Using Bollinger Bands

by John Bollinger

Trading bands, which are lines plotted in and around the price structure to form an envelope, are the action of prices near the edges of the envelope that we are interested in. It's not the newest of ideas, but as John Bollinger of Bollinger Capital Management points out, it's one of the most powerful concepts available to the technically based investor, answering not whether absolute buy and sell signals are being given but whether prices are high or low on a relative basis. Trading bands can forewarn whether to buy or sell by using indicators to confirm price action. How do trading bands work? Bollinger, of Bollinger Bands fame, explains how.

Trading bands are one of the most powerful concepts available to the technically based investor, but they do not, as is commonly believed, give absolute buy and sell signals based on price touching the bands. What they do is answer the perennial question of whether prices are high or low on a relative basis. Armed with this information, an intelligent investor can make buy and sell decisions by using indicators to confirm price action.

But before we begin, we need a definition of what we are dealing with. Trading bands are lines plotted in and around the price structure to form an "envelope". It is the action of prices near the edges of the envelope that we are particularly interested in. The earliest reference to trading bands I have come across in technical literature is in *The Profit Magic of Stock Transaction Timing*; author J.M. Hurst's approach involved the drawing of smoothed envelopes around price to aid in cycle identification. Figure 1 shows an example of this technique Note in particular the use of different envelopes for cycles of differing lengths.
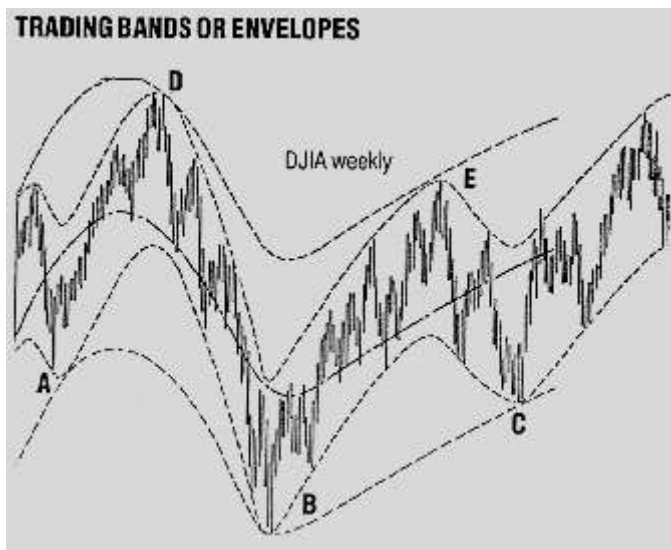
FIGURE 1: *The trading bands or envelopes are first drawn by hand over the price series. An average width is determined by measuring the distance from the top and bottom of the bands.*

Asking the market what is happening is always a better approach than telling the market what to do.

The next major development in the idea of trading bands came in the mid- to late 1970s, as the concept of shifting a moving average up and down by a certain number of points or a fixed percentage to obtain an envelope around price gained popularity, an approach that is still employed by many. A good example appears in Figure 2, where an envelope has been constructed around the Dow Jones Industrial Average (DJIA). The average used is a 21-day simple moving average. The bands are shifted up and down by 4%.

The procedure to create such a chart is straightforward. First, calculate and plot the desired average. Then calculate the upper band by multiplying the average by 1 plus the chosen percent $(1 + 0.04 = 1.04)$. Next, calculate the lower band by multiplying the average by the difference between 1 and the chosen percent $(1 - 0.04 = 0.96)$. Finally, plot the two bands. For the DJIA, the two most popular averages are the 20- and 21-day averages and the most popular percentages are in the 3.5 to 4.0 range.

CHAIKIN'S INNOVATION

The next major innovation came from Marc Chaikin of Bomar Securities, who, in attempting to find some way to have the market set the band widths rather than the intuitive or random-choice approach used before, suggested that the bands be constructed to contain a fixed percentage of the data over the past year. He stuck with the 21-day average and suggested that the bands ought to contain 85% of the data. Bomar bands were the result. Figure 3 depicts this powerful and still very useful approach. The width of the bands is different for the upper and lower bands. In a sustained bull move, the upper band width will expand and the lower band width will contract. The opposite holds true in a bear market. Not only does the total band width change across time, the displacement around the average changes as well.

