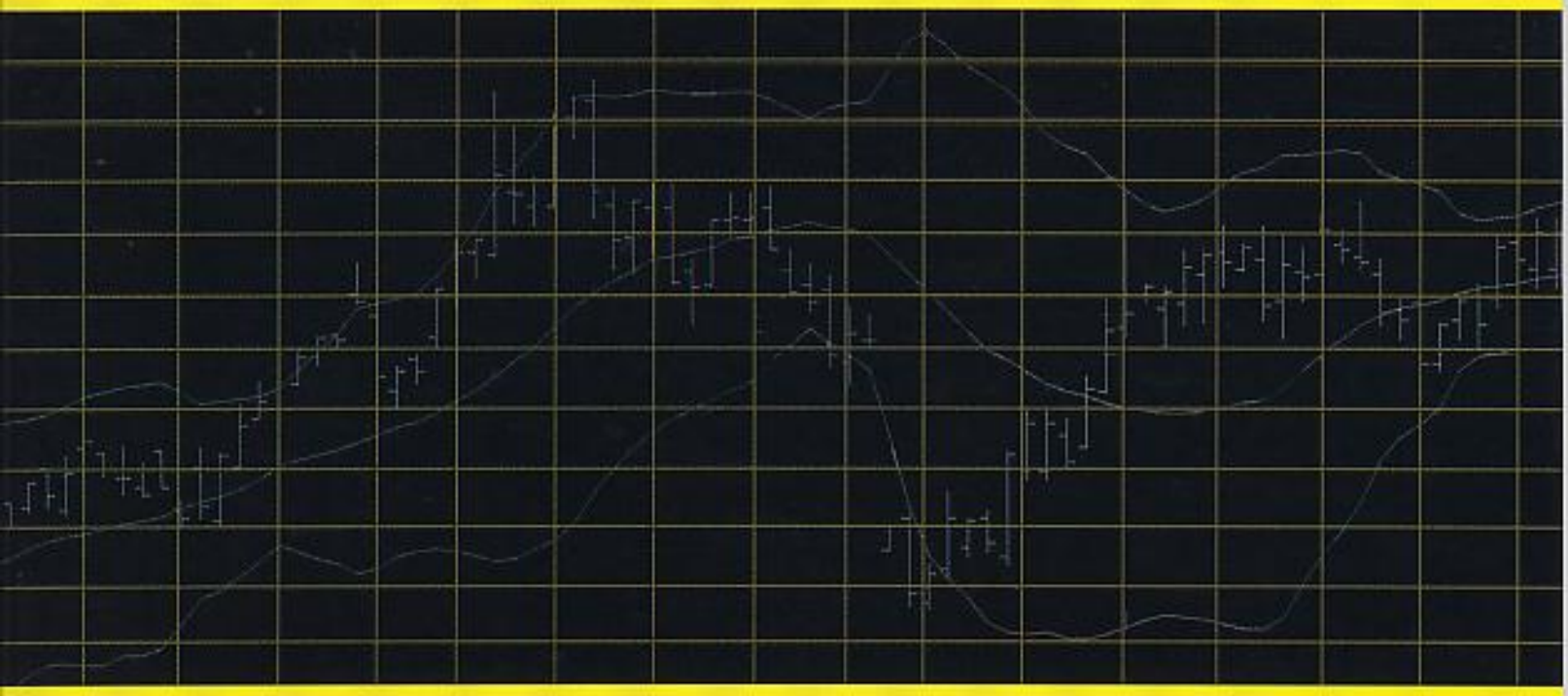
Understanding Bollinger Bands



Edward D. Dobson

TRADERS PRESS INC.

1975 ~ 2000
25th Anniversary

TRADING SOFTWARE

FOR SALE & EXCHANGE

www.trading-software-collection.com

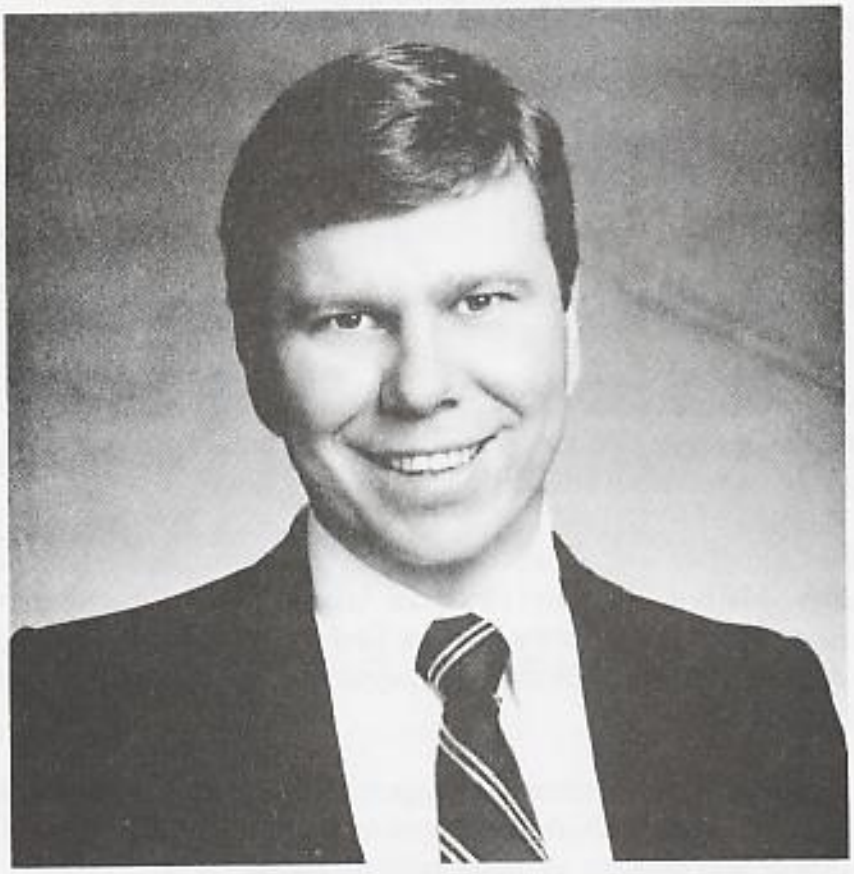
Mirrors:

www.forex-warez.com
www.traders-software.com
www.trading-software-download.com

Join My Mailing List

This booklet is dedicated to

John Bollinger,
the creator of Bollinger Bands
and the chief contributor to the material presented herein.



John Bollinger, CFA, CMT

John Bollinger, CFA, CMT, is the president and founder of Bollinger Capital Management, Inc. an investment management company that provides technically driven money management services to individuals and pension funds

Mr. Bollinger was the Chief Market Analyst for ten years for Financial News Network, a nationwide cable network. He continues to present occasional market analysis and commentary on CNBC, FNN's successor.

His specialty is market model construction. His better known market models include a model which forecasts changes in the Federal Reserve Board's discount rate and a technical asset allocation model for individual investors.

John Bollinger is probably best known for his Bollinger Bands which have been widely accepted and integrated into most analytical software currently in use.

After purchasing his first micro computer in 1977, Mr. Bollinger became involved in the seminal stages of computer driven market analysis. Today he continues to write some of his own software and also makes use of a number of commercial analysis packages.

He graduated from the School of Visual Arts majoring in cinematography and started studying the market shortly thereafter. He is a Chartered Financial Analyst (CFA), Chartered Market Technician (CMT), and is on the Board of Directors of the Market Technicians Association. Mr. Bollinger is also a member of the Los Angeles Society of Financial Analysts and was the founding president of Market Analysts of Southern California.

Bollinger Capital Management is an investment management company that provides technically driven money management services to individuals and pension plans. John Bollinger, CFA, CMT, is the principal investment officer and governs all investment decisions.

Bollinger Capital Management also publishes a newsletter, ***John Bollinger's Capital Growth Letter***. It is published monthly and updated via telephone hotline twice a week. Bollinger Band numbers are available daily for stocks and bonds. The newsletter provides investment advice for the average investor employing a technically driven asset allocation approach.

For more information, contact Bollinger Capital Management, P.O. Box 3358, Manhattan Beach, CA 90266. (310) 798-8855.

TABLE OF CONTENTS

INTRODUCTION

There has long been a need for this booklet. Bollinger Bands have been a popular method of technical analysis for several years, however there has never been any comprehensive reference on the subject available. The discussion and treatment of Bollinger Bands has been either "shortchanged" or omitted in recent books which offer guidance in the interpretation and usage of technical studies and indicators, such as Elder's *TRADING FOR A LIVING* (only 2 pages) and Pring's *ON MARKET MOMENTUM* (omitted). Bollinger Bands are included in many different software packages but the manuals give little in-depth guidance on usage and interpretation.

John Bollinger, the creator of the study, advises me that despite the many pleas he has received to write a full length book on Bollinger Bands his schedule will not permit a project of this magnitude and thus there is little or no hope in the foreseeable future for such a book.

While I had originally envisioned writing this booklet in its entirety myself, I soon realized that I was not experienced or knowledgeable enough in their usage to qualify as anything approaching an "expert" on the subject.

