

How Reliable Are Candlesticks?

If you're a hard-numbers kind of trader, statistically oriented, you've probably always been suspicious of the candlestick technique. How reliable are they, you've probably asked. Here's your answer.

by Giovanni Maiani

In order to quantify the reliability of Japanese candlestick formations, I decided to conduct some statistical research. I found the most reliable of the simple candlestick patterns — those made up of a single candlestick — to be the dragonfly doji, hammer, inverted hammer, and rising window formations.

I analyzed 575 American stocks/bonds over a period of 15–20 years, from the early 1980s to the present. Using MetaStock's definition for candlestick patterns, those being international standards, I identified each candlestick formation and observed the trend starting from the day after the formation occurred. I looked for about 40 patterns and tabulated each trend's subsequent rise, decline, or neutral movement. My goal was to get statistical percentages on the most reliable candlestick formations.

RESULTS

In my studies, I found more than 6.14 million candlestick formations. This number may be unusually high because some of the simple formations such as the inverted hammer (or black marubozu)

CANDLESTICKS	# found	% of total	% of day after		
			Up	Down	=
White body	2003843	32.6	44.02	43.85	12.12
Hammer	776772	12.6	40.86	45.71	13.42
Black body	741653	12.1	45.89	46.06	8.01
Long upper shadow	531103	8.6	44.45	41.60	13.94
Inverted hammer	450521	7.3	46.91	41.22	11.86
Tweezer bottoms	255030	4.2	39.92	40.08	20.00
Tweezer tops	242824	4.0	40.51	40.49	19.00
Doji	171945	2.8	42.28	42.48	15.22
Long white body with small shadows	139147	2.3	45.90	46.25	7.83
Spinning top	134383	2.2	46.93	47.93	5.08
Dark cloud cover	4839	0.08	48.75	44.31	6.90
Bearish harami	3052	0.05	43.55	50.82	5.57
Bullish harami	2162	0.04	48.43	47.09	4.49
Long-legged doji	1318	0.02	42.15	41.93	15.85
Three white soldiers	235	0.00	35.74	53.62	10.64
Morning star doji	205	0.00	48.78	43.90	7.32
Evening star doji	180	0.00	40.56	53.33	6.11
Evening star	157	0.00	48.41	48.41	3.18
Morning star	150	0.00	47.33	50.67	2.00
Three black crows	102	0.00	67.65	27.45	4.90

FIGURE 1: Most frequent and least common candlestick formations.

CANDLESTICKS	% of day after			# found	% of total
	Up	Down	=		
Three black crows	67.65	27.45	4.90	102	0.0
Inverted black hammer	50.18	44.48	5.32	5429	0.1
Inverted hammer	49.81	44.84	5.30	12616	0.2
Shooting star	49.81	44.84	5.30	12616	0.2
On neckline	49.29	45.99	4.72	5717	0.1
Morning star doji	48.78	43.90	7.32	205	0.0
Dark cloud cover	48.75	44.31	6.90	4839	0.1
Bullish harami	48.43	47.09	4.49	2162	0.0
Evening star	48.41	48.41	3.18	157	0.0
Rising window	48.26	42.77	8.93	101003	1.6

FIGURE 2: Occurrences of the most reliable candlestick patterns.

CANDLESTICKS	% of day after			# found	% of total
	Up	Down	=		
Three white soldiers	35.74	53.62	10.64	235	0.0
Evening star doji	40.56	53.33	6.11	180	0.0
Bearish harami	43.55	50.82	5.57	3052	0.0
Hammer	43.97	50.71	5.25	14963	0.2
Hanging man	43.97	50.71	5.25	14963	0.2
Morning star	47.33	50.67	2.00	150	0.0
Long lower shadow	40.61	49.12	10.24	115131	1.9
Evening star	48.41	48.41	3.18	157	0.0
Spinning top	46.93	47.93	5.08	134383	2.2
Piercing line	45.31	47.87	6.82	8074	0.1

FIGURE 3: Candlestick patterns that are most accurate in anticipating a declining session.