BOLLINGER'S BRAINSTORM

Asking the market what is happening is always a better approach than telling the market what to do. In the late 1970s, while trading warrants and options and in the early 1980s, when index option trading started, I focused on volatility as the key variable. To volatility, then, I turned again to create my own approach to trading bands. I tested any number of volatility measures before selecting standard deviation as the method by which to set band width. I became especially interested in standard deviation because of its sensitivity to extreme deviations. As a result, Bollinger Bands are extremely quick to react to large moves in the market.

Bollinger Bands are plotted two standard deviations above and below a simple moving average. The data used to calculate the standard deviation are the same data as those used for the simple moving average. In essence, you are using moving standard deviations to plot bands around a moving average. The time frame for the calculations is such that it is descriptive of the intermediate term trend. (See Figure 4 for a precise mathematical definition and the formula.)

Figure 5 again depicts the DJIA, this time with Bollinger Bands. Note the bands' responsiveness to changing market conditions. The width of the bands varies by more than three times from point A to point B; note that many reversals occur near the bands and that the average provides support and resistance in many cases.
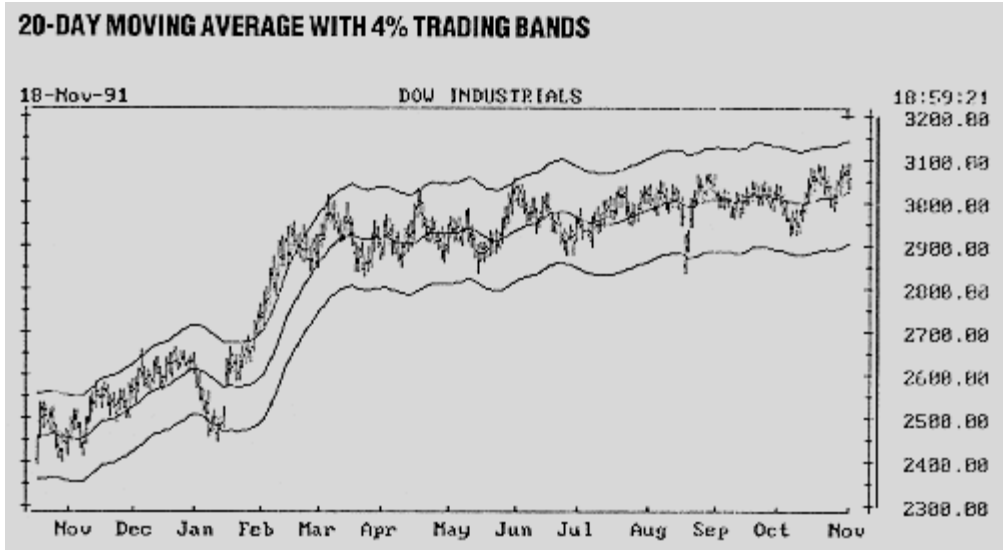
20-DAY MOVING AVERAGE WITH 4% TRADING BANDS