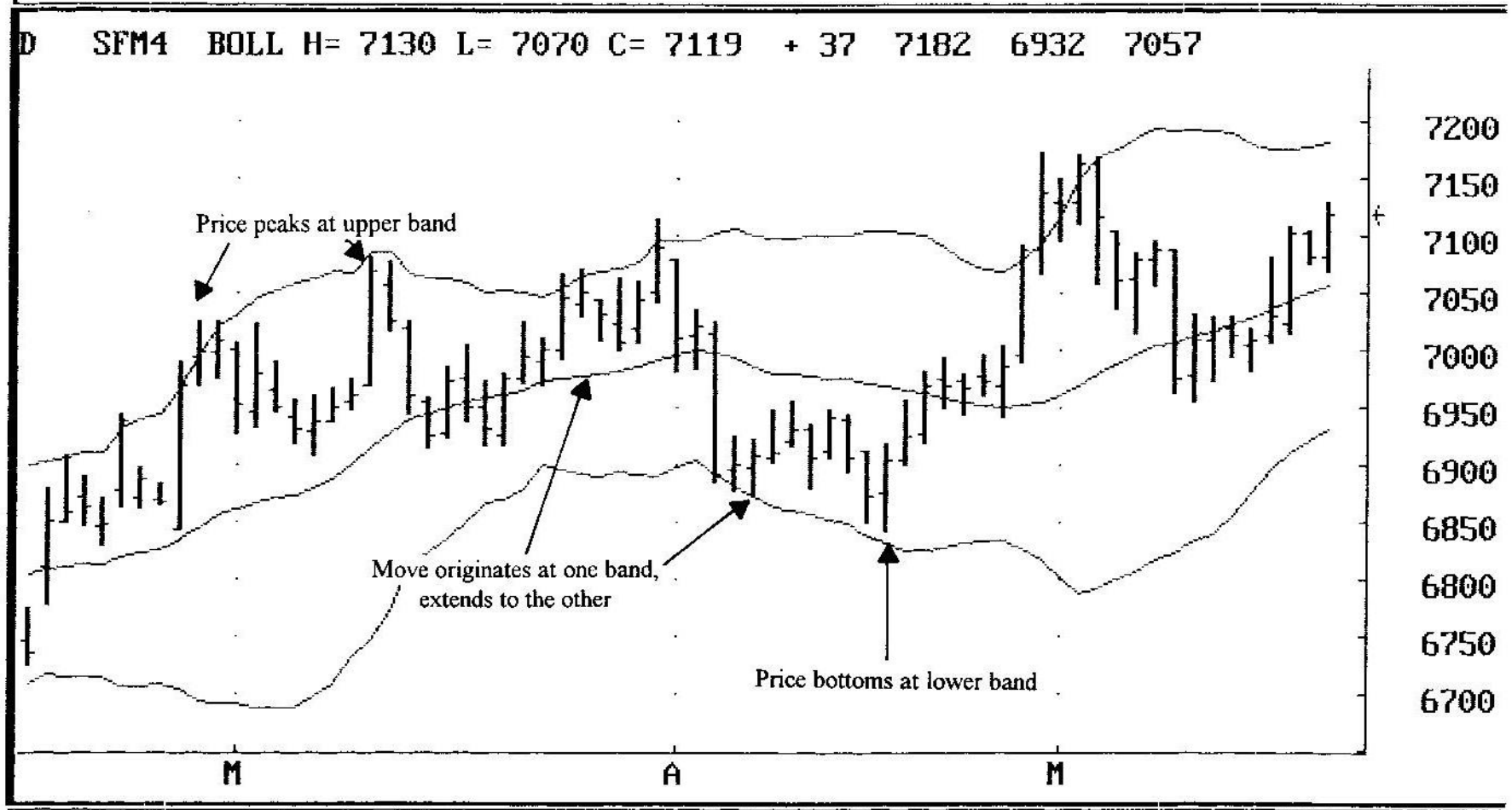
In researching this topic it became apparent that the foremost authority on Bollinger Bands was John Bollinger himself. He is essentially the only person to have written any significant amount of material on the subject. Consequently, my role in the creation of this booklet has been relegated to that of editor, and I felt that the most meaningful and helpful writings I could include were not my own, but those of the creator of the technique.

I have annotated each item in the bibliography, which lists all references I could locate on Bollinger Bands, to describe the nature and extent of the coverage provided. My thanks go to John Bollinger for his kind permission to reprint his monograph and his current comments on pages 27 and 28, to *Technical Analysis of Stocks and Commodities Magazine*, for their permission to reprint their article "Using Bollinger Bands," and to FutureSource for the illustrations using their on-line service.

It is my hope that this booklet will prove helpful to the reader interested in increasing his knowledge of Bollinger Bands and their effective and proper usage.

Edward Dobson
June, 1994

DAILY JUNE 1994 SWISS FRANCS
BOLLINGER BANDS



REPRINTED WITH PERMISSION
FROM FUTURESOURCE

SUMMARY OF KEY POINTS

The following are key points from various references cited in the bibliography (pages 29-31).

• Bollinger Bands are bands plotted above and below a simple moving average.

• The recommended moving average is 20 periods which is an effective representation of the intermediate trend.

• The bands plotted above and below this moving average are moving standard deviations, Bollinger's choice of volatility measures to set band width. The bands vary in distance from the average as a function of the market's volatility.

• Two standard deviations above and below the moving average is the recommended setting for band width.

• If the number of periods in the moving average is increased, say, to 50 in order to analyze long term trends, it is recommended that the number of standard deviations be increased to two and a half. Conversely, if the number is decreased below 20, the number of standard deviations should be decreased. At 10, one and a half seems to be effective in most cases.

- Bollinger Bands may be applied to any market or security.

- Any time frame may be analyzed, from daily, weekly or monthly charts, down to an intraday basis. As these words are being written, a glance at a 5 minute June 1994 S&P chart shows that Bollinger Band analysis is quite effective even on a basis this short term. A 30 minute chart (covering about 3 weeks) reveals the same pattern.

- One of the primary uses of Bollinger Bands is to show whether prices are high or low on a relative basis.

- The bands are narrow after a quiet period in the market under study. Band width expands rapidly as the market becomes more volatile.

- Narrow band widths indicate low volatility, and vice versa. This information can be especially helpful to options traders, since options prices are heavily influenced by swings in volatility.

- Rapid and substantial price moves often tend to occur after Bollinger Bands tighten (narrow).

- Bollinger Bands should be used in conjunction with other technical studies in order to detect high probability trend reversal or turning points.

- When prices move above the upper band, this is a sign of great strength, and when they move below the lower band, a sign of great weakness.

• When prices move outside the bands, trend continuation is often a valid assumption.

• A price move which originates from one band often tends to extend to the other band, especially during choppy markets. Many extremes in price moves occur at or near the bands. This observation is exceptionally useful in projecting price targets.

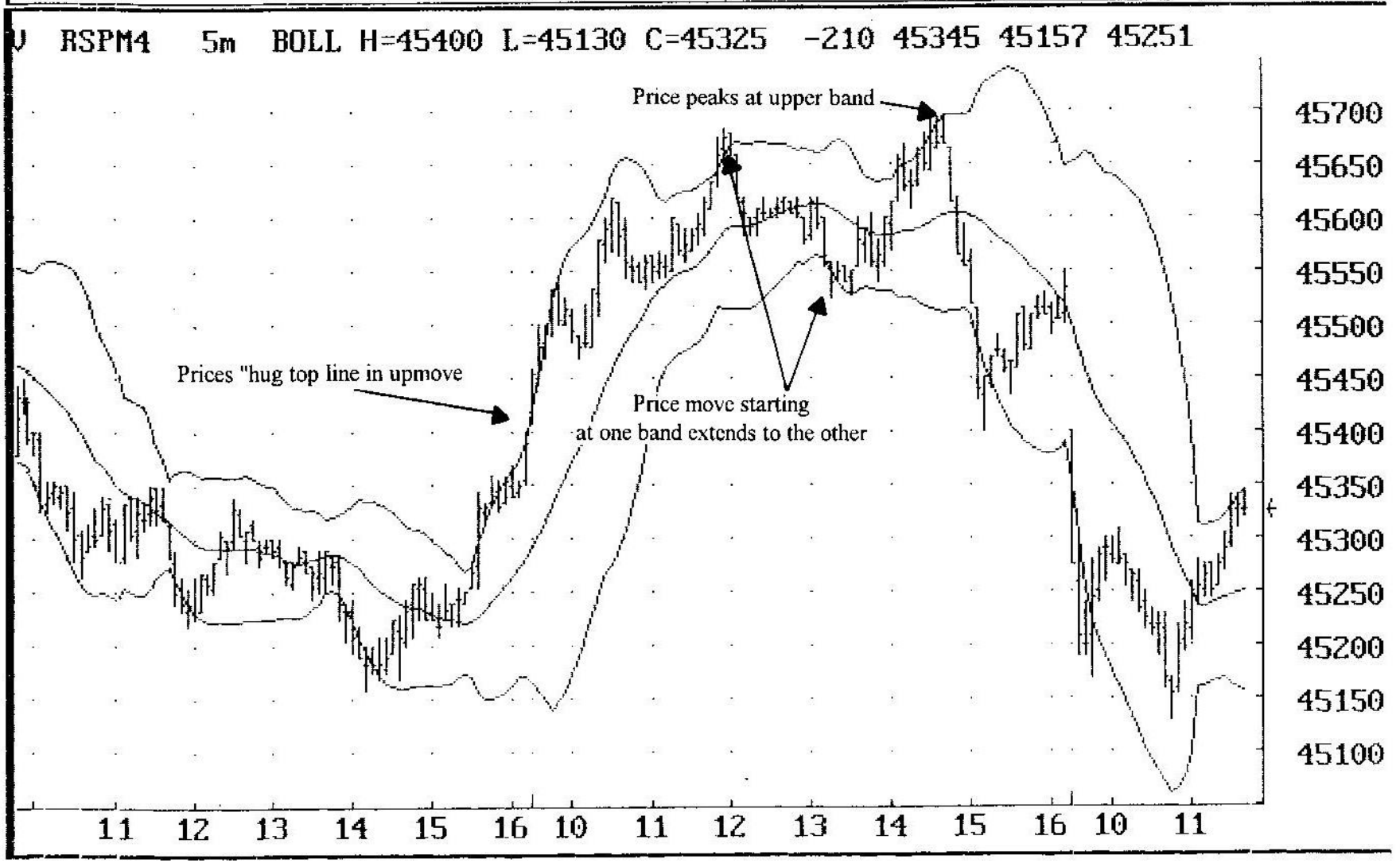
• Like many useful technical analysis techniques, there is no claim made for the statistical validity of Bollinger Bands, just the empirical observation that **they work.**

• When the bands are set at two standard deviations, they contain about 95% of price data.

