

Open-High-Low-Close Candlestick Plot (Statlet)

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Summary

The **Open-High-Low-Close Candlestick Plot** Statlet is designed to plot security prices in a manner often used by stock traders. It shows the opening price for each trading session, high and low prices during the session, and the closing price using a graphical image often referred to as a candlestick. Trading volumes may also be displayed as bars along the bottom of the plot.

In addition to the raw data, a smoother may be added to the plot using either a simple moving average or an exponentially weighted moving average. Trading bands may be plotted around the smoothed line at either a fixed percentage or using the method developed by Bollinger. The %b statistic is calculated to measure where the closing price lies with respect to the bands. A bandwidth is also calculated to measure volatility.

Sample StatFolio: *openhighlowclose.sgp*

Sample Data

The file *AAPL.sgd* contains information about the price of common stock for Apple, Inc. during several months in 2011. The first several rows of that file are shown below:

<i>Date</i>	<i>Open</i>	<i>High</i>	<i>Low</i>	<i>Close</i>	<i>Volume</i>
1/3/11	325.64	330.26	324.84	329.57	15897800
1/4/11	332.44	332.50	328.15	331.29	11038600
1/5/11	329.55	334.34	329.50	334.00	9125700
1/6/11	334.72	335.25	332.90	333.73	10729600
1/7/11	333.99	336.35	331.90	336.12	11140400
1/10/11	338.83	343.23	337.17	342.45	16020000
1/11/11	344.88	344.96	339.47	341.64	15861000
1/12/11	343.25	344.43	342.00	344.42	10806800
1/13/11	345.16	346.64	343.85	345.68	10599300
1/14/11	345.89	348.48	344.44	348.48	11030000
1/18/11	329.52	344.76	326.00	340.65	67178500
1/19/11	348.35	348.60	336.88	338.84	40557600

Data Input

The data to be analyzed are specified on the following data input dialog box:

Each row of the datasheet is assumed to contain data for a single trading session. Enter the names of the columns that contain:

- **Opening Values:** the opening price at the start of each session.
- **High Values:** the highest price during each session.
- **Low Values:** the lowest price during each session.
- **Closing Values:** the closing price at the end of each session.
- **Volume:** the number of shares traded during each session (optional).
- **Time indices:** time, date or other index associated with each session. Each value in this column must be unique and arranged in either ascending or descending order.
- **Select:** subset selection.

Statlet

The output of this procedure is displayed in a dynamic Statlet window:



For each trading session, the plot shows a candlestick, colored green if the price rose during the session or red if the price fell. The solid part of the candlestick covers the distance between the opening and closing prices, while the lines extend outward to the high and low prices. If volumes are provided, they are shown as bars along the bottom of the graph. The data for the most recent trading session is shown to the right of the graph.

Plot type

This field determines the manner in which the data are displayed. Instead of a candlestick plot, the closing prices only may be plotted by selecting “Close line”.

Smoother

Two types of smoothers may be added to the plot. The first is a simple moving average, which shows the average of the most recent N observations. If X_t is the closing price at time t , then the moving average at time t is calculated from

$$MA_t = \frac{\sum_{i=0}^{N-1} X_{t-i}}{N} \quad (1)$$

The default value for N is 20, but it may be changed using the leftmost slider. The second type of smoother is an exponentially weighted moving average, calculated from

$$EWMA_t = \alpha X_t + (1 - \alpha)EWMA_{t-1} \quad (2)$$

The EWMA at time $t = 1$ is initialized using a method called “backforecasting”, in which the closing prices are smoothed backwards in time to give an initial value for $t = 0$. The default value for α is 0.1, but it may be changed using the second slider.

Trading bands

Trading bands may be added above and below the smooth. Such bands are often used to trigger buy and sell actions. The simplest type of bands are drawn at a *fixed percentage* of the smoothed value, such as $\pm 4\%$. Another type of widely used bands are the so-called *Bollinger bands*. These bands are plotted at $\pm K\sigma_N$ where σ_N is the square root of the mean squared error calculated by applying either a simple moving average or an exponentially weighted moving average to the squared differences between the closing prices and the smoothed values. If a simple moving average is used, then

$$\sigma_N = \sqrt{\frac{\sum_{i=0}^{N-1} (X_{t-i} - MA_{t-i})^2}{N}} \quad (3)$$

Buy-Sell Indicators

Two indicators are also calculated and may be plotted on the graph if desired. The first indicator is called %b and is calculated from

$$\%b = \frac{X_t - \text{lowerband}}{\text{upperband} - \text{lowerband}} \quad (4)$$

It shows the relative location of the closing price within the bands, where $\%b = 0$ at the lower band and $\%b = 1$ at the upper band.

The second indicator is called *bandwidth* and is calculated from

$$BW = \frac{\text{upperband} - \text{lowerband}}{\text{smoothedvalue}} \quad (5)$$

Similar to a coefficient of variation, a relatively large value of BW implies that the stock price has been changing rapidly in the recent past.

Cursor location

The data corresponding to a particular trading period (indicated by a vertical line) are displayed to the right of the main plot. The *cursor location* scrollbar changes the period for which the data are displayed.

Show alerts

Alerts may be generated whenever the data values for the last period plotted are unusual. If the *show alerts* checkbox is checked, any alerts defined for the current StatFolio will be generated. To select the types of alerts that will be generated, go to *Tools* on the main Statgraphics menu and select *StatFolio Alerts*. A detailed description of the available alerts is contained in the PDF document titled *StatFolio Alerts*.

References

Bollinger, J. (2001). *Bollinger on Bollinger Bands*. New York: McGraw Hill.