18-Nov-91   DOW INDUSTRIALS   18:59:21
3200.88
3188.88
3888.88
2988.88
2888.88
2788.88
2688.88
2588.88
2488.88
2388.88

Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov

FIGURE 2: *The concept emerged in the 1970s of shifting a moving average up and down by a certain number of points or a fixed percentage to obtain an envelope around price. Here, an envelope has been constructed around the Dow Jones Industrial Average (DJIA). The average used is a 21-day simple moving average. The bands are shifted up and down by 4%.*
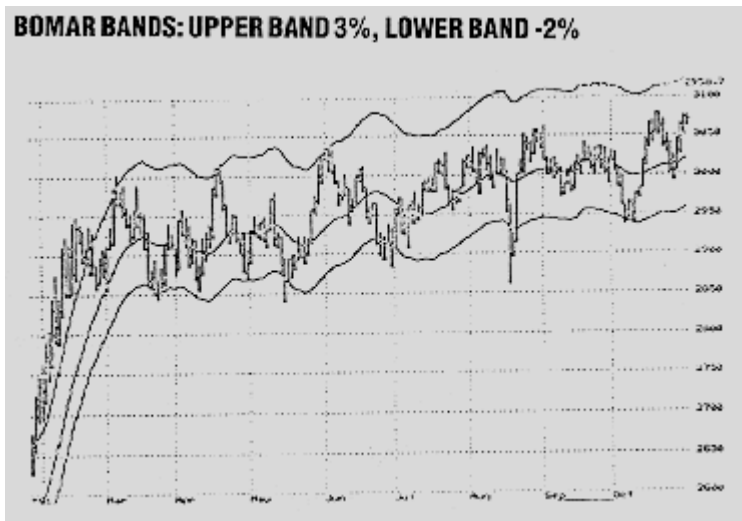
BOMAR BANDS: UPPER BAND 3%, LOWER BAND -2%

FIGURE 3: *Marc Chaikin, to find some way to have the market set the band widths rather than the intuitive approach used before, suggested that the bands be constructed to contain a fixed percentage of the data over the past year. He stuck with the 21-day average and suggested that the bands ought to contain 85% of the data. Bomar bands were the result.*

BOLLINGER BAND FORMULAS

$$\sigma = \sqrt{\dfrac{\sum\limits_{j=1}^{N}(X_j - \overline{X})^2}{N}}$$

$$\overline{X} = \dfrac{\sum\limits_{j=1}^{N}X_j}{N}$$

Upper band $= \overline{X} + 2\sigma$

Middle band $= \overline{X}$

Lower band $= \overline{X} - 2\sigma$

FIGURE 4: *Bollinger Bands are plotted two standard deviations above and below a simple moving average. The data used to calculate the standard deviation are the same data as those used for the simple moving average. In essence, you are using moving standard deviations to plot bands around a moving average. The time frame for the calculations is such that it is descriptive of the intermediate-term trend. For the mathematically inclined, the middle band is the n-day mean. The upper band is the n-day mean plus twice the root mean squared deviation from that mean, while the lower band is the n-day mean minus twice the root mean squared deviation from that mean where n is chosen such that it describes the intermediate-term trend.*
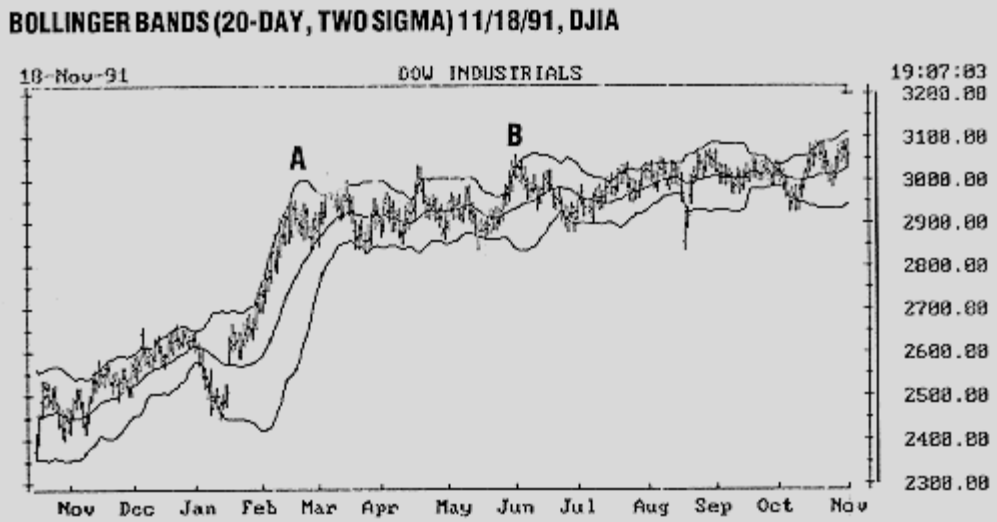
BOLLINGER BANDS (20-DAY, TWO SIGMA) 11/18/91, DJIA