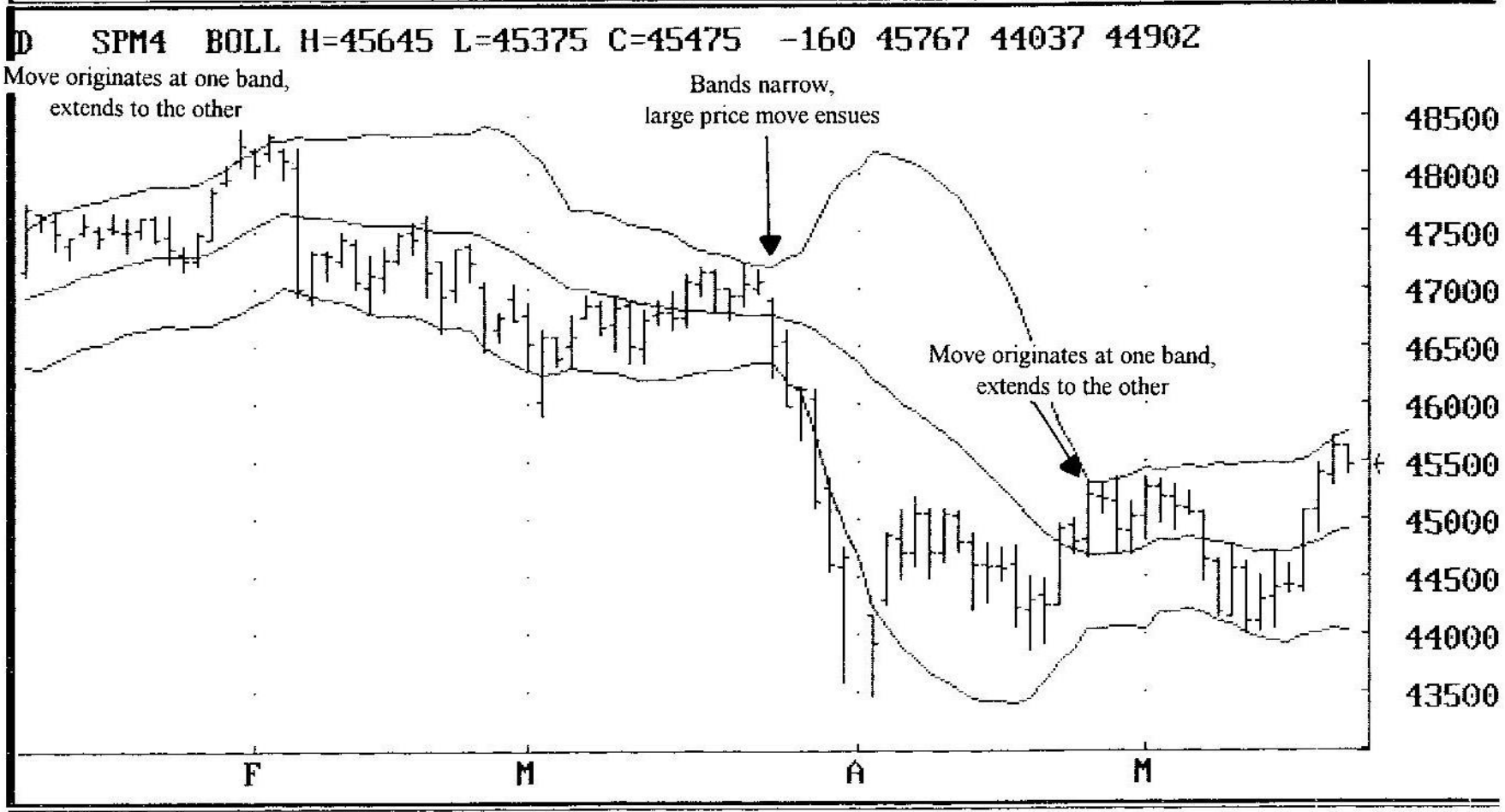
• The primary indicator that Bollinger likes to use in conjunction with the bands is RSI.

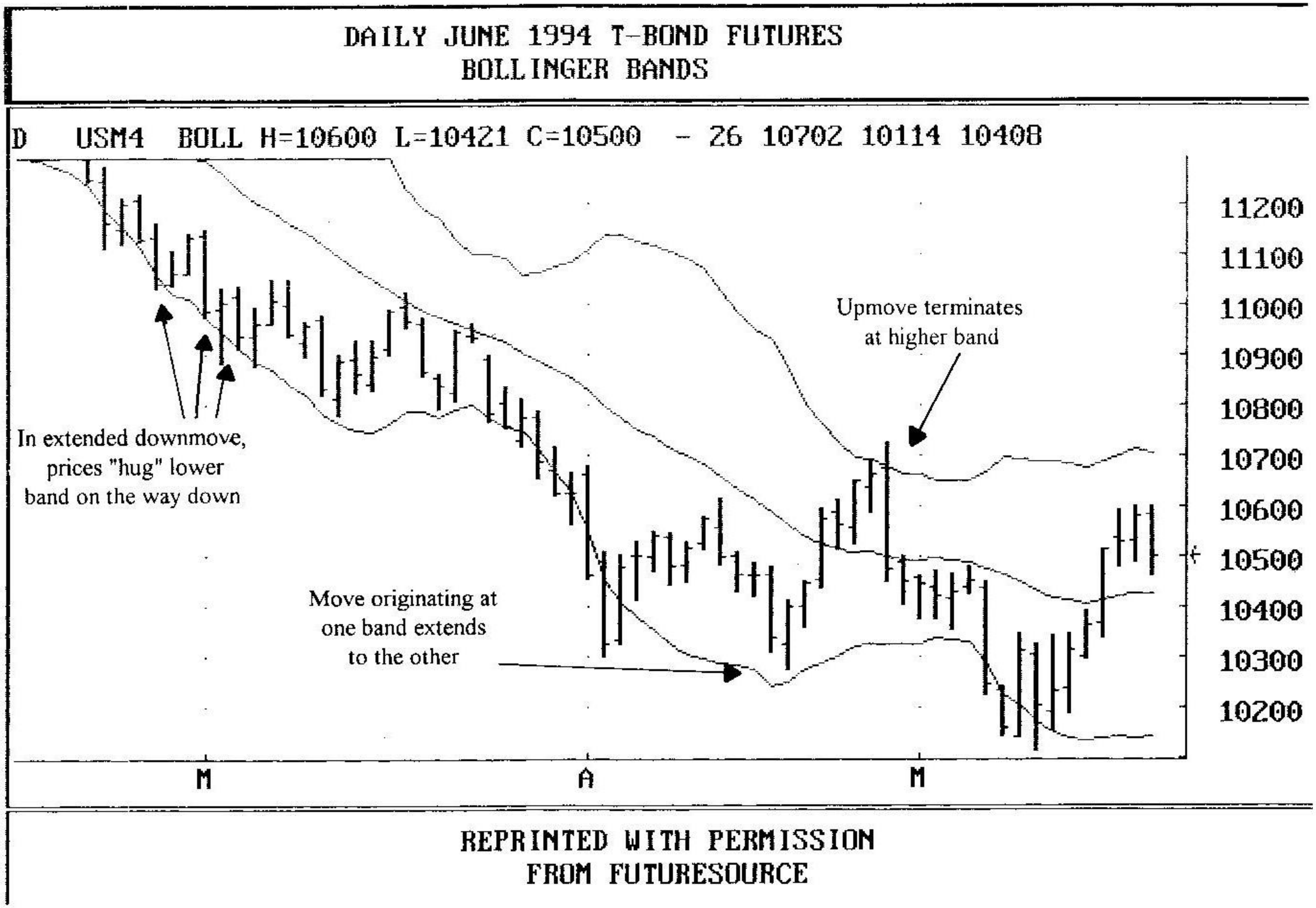
• The best overall reference work for learning more about trading bands in general is THE PROFIT MAGIC OF STOCK TRANSACTION TIMING, by J.M. Hurst.