CANDLESTICKS	% of day after			# found	% total
	Up	Down	=		
Gravestone doji	45.37	31.10	23.53	30218	0.5
Tweezer bottoms	39.92	40.08	20.00	255030	4.2
Tweezer tops	40.51	40.49	19.00	242824	4.0
Bullish harami cross	43.09	40.66	16.24	6746	0.1
Long-legged doji	42.15	41.93	15.85	1318	0.0
Bearish harami cross	41.32	43.00	15.68	8965	0.1
Doji	42.28	42.48	15.22	171945	2.8
Long upper shadow	44.45	41.60	13.94	531103	8.6
Hammer	40.86	45.71	13.42	776772	12.6
White body	44.02	43.85	12.12	2003843	32.6

FIGURE 4: Candlestick patterns that are most accurate in anticipating an unchanged session.

CANDLESTICKS	% of day after			% of total	Cumulative
	Up	Down	=		
White body	44.0	43.9	12.1	32.6	32.6
Hammer	40.9	45.7	13.4	12.6	45.3
Black body	45.9	46.1	8.0	12.1	57.4
Long upper shadow	44.5	41.6	13.9	8.6	66.0
Inverted hammer	46.9	41.2	11.9	7.3	73.3
Tweezer bottom	39.9	40.1	20.0	4.2	77.5
Tweezer top	40.5	40.5	19.0	4.0	81.4
Doji	42.3	42.5	15.2	2.8	84.2
Long white body with small shadows	45.9	46.3	7.8	2.3	86.5
Spinning top	46.9	47.9	5.1	2.2	88.7
Long lower shadow	40.6	49.1	10.2	1.9	90.6
Long black body with small shadows	48.0	44.3	7.7	1.7	92.3
Rising window	48.3	42.8	8.9	1.6	94.0
Falling window	43.2	47.0	9.7	1.5	95.5

FIGURE 5: Most frequently occurring candlestick patterns.

were counted twice if they became part of a larger, multiple-candlestick formation. Counting both simple and compound candlestick formations offers a complete, detailed, and effective analysis. Figure 1 displays the 10 most frequent and the 10 least common candlestick formations. The second column shows the percentage of the total found, and the last column shows the percentage that preceded a rise, fall, or sideways movement on the following day. Clearly, the white body is the most common candlestick, with more than two million occurrences. This represents 32.6% (nearly one-third) of the total. Second and third most common are the hammer and black body, with 12.6% and 12.1% of the total, respectively. These three figures represent more than half the candlestick formations. Note that while the white body appears almost one-third of the time, big white candles appear only 2% of the time.

At the bottom of the chart are the star formations: morning doji, evening doji, evening star, and morning star. These are quite rare, as are the three white soldiers and three black crow formations.

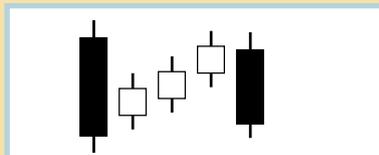
The last three columns in Figure 1 show how many up, down, or neutral days followed a candlestick formation. In 44.02% of the cases, a white body anticipated a rising session; in 43.85% of the cases a decline occurred; and 12.12% of the time the price did not change. The number of up days is almost the same as down days. I attribute this to the large number of occurrences, which tends to smooth out the results. Nevertheless, my results for the most reliable candlestick patterns can be seen in Figure 2.

Figure 2 does not take into consideration the total number of occurrences, or any percentage of the

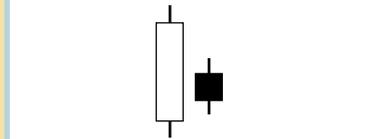
My study shows that generally, the rarer the pattern, the more likely it is to be accurate.

CANDLESTICK PATTERNS

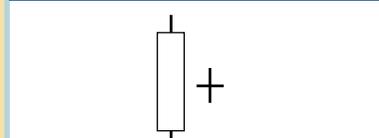
Below is a guide to some of the candlestick patterns discussed in this article.