FIGURE 5: *Here is the DJIA, this time with Bollinger Bands. Note the bands ' responsiveness to changing market conditions. The width of the bands varies by more than three times from point A to point B, note also that many reversals occur near the bands and that the average provides support and resistance in many cases.*
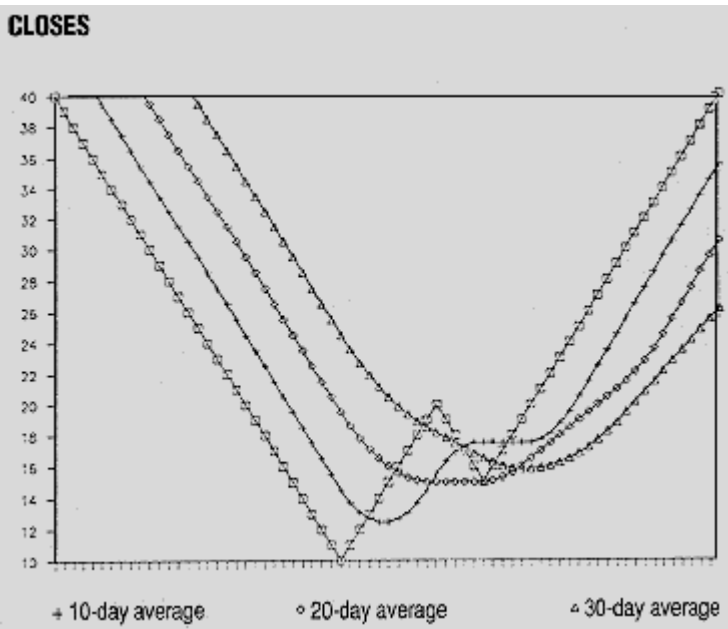

FIGURE 6: *The easiest way to identify the proper average is to choose one that provides support to the correction of the first move up off a bottom. U the average is penetrated by the correction, then the average is too short. If, in turn, the correction falls short of the average, then the average is too long. An average that is currently chosen will provide support far more often than it is broken.*

There is great value in considering different measures of price. The typical price, (high + low + close) / 3, is one such measure that I have found to be useful. The weighted close, (high + low + close + close) / 4, is another. To maintain clarity, I will confine my discussion of trading bands to the use of closing prices for the construction of bands. My primary focus is on the intermediate term, but short- and long-term applications work just as well. Focusing on the intermediate trend gives one recourse to the short and long-term arenas for reference, an invaluable concept.

For the stock market and individual stocks, a 20-day period is optimal for calculating Bollinger Bands. It is descriptive of the intermediate-term trend and has achieved wide acceptance. The short-term trend seems well served by the 10-day calculations and the long-term trend by 50-day calculations.

The average that is selected should be descriptive of the chose; time frame. This is almost always a different average length than the one that proves most useful for crossover buys and sells. The easiest way to identify the proper average is to choose one that provides support to the correction of the first move up off a bottom. If the average is penetrated by the correction, then the average is too short. If, in turn, the correction falls short of the average, then the average is too long. An average that is correctly chosen will provide support far more often than it is broken. (See Figure 6.)

Bollinger Bands can be applied to virtually any market or security. For all markets and issues, I would use a 20-day calculation period as a starting point and only stray from it when the circumstances compel me to do so. As you lengthen the number of periods involved, you need to increase the number of standard deviations employed. At 50 periods, two and a half standard deviations are a good selection, while at 10 periods one and a half do the job quite well.

In most cases, the nature of the periods is immaterial; all seem to respond to correctly specified Bollinger Bands. I have used them on monthly and quarterly data, and I know many traders apply them on an intraday basis.

ANSWERING THE QUESTIONS

Trading bands answer the question whether prices are high or low on a relative basis. The matter actually centers on the phrase "a relative basis." Trading bands do not give absolute buy and sell signals simply by having been touched; rather they provide a framework within which price may be related to indicators.

Some older work stated that deviation from a trend as measured by standard deviation from a moving average was used to determine extreme overbought and oversold states. But I recommend the use of trading bands as the generation of buy, sell and continuation signals through the comparison of an additional indicator to the action of price within the bands.

Bollinger Bands can be applied to virtually any market or security. For all markets and issues, I would use a 20-day calculation period as a starting point and only stray from it when the circumstances compel me to do so.