JUNE 1994 S&P FUTURES-5 MINUTE BARS
BOLLINGER BANDS

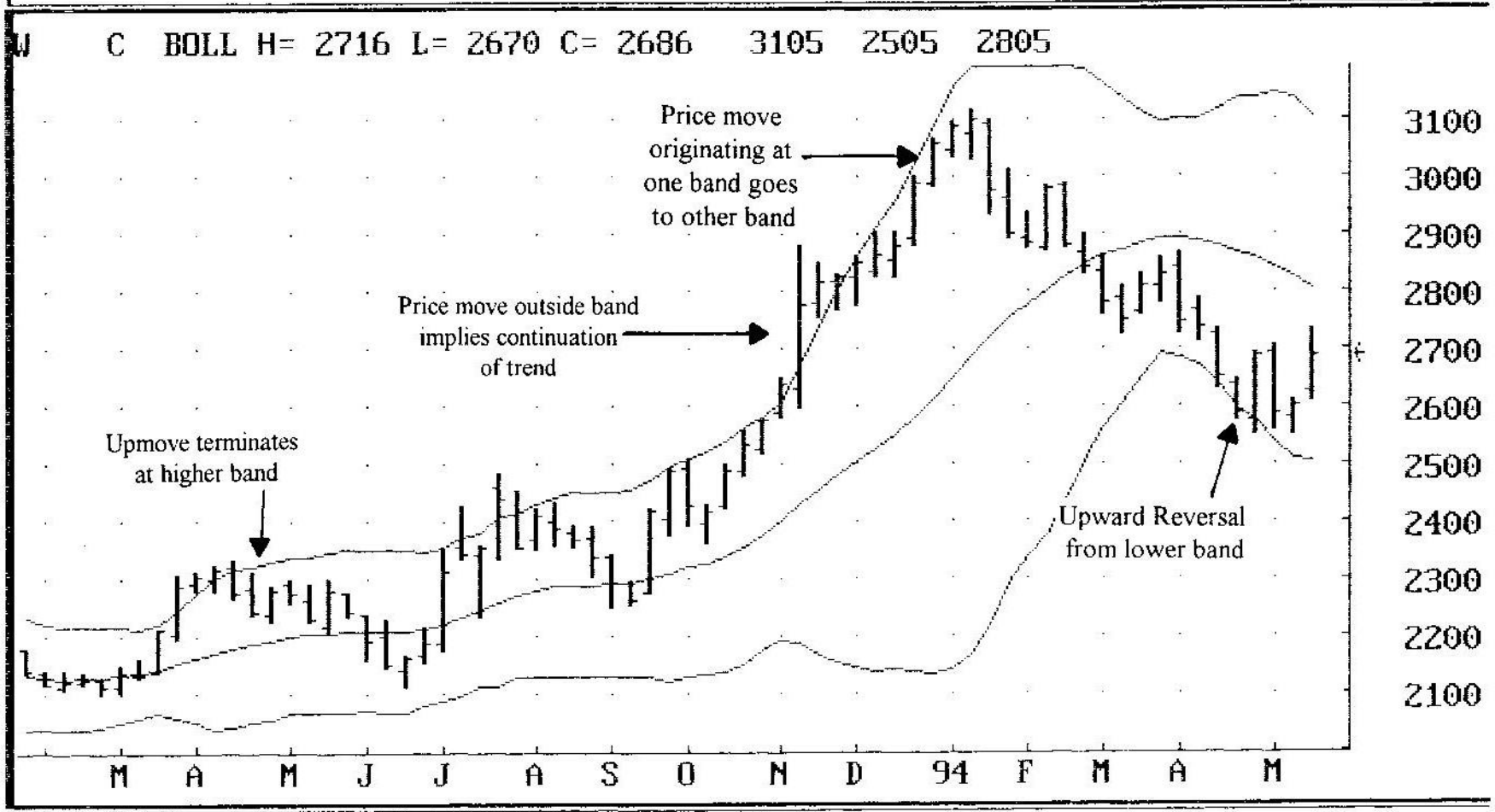


DAILY JUNE 1994 S&P 500 INDEX FUTURES
BOLLINGER BANDS



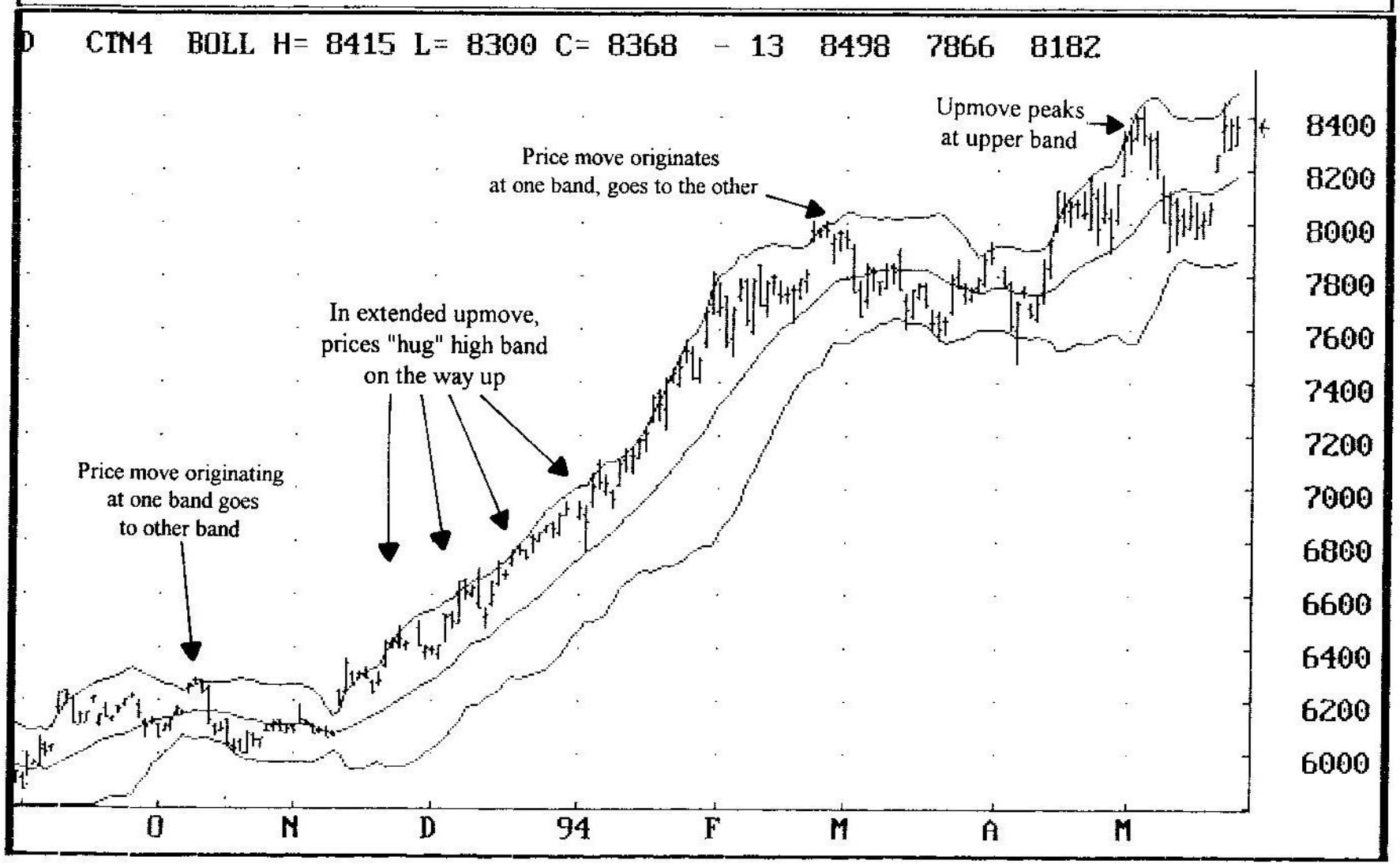


WEEKLY CORN FUTURES
BOLLINGER BANDS



REPRINTED WITH PERMISSION
FROM FUTURESOURCE

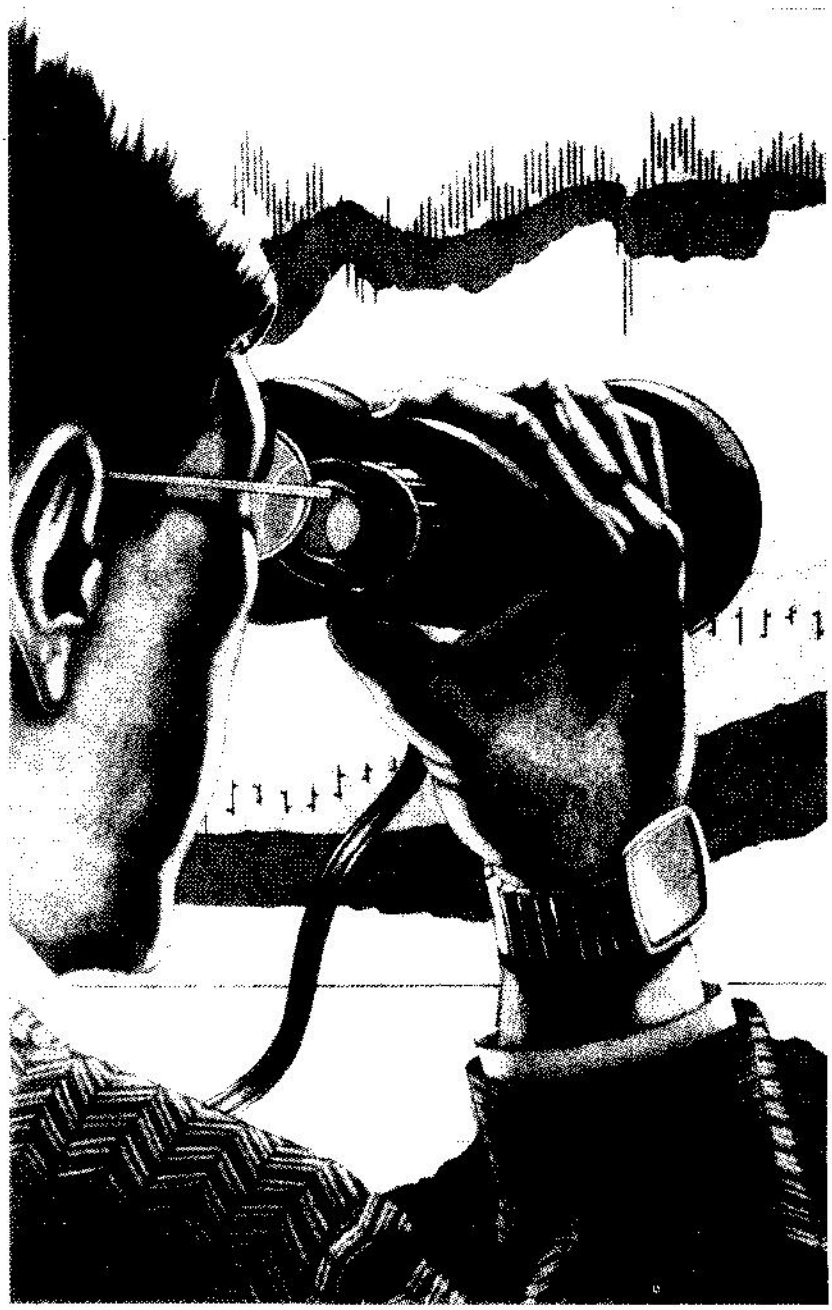
DAILY JULY 1994 COTTON
BOLLINGER BANDS



TECHNICAL ANALYSIS OF STOCKS & COMMODITIES

TRADING TECHNIQUES

Using Bollinger Bands



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.

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

by John Bollinger

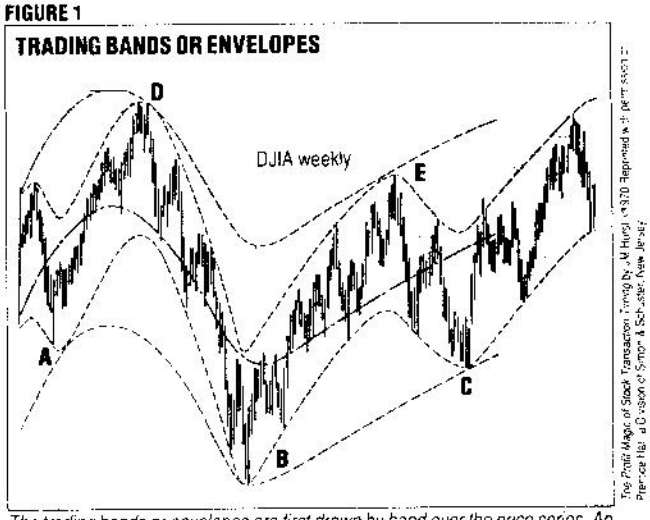
The next major development in the idea of trading bands came

†See Traders' Glossary for complete description

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.

FIGURE 1

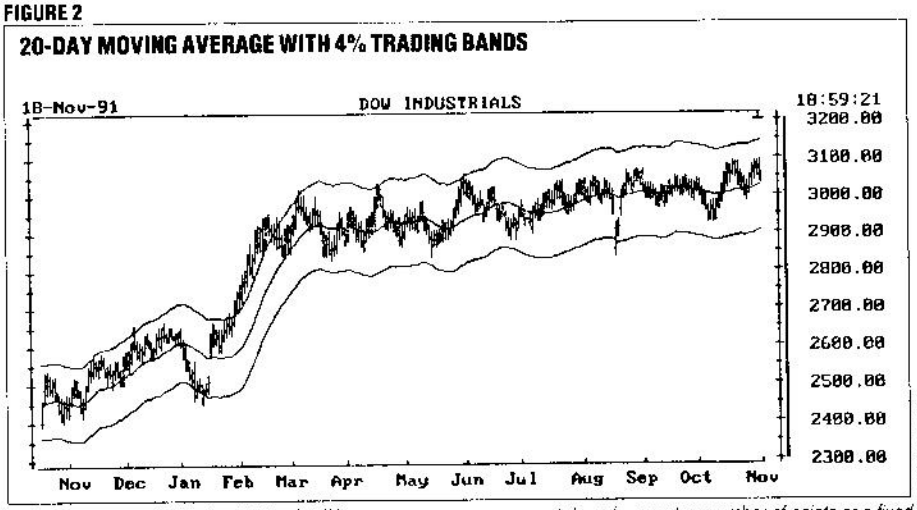


The trading bands or envelopes are first drawn by hand over the price series. An average width is determined by measuring the distance from the top and bottom of the bands.

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.

FIGURE 2



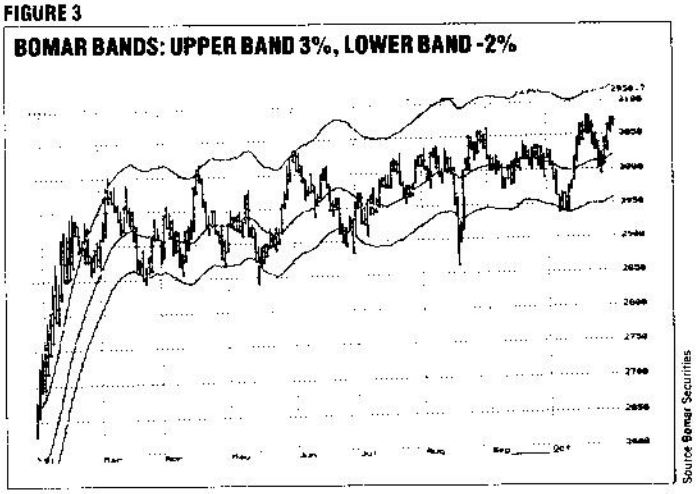
The concept emerged in the 1970s of shifting a moving average up and down by a certain number of points or a fixed percentage to obtain an envelope around price. Here, an envelope has been constructed around the Dow Jones Industrial Average (DJIA). The average used is a 21-day simple moving average.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

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-

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.

Reprinted with permission from *Technical Analysis of* STOCKS & COMMODITIES magazine. Copyright ©1992 Technical Analysis, Inc., 4757 California Ave. SW, Seattle, WA 98116, (800) 832-4642.