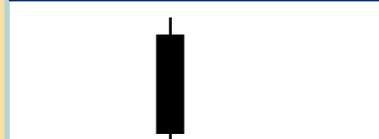
Bearish 3 Method Formation



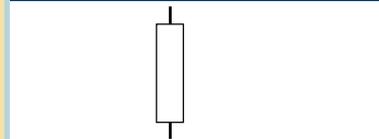
Bearish Harami



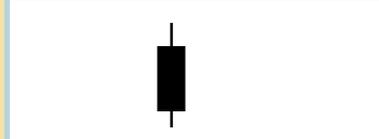
Bearish Harami Cross



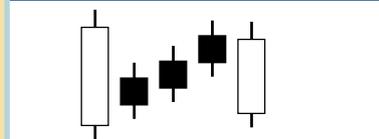
Big Black Candle



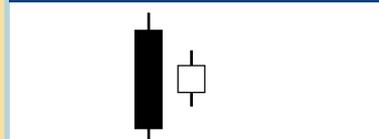
Big White Candle



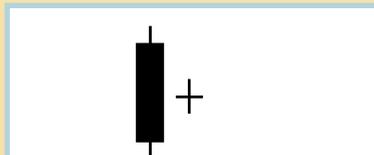
Black Body



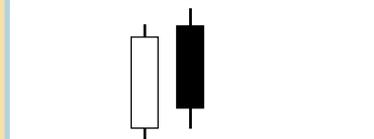
Bullish 3 Method Formation



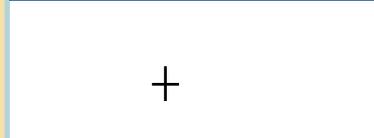
Bullish Harami



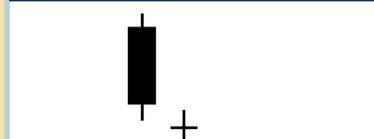
Bullish Harami Cross



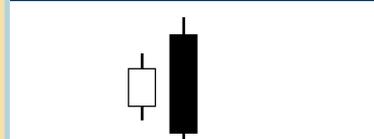
Dark Cloud Cover



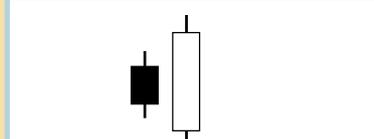
Doji



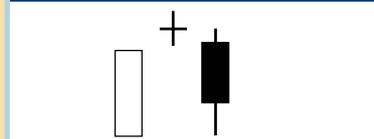
Doji Star



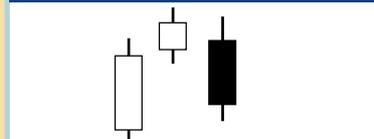
Engulfing Bearish Line



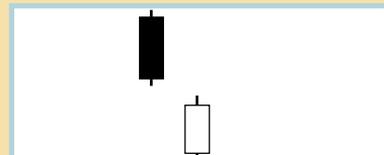
Engulfing Bullish Line



Evening Doji Star



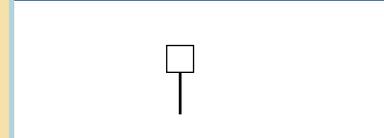
Evening Star



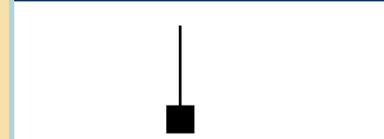
Falling Window



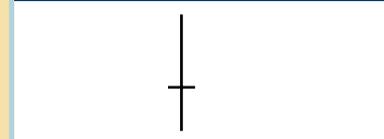
Gravestone Doji



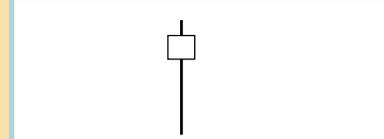
Hammer, Hanging Man



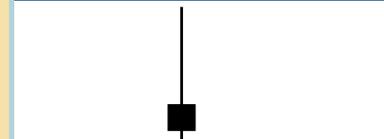
Inverted Black Hammer



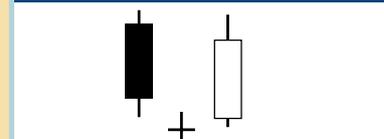
Long Legged Doji



Long Lower Shadow

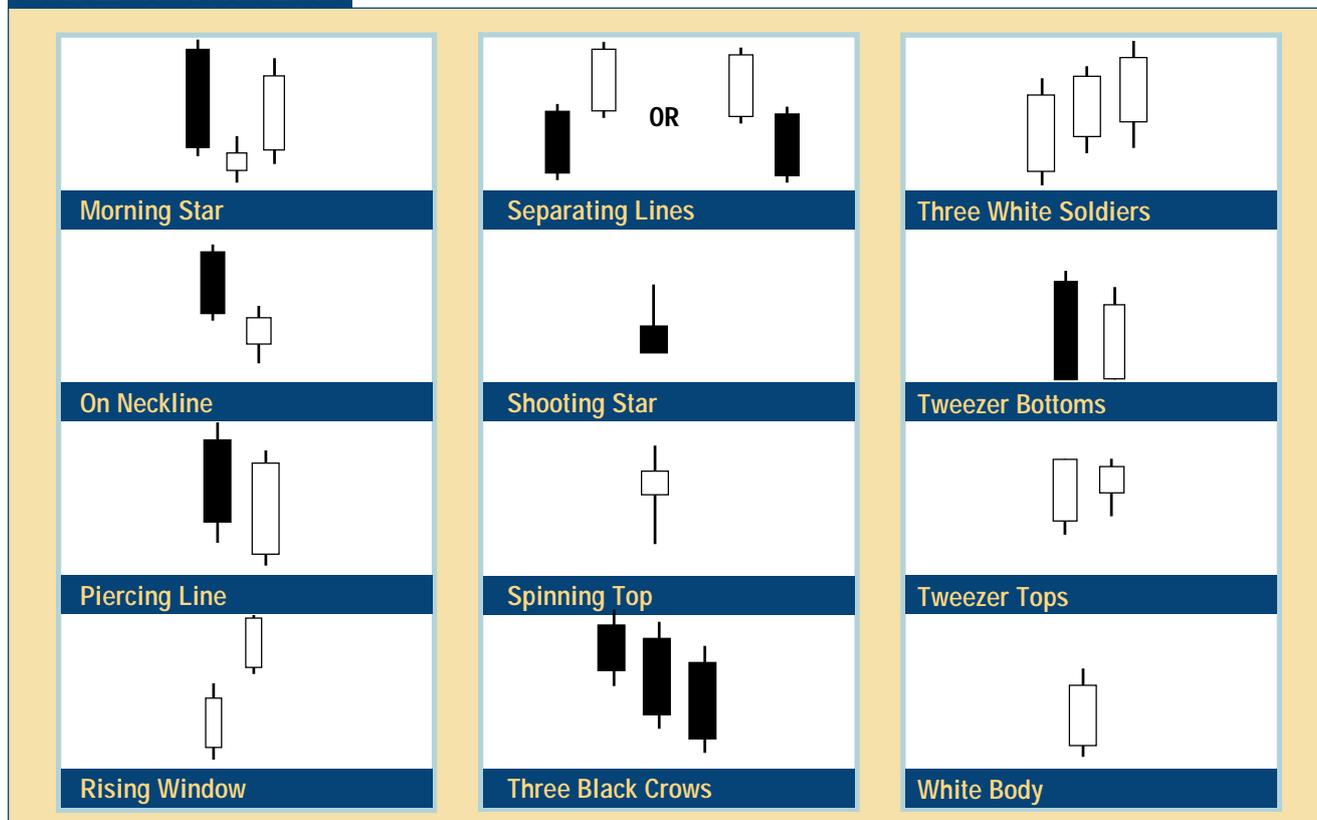


Long Upper Shadow



Morning Doji Star

CANDLESTICK PATTERNS



total, but only the percentage of rising versus falling sessions. This makes the candlesticks easier to compare with each other. From this standpoint, three black crows anticipates an up day 67.65% of the time, a down day 27.45%, and unchanged prices 4.90% of the time. But going back to the frequency of occurrences, how much can you benefit from a candlestick pattern that, although correct 68% of the time, has only occurred 102 times in 6.14 million sessions? You would get an accurate buy signal 0.001% of the time, or 69 times in 20 years of trading!

My study shows that generally the rarer the pattern, the more likely it is to be accurate. Let's see if this phenomenon also occurs in candlesticks anticipating declining sessions.

In the same way, in Figure 3 you see the 10 most accurate candlestick patterns to anticipate a declining session. In this case we find three white soldiers, the complement to three black crows, in first place. This pattern anticipated a down day 53.62% of the time, an up day 35.74% of the time, and for 10.64% the price remained unchanged. Also note that candlesticks predicting bearish reversals occur less frequently than those with bullish implications. Again, the larger the database, or the more frequent the occurrences, the more likely the pattern is to be statistically accurate. (In extreme cases, such as if a pattern only occurs once, it appears as either 100% accurate or inaccurate.)