If price tags the upper band and indicator action confirms it, no sell signal is generated. On the other

hand, if price tags the upper band and indicator action does not confirm (that is, it diverges), we have a sell signal. The first situation is not a sell signal; instead, it is a continuation signal if a buy signal was in effect.

It is also possible to generate signals from price action within the bands alone. A top (chart formation) formed outside the bands followed by a second top inside the bands constitutes a sell signal. There is no requirement for the second top's position relative to the first top, only relative to the bands. This often helps in spotting tops where the second push goes to a nominal new high. Of course, the converse is true for lows.

INTRODUCING %B AND BAND WIDTH

An indicator derived from Bollinger Bands that I call %b can be of great help, using the same formula that George Lane used for stochastics. The indicator %b tells us where we are within the bands. Unlike stochastics, which are bounded by 0 and 100, %b can assume negative values and values above 100 when prices are outside of the bands. At 100 we are at the upper band, at 0 we are at the lower band, above 100 we are above the upper bands and below 0 we are below the lower band. See Figure 7 for the exact formula.

Indicator %b lets us compare price action to indicator action. On a big push down, suppose we get to -20 for %b and 35 for relative strength index (RSI). On the next push down to slightly lower price levels (after a rally), %b only falls to 10, while RSI stops at 40. We get a buy signal caused by price action within the bands. (The first low came outside of the bands, while the second low was made inside the bands.) The buy signal is confirmed by RSI, as it did not make a new low, thus giving us a confirmed buy signal.

T rading bands and indicators are both good tools, but when they are combined, the resultant approach to the markets becomes powerful. Band width, another indicator derived from Bollinger Bands, may also interest traders. It is the width of the bands expressed as a percent of the moving average. When the bands narrow drastically, a sharp expansion in volatility usually occurs in the very near future. For example, a drop in band width below 2% for the Standard & Poor's 500 has led to some spectacular moves. The market most often starts off in the wrong direction after the bands tighten prior to really getting under way, of which January 1991 is a good example (Figure 9).

AVOIDING MULTIPLE COUNTS

A cardinal rule for the successful use of technical analysis requires avoiding multicolinearity amid indicators. Multicolinearity is simply the multiple counting of the same information. The use of four different indicators all derived from the same series of closing prices to confirm each other is a perfect example.

So one indicator derived from closing prices, another from volume and the last from price range would provide a useful group of indicators. But combining RSI, moving average convergence/divergence (MACD) and rate of change (assuming all were derived from closing prices and used similar time spans) would not. Here are, however, three indicators to use with bands to generate buys and sells without running into problems. Amid indicators derived from price alone, RSI is a good choice. Closing prices

%b

$$\%b = \frac{\text{close - lower band}}{\text{upper band - lower band}}$$

$$\text{Band width} = \frac{\text{upper band - lower band}}{\text{middle band}}$$

FIGURE 7: *This indicator tells us where we are within the bands. Unlike stochastics, which are bounded by 0 and 100, %b can assume negative values and values above 100 when prices are outside of the bands. At 100 we are at the upper band at 0 we are at the lower band, above 100 we are above the upper bands and below 0 we are below the lower band. Also shown is the formula for band width.*
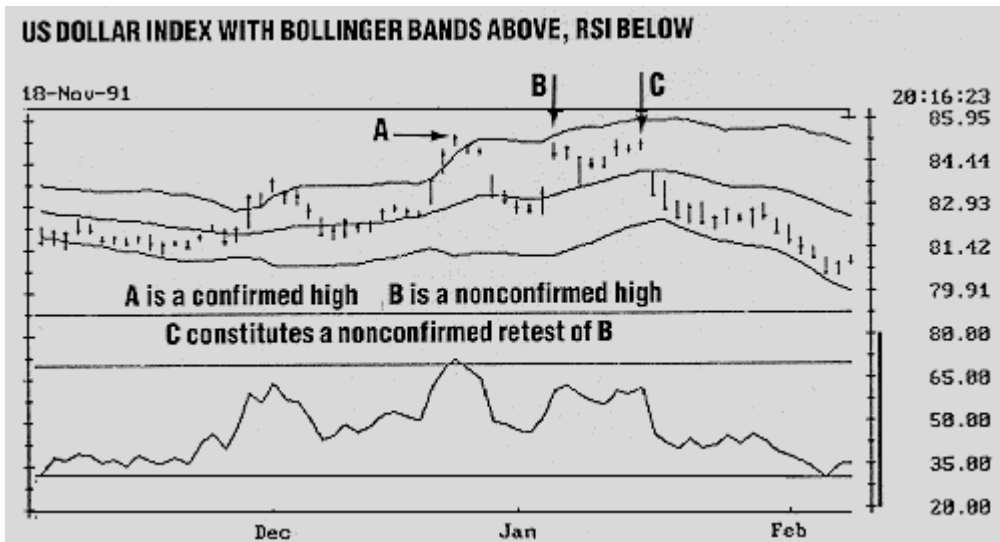