From "Using Bollinger Bands" by John Bollinger. *Technical Analysis of STOCKS AND COMMODITIES*, Vol. 10, No.2 (Feb. 1992), pp.47-51.

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.

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.

FIGURE 4

BOLLINGER BAND FORMULAS

$$\sigma = \sqrt{\frac{\sum_{j=1}^{N}\left(X_j - \overline{X}\right)^2}{N}}$$

$$\overline{X} = \frac{\sum_{j=1}^{N} X_j}{N}$$

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

Middle band = $\overline{X}$

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

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.

The average that is selected should be descriptive of the chosen 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

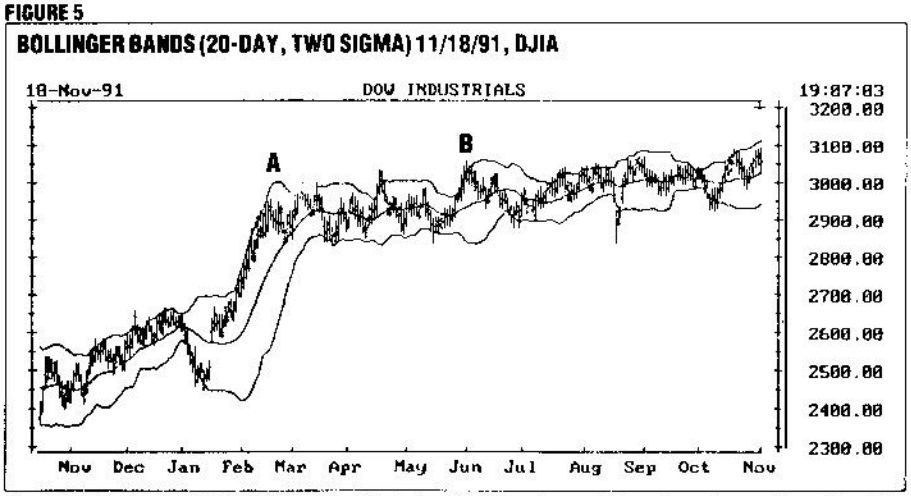
Trading bands answer the question whether prices are high or low on a relative basis. The matter actually centers on the phrase "a relative basis." Trading bands do not give absolute buy and sell signals simply by having been touched; rather, they provide a framework within which price may be related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

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.

From "Using Bollinger Bands" by John Bollinger. *Technical Analysis of STOCKS AND COMMODITIES*, Vol. 10, No.2 (Feb. 1992), pp.47-51.

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.

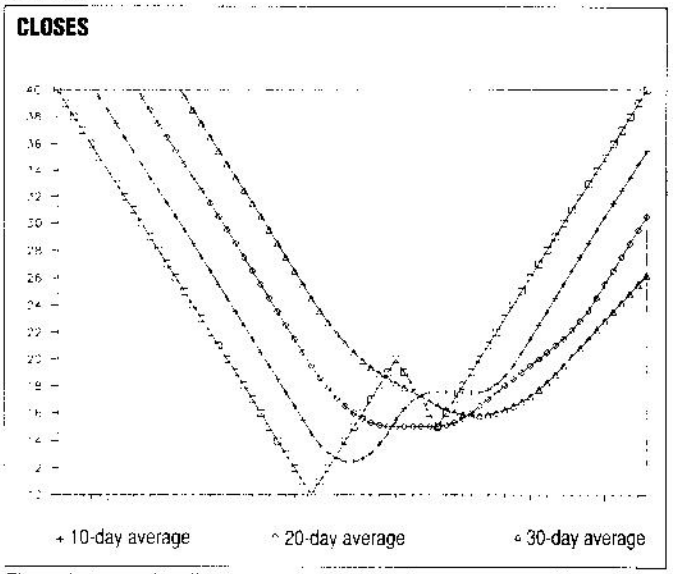
Trading bands and indicators are both good tools, but when they are combined, the resultant approach to the markets becomes powerful. Band width, another indicator derived from Bollinger Bands, may also interest traders. It is the width of the bands expressed as a percent of the moving average. When 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.