Figure 4 shows the top 10 candlesticks to anticipate an unchanged session. At the top is the gravestone doji, which is accurate 23.53% of the time. This particular pattern doesn't appear to be any more reliable in predicting up or

down days either. The same applies to tweezer bottom and tweezer top formations, which in one-fifth of the cases anticipate an unchanged session. These candlesticks do occur quite frequently, however — 4.2% and 4.0% of the time, respectively.

Figure 5 shows the 14 most frequently occurring candlestick patterns. These represent 95.5% of the total found, but in only a few cases can they be used to anticipate the following day's session. Of these, the long lower shadow seems to be the most reliable. It is present 1.9% of the time, and anticipates a declining session 49.12% of the time and a rising session 40.61% of the time. Second-most reliable is the inverted hammer, with 46.91% of the following sessions rising, versus 41.2% declines. Third is the hammer, which is present 12.6% of the time; it precedes a decline 45.71% of the time, while a rising session occurs following 40.9% of hammers.

INTERNATIONAL COMPARISON

I have repeated my analysis for the international shares market and in all cases have found that the three most frequent candlestick formations are the white body, hammer, and black body. The results of these tests can be seen in Figure 6. I compared nine markets and found the three most frequently occurring candlestick patterns, their percentage of occurrence, and the rise, fall, or neutral movement of the stock on the following day.

I found that the three most frequently occurring patterns represented from 46.7% to 57.4% of all candlestick pattern occurrences for each market. These results are roughly the

same as those found in the US market.

CONCLUSION

The candlestick technique has been in use for hundreds of years. How useful the candlestick patterns are to the modern trader depends on the kind of trader you are. For traders who are quantitatively based, candlestick patterns are not terribly useful, while they are very useful to those who are more visual in nature.

Further, some candlestick patterns are more useful than others. The distribution of candlestick patterns, at least for the three most commonly occurring, has been consistent over time and through different markets. These three patterns are the white body, hammer, and black body. The analysis done in this article shows the reliability of these formations. When used in combination with indicators and other patterns, they can be a very powerful tool.

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SUGGESTED READING

Yamanaka, Sharon [2000]. "Stocks And The Art Of Charts," *Working Money*, November 22.

CANDLESTICKS	% of day after			% of total	Cumulative
	Up	Down	=		
America: 6141021					
White body	44.0	43.9	12.1	32.6	32.6
Hammer	40.9	45.7	13.4	12.6	45.3
Black body	45.9	46.1	8.0	12.1	57.4
Canada: 237951					
Black body	43.7	45.9	10.4	16.1	16.1
Hammer	39.3	45.0	15.7	16.1	32.2
White body	46.0	43.9	10.0	15.9	48.1
France: 900264					
White body	45.9	48.0	6.0	17.6	17.6
Black body	46.9	47.1	5.9	17.4	35.0
Hammer	41.0	48.8	10.1	14.5	49.5
Italy: 2296292					
White body	44.5	46.3	9.2	24.1	24.1
Hammer	40.1	44.7	15.2	21.0	45.1
Black body	46.3	50.3	3.3	8.3	53.4
Germany: 886450					
White body	45.9	48.1	5.9	18.1	18.1
Hammer	41.0	48.9	10.1	14.9	33.0
Black body	45.7	47.9	6.3	13.7	46.7
Hong Kong: 341373					
Black body	41.9	46.4	11.7	17.7	17.7
White body	44.1	45.0	10.8	16.0	33.7
Hammer	39.3	45.4	15.1	15.3	49.0
England: 2028075					
Hammer	39.2	37.7	23.0	16.6	16.6
Black body	38.4	46.6	14.9	16.4	33.0
White body	47.5	38.0	14.5	16.3	49.3
Nasdaq: 648745					
White body	44.4	44.3	11.3	24.3	24.3
Black body	47.2	46.5	6.3	18.5	42.8
Hammer	40.0	46.1	13.9	10.3	53.1
Tokyo: 1379115					
Black body	47.7	44.2	8.1	20.1	20.1
White body	40.6	51.8	7.5	17.4	37.5
Hammer	39.2	51.0	9.8	13.8	51.3

FIGURE 6: Most frequent candlestick patterns across international markets.

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