US DOLLAR INDEX WITH BOLLINGER BANDS ABOVE, RSI BELOW

FIGURE 8: *Selecting the relative strength index (RSI) as our confirming indicator, we can observe that at A, the dollar index moved above the upper band while the RSI made a new high (confirmation). At B, the dollar index edged close to the upper band while the RSI failed to confirm (divergence). C constitutes a nonconfirmed retest of B.*
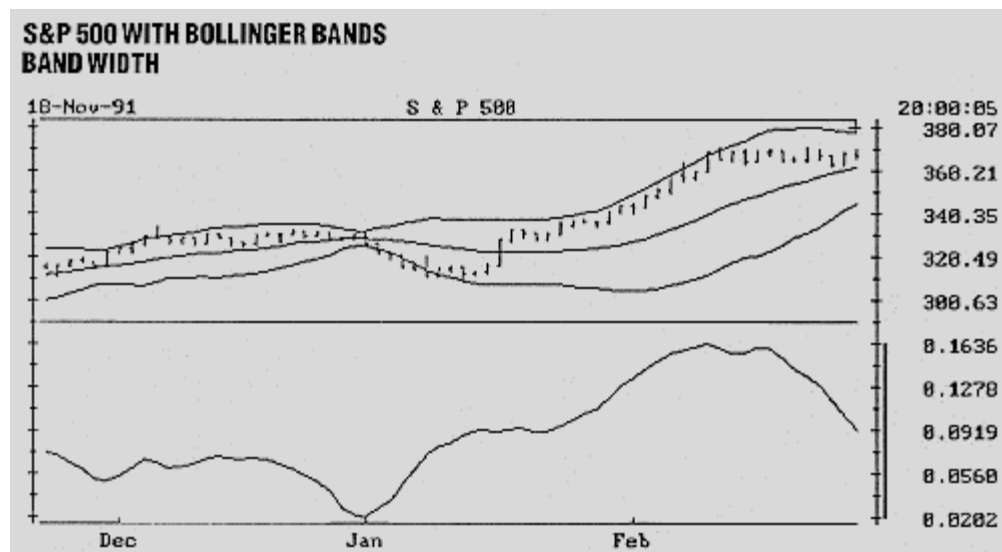
FIGURE 9: *When the band width indicator falls, the implication is that volatility is declining. At some point, the volatility returns. A drop in the band width to below 2% for the S&P 500 has led to some spectacular moves (such as January).*

and volume combine to produce on-balance volume, another good choice. Finally, price range and volume combine to produce money flow, again a good choice. None is too highly colinear and thus together combine for a good grouping of technical tools. Many others could have been chosen as well: MACD could be substituted for RSI, for example.

The Commodity Channel Index (CCI) was an early choice to use with the bands, but, as it turned out, it was a poor one, as it tends to be colinear with the bands themselves in certain time frames. The bottom line is to compare price action within the bands to the action of an indicator you know well. For confirmation of signals, you can then compare the action of another indicator, as long as it is not colinear with the first.

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FOR FURTHER READING

Hurst, J.M. [1970]. *The Profit Magic of Stock Transaction Timing*, Prentice-Hall.

Star, Barbara [1992] . "The Commodity Channel Index," STOCKS & COMMODITIES, February.