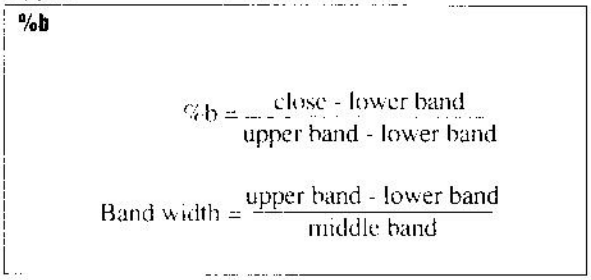
So one indicator derived from closing prices, another from volume and the last from price range would provide a useful group of indicators. But combining RSI,

FIGURE 6



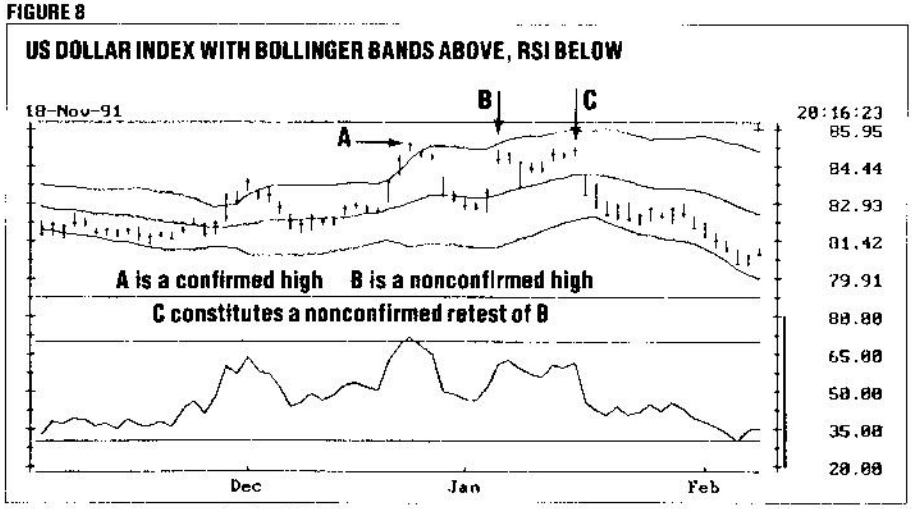
The easiest way to identify the proper average is to choose one that provides support to the correction of the first move up off a bottom. If the average is penetrated by the correction, then the average is too short. If, in turn, the correction falls short of the average, then the average is too long.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

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.

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.

SIDEBAR FIGURE 1

CALCULATING BOLLINGER BANDS

	A	B	C	D	E	F	G	H	I	J
1	Date	High	Low	Close	Typical Price					
2	910924	3043.38	2995.97	2995.97	3011.77					
3	910925	3048.52	3004.92	3004.92	3019.45					
4	910926	3040.70	2996.87	2996.87	3011.48					
5	910927	3040.70	2989.49	2989.49	3006.56					
6	910930	3032.87	2982.78	2982.78	2999.48					
7	911001	3043.60	3002.46	3018.34	3021.47					
8	911002	3040.25	2992.40	3012.52	3015.06					
9	911003	3021.24	2972.50	2984.79	2992.84					
10	911004	3007.16	2956.17	2961.76	2975.03					
11	911007	2973.17	2926.21	2942.75	2947.38					
12	911008	2983.68	2927.77	2963.77	2958.41					
13	911009	2984.79	2925.54	2946.33	2952.22					
14	911010	2985.47	2930.23	2976.52	2964.07					
15	911011	3000.89	2957.51	2983.68	2980.69					
16	911014	3026.39	2975.85	3019.45	3007.23					
17	911015	3057.59	3000.22	3041.37	3033.09					
18	911016	3082.29	3016.10	3061.72	3053.37					
19	911017	3077.15	3027.06	3053.00	3052.40					
20	911018	3089.45	3045.62	3077.15	3070.74	20 day Average	Standard Deviation	Upper Bollinger Band	Middle Bollinger Band	Lower Bollinger Band
21	911021	3085.20	3042.49	3060.38	3062.69	3006.77	35.54	3077.85	3006.77	2935.70
22	911022	3084.53	3020.57	3039.80	3048.30	3008.60	36.67	3081.94	3008.60	2935.26
23	911023	3065.52	3015.21	3040.92	3040.55	3009.65	37.26	3084.18	3009.65	2935.12
24	911024	3047.63	2991.73	3016.32	3018.56	3010.01	37.31	3084.63	3010.01	2935.38
25	911025	3034.44	2983.01	3004.92	3007.46	3010.05	37.31	3084.67	3010.05	2935.43
26	911028	3055.23	3001.57	3045.62	3034.14	3011.79	37.58	3086.95	3011.79	2936.62
27	911029	3077.82	3020.13	3061.94	3053.30	3013.38	38.62	3090.61	3013.38	2936.14
28	911030	3090.12	3038.24	3071.78	3066.71	3015.96	40.33	3096.63	3015.96	2935.29
29	911031	3091.01	3045.62	3069.10	3068.58	3019.75	41.52	3102.79	3019.75	2936.70
30	911101	3091.91	3031.75	3056.35	=(B30+C30+D30)/3	=AVERAGE(E11:E30)	=STDEVP(E11:E30)	=F30+(2*G30)	=F30	=F30-(2*G30)

CALCULATING BOLLINGER BANDS

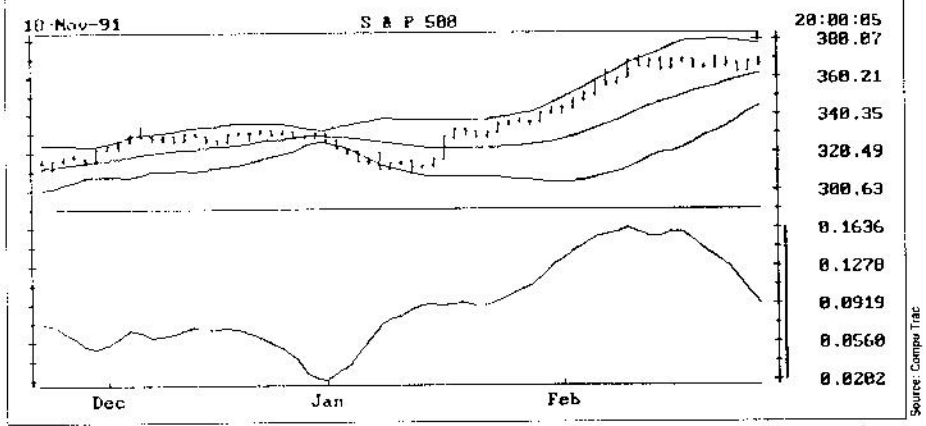
An Excel spreadsheet is used to calculate Bollinger Bands for the DJIA. The actual formula for each cell is shown at the bottom of the column; the formula presented is specific for the location of that cell.

First, determine the typical price (column E), which is the high, low and close summed and divided by three. Then calculate the 20-day simple moving average (column F). Next, the standard deviation of the typical price over the 20-day period is calculated using the *population* formula in the spreadsheet (column G). The standard deviation of the population formula is used. The upper Bollinger Band is the 20-day moving average plus two times the standard deviation (column H). The middle band is the 20-day simple moving average (column I). The lower band is the 20-day simple moving average minus two times the standard deviation.

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 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.

FIGURE 9

S&P 500 WITH BOLLINGER BANDS BAND WIDTH



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).

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.

John Bollinger, CFA, CMT, PO Box 3358, Manhattan Beach, CA 90266, (310) 545-0610, is president and founder of Bollinger Capital Management and publishes the monthly "Capital Growth Letter," a market letter for the average investor employing a technically driven asset allocation approach. He is also market analyst for CNBC/FNN.

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.

SOFTWARE PACKAGES WHICH INCLUDE BOLLINGER BAND ANALYSIS

Bollinger Bands are a major new addition to the array of technical studies and indicators that are in common usage. They have been incorporated into most major analytical software packages which are commercially available. Some of the major vendors of software which incorporates Bollinger Bands are:

- **AIQ**
- **Metastock**
- **Telescan**
- **Knight Ridder**
  - *Trade Center*
  - *Profit Center*
- **Windows on Wall Street**
- **Omega**
  - *Trade Station*
  - *Super Charts*
- **Papyrus Technology**
  - *Clarity*
  - *Composer*
- **Trendsetter**
- **Dow Jones**
  - *Teletrac*
- **Technifilter**
- **Megatech**
- **FutureSource**
- **Points Ahead!**

This list is only representative and is by no means complete.

John Bollinger's
CAPITAL GROWTH LETTER

Reprinted with permission from John Bollinger's capital Growth Letter.

