the twenty stocks.

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