Bollinger Bands

One of the most useful technical concepts developed in recent years is trading bands. First suggested by J.M. Hurst, trading bands are lines drawn at an interval around a moving average. They are widely used to determine overbought/oversold levels, to confirm divergences between price and indicators and to project price targets.

I found several problems with the traditional methods of constructing trading bands. First, I found different market conditions required bands of different widths. Next, I discovered different time intervals often required different width bands for the same data series. For example, 20 day bands are generally narrower than 50 day bands. Daily, weekly and monthly data for the same security may each require a different band width and average length.

I began to experiment with various methods of determining the proper widths to use and came to the conclusion that the width should be driven by the data series itself. I became convinced that the type of calculation applied by statisticians to determine the standard deviation of a data series could be adapted to govern the width of the trading bands. This led to the development of Bollinger Bands, which are bands that vary in distance from the average as a function of the market's volatility. To produce the bands I calculate moving standard deviation in parallel with a simple moving average and place the bands two moving standard deviations above and below the average.

I have experimented with various time periods from 5 to 200 days for Bollinger Bands. Periods of less than 10 days do not seem to work well. 20 or 21 days proved to be the optimal period for most applications. 50 days were helpful in gaining an intermediate term perspective and much longer periods have proved valuable for long term analysis. The bottom line is that 20 days is a very good departure point. If you reduce the number of days used to calculate the bands, you'll find the number of deviations must also be reduced and vice versa. For example, for 50 day bands try 2.5 standard deviations; for 10 day bands, 1.5 or 1.0.

For the mathematically inclined, the bands are plotted above and below the chosen average at a distance equal to two times the root mean square of the deviations from the average. The length of the data used in the calculations is equal to the length of the simple moving average being employed. For many markets the bands can be improved by using the typical price [(high + low + close) / 3] for both the average and the volatility calculations.

Attached are examples using the S&P 500 Index, but this technique can be applied to any market. All of the charts cover the same six month period. The first chart is a bar chart of the S&P 500 with a 20 day simple moving average and fixed width bands of 4 percent. This chart is presented for comparison purposes. It is perhaps the most commonly used market and band combination. The second chart is the same bar chart of the index and moving average, but with two standard deviation, 20 day Bollinger Bands instead of the fixed

width bands.

The following are some useful observations about Bollinger Bands:
1) Sharp moves tend to occur after the bands tighten to the average (volatility lessens). The bond market and foreign currencies are good examples of this.
2) A move outside the bands calls for a continuation of the trend, not an end to it. Often, the first push of a major move will carry prices outside of the bands. This is an indication of strength.
3) A sharp move outside the bands followed by an immediate retracement of that move is a sign of exhaustion.
4) Bottoms (tops) made outside the bands followed by bottoms (tops) made inside the bands call for reversals in trend.
5) The bands can help in diagnosing double tops and bottoms, especially when the second part of the top (bottom) is higher (lower) than the first and lower (higher) in relation to the bands.
6) The average should give support (resistance) during bull (bear) moves.
7) A move originating at one band tends to go to the other band. This is useful for projecting price targets early on and provides revised targets as events unfold.

Bollinger bands may be applied to indicators rather than security prices. This line of research is proving to be very fruitful - especially in the area of analysis and interpretation of unbounded indicators such as On Balance Volume and Money Flow.

Charts three and four line up indicators below the chart of the index and Bollinger Bands. When analysis of the bands is combined with convergence/divergence analysis of these indicators, a superior approach to forecasting market moves is obtained. Excellent indicators in this regard are Wilder's RSI and the Chaikin Oscillator.

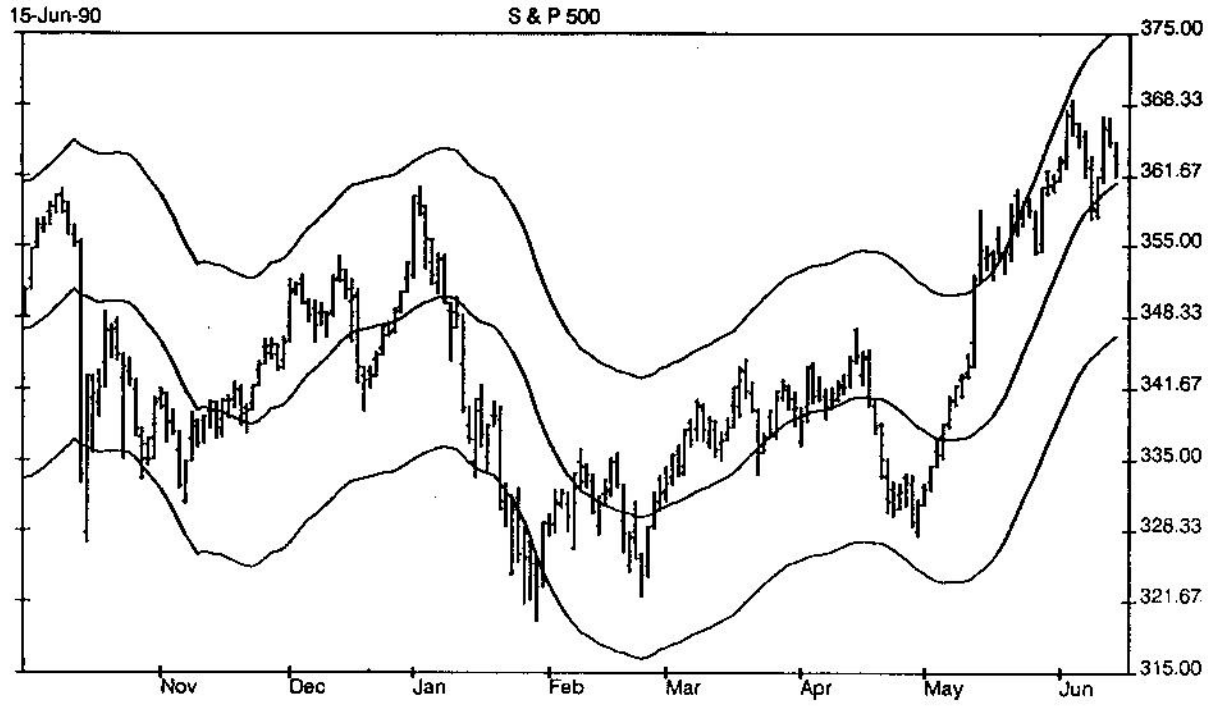
On chart three, note the action of the Relative Strength Index. It confirmed first the short term bottom at the end of January and beginning of February. Then, in an intermediate term time frame, the massive "W" shaped bottom formed during the Spring that led to a substantial rally which took the S&P to a new high. Note the divergence on the right hand side of the chart indicating a possible short term top as prices hold at high levels and the indicator slips. On the final push to new highs, prices were not able to tag the upper Bollinger Band even though it moved lower immediately after the previous highs. This is indicative of a momentum failure.

Chart four replaces RSI with the Chaikin Oscillator. This adds a new factor, volume, to the analytical mix. You can see the same divergence on the right hand side of the chart as you saw with the purely price based indicator, RSI. This provides additional confidence in diagnosing the developing top as there are now analytical inputs from the bands, a priced based indicator and a volume based indicator in agreement.

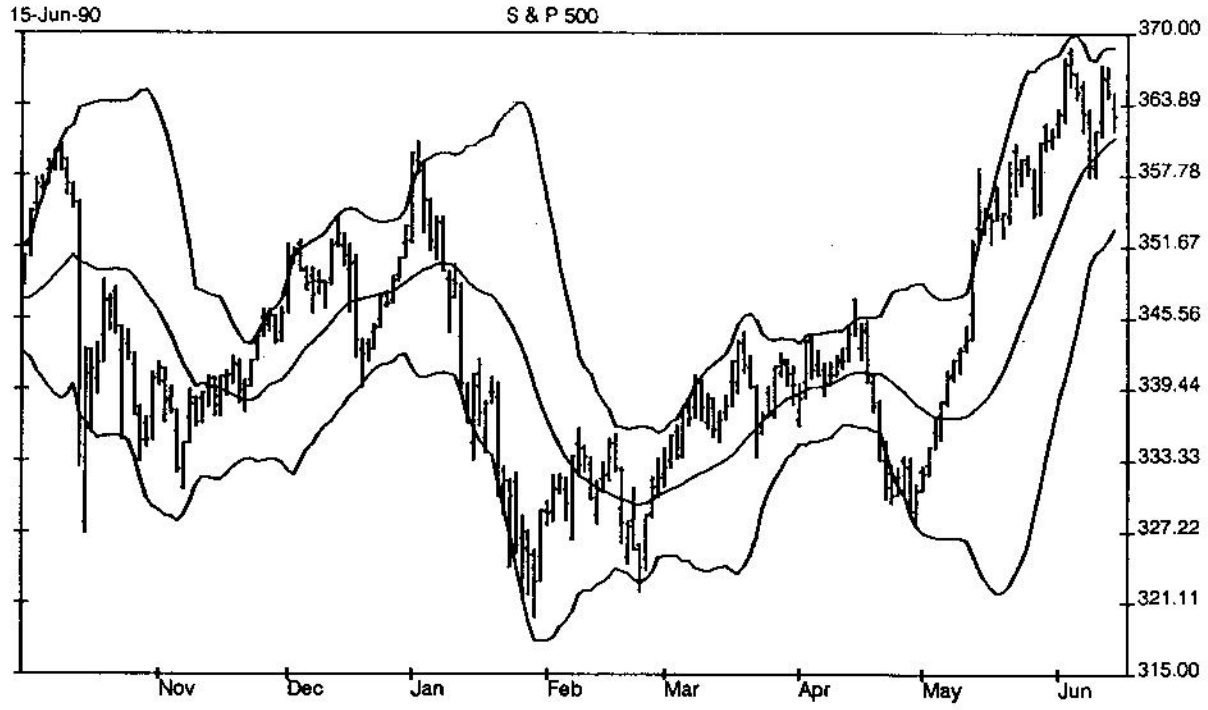
Bollinger Bands are the result of applying statistical technique to technical analysis. I have found that techniques developed by statisticians can be of use in the market. I make no claim for the statistical validity of my bands, just the observation that they work. One statistician I know liked the bands and explained why statistical theory supported such an application. Another was horrified by the misuse of the concept of standard deviation. You be the judge. I am confident that once you start to use Bollinger Bands, you'll want to continue.

John Bollinger, CFA, CMT

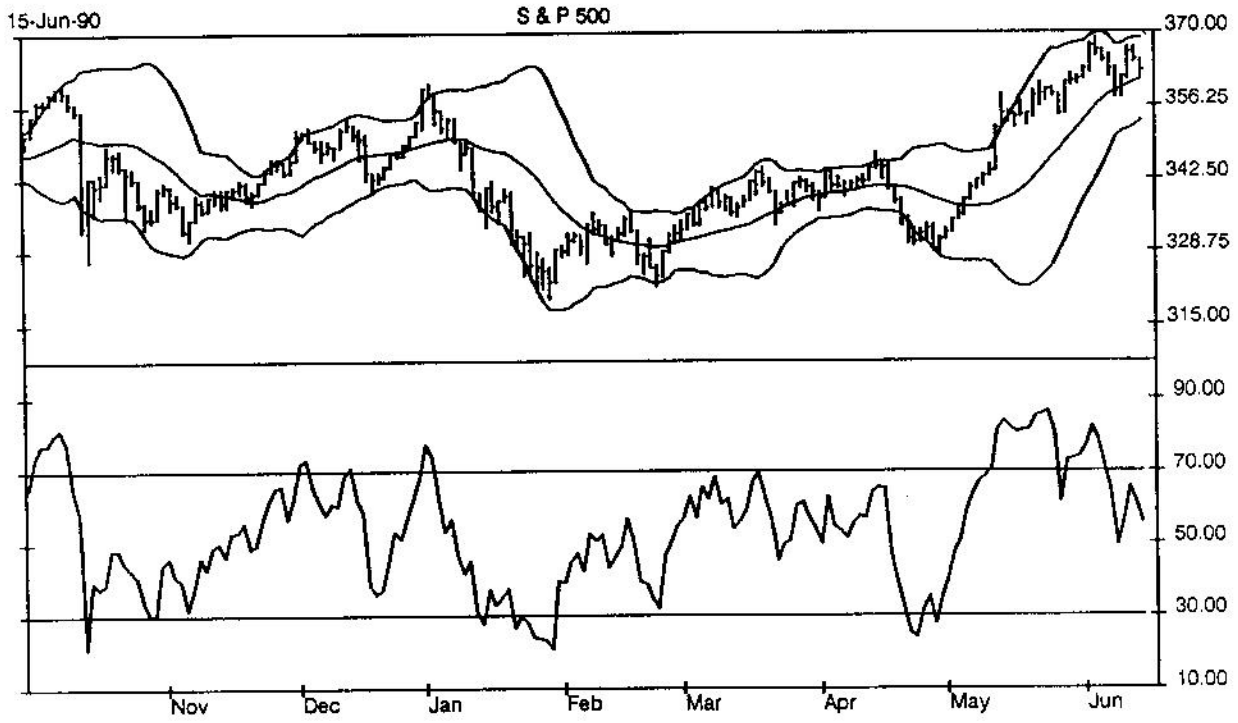
Bollinger Capital Management
P.O. Box 3358
Manhattan Beach, CA 90266
310-545-0610



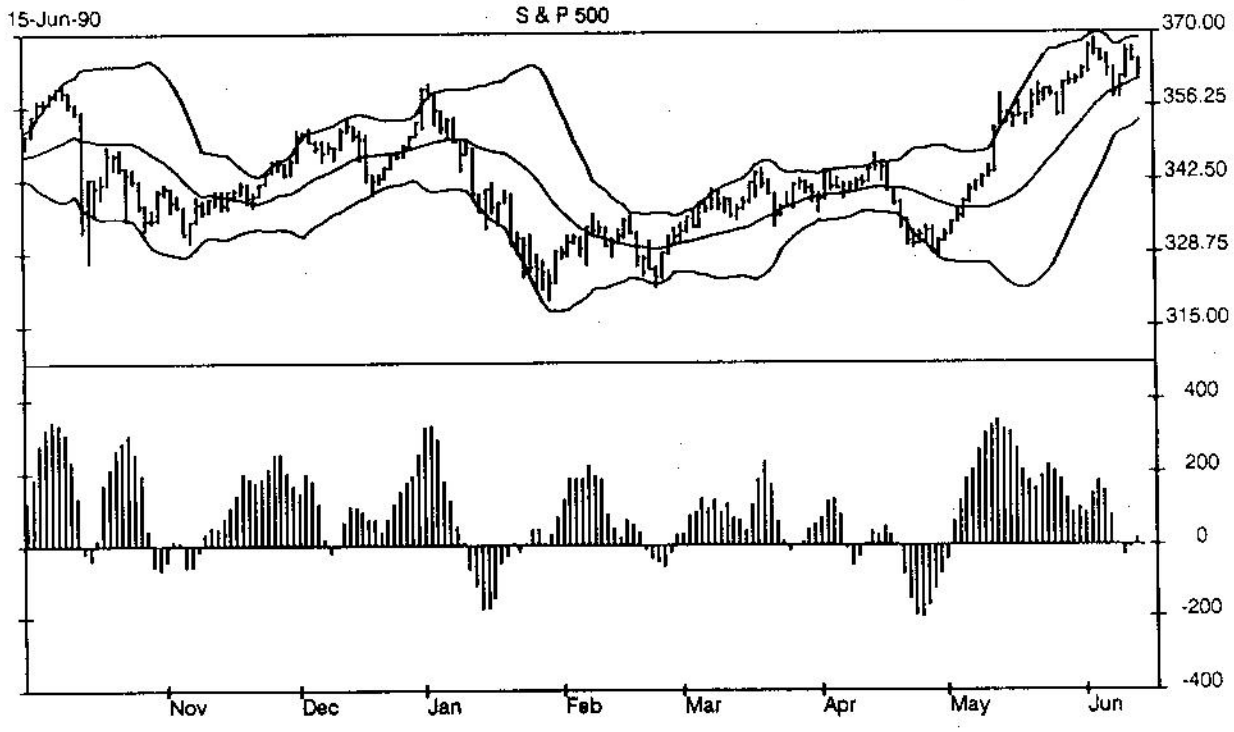
S&P 500 Index with 20 Day Average and 4% Trading Bands



S&P 500 Index with Bollinger Bands (20 Day)



S&P 500 with Bollinger Bands and Wilder's RSI (9 Day)



S&P 500 Index with Bollinger Bands and Chaikin Oscillator

UPDATED COMMENTS FROM JOHN BOLLINGER

MAY 1994

Some years ago an eminent statistician was scheduled to give the presentation after mine at an investment conference. I purposely rearranged my schedule in order to be able to hear his presentation. As it turned out, he had heard my presentation on Bollinger Bands. You can imagine my shock when he launched into a tirade against the selection of standard deviation as an appropriate volatility measure for determining trading band width. He suggested that the calculation underlying standard deviation was extremely sensitive to large excursions. This, he argued, made it completely inappropriate for use in the determination of band width. He then argued for the selection of another volatility measure, mean absolute deviation, saying it was more appropriate as it was less sensitive to large deviations.

Perhaps from a theoretical perspective he was right, but from a practical perspective he was dead wrong. High sensitivity to large moves is exactly what we want. In fact, a good portion of the value added to the analytical process by Bollinger Bands derives from the fact that they react quickly to market developments. There is a lesson to be learned from this. The world of the academic lies a long distance from the world of the trader. While the academic is free to pursue knowledge and assert correctness, the trader must pursue practical methodology and achieve profitability.

Standard deviation, which is derived by calculating an average price and then measuring the spread of prices around that average, turns out to be an excellent tool for determining band width. While other measures of volatility are available, none seem to work as well in practice. In the calculation, the deviations from the average are squared. The purpose is to remove the sign so that when the deviations are summed the result is meaningful instead of zero. The consequences of the squaring is that large deviations from the average are magnified. The result of this is that when prices move sharply the bands play catch up in a hurry. This gives rise to one of the best chart diagnostics. Often when a bottom is forming, the first low will occur outside the bands and the second low inside them. The opposite is true for a top. This gives rise to a practical and rigorous definition of an "M" type top or "W" type bottom.

Ed Dobson has collected herein much of what I have published on bands as well as some of his own thoughts and observations. Perhaps one day I will have the time to write a book, but with day-to-day responsibilities of managing money and writing newsletter it is not likely to be soon. So this effort will have to do for the nonce. Ed asked me to reflect on two areas in this introduction. First, some thoughts on standard deviation which I have shared above. Second, he asked that I provide an overview of where my research into the bands is at present.

%B remains on the front burner, a position it has occupied for some time. I spend a lot of time comparing the action of bounded indicators and %b and developing rules from them. In review, %b simply gives you your location in relation to the bands. It equals one at the upper band and zero at the lower band. It is a percentage measure, so a %b reading of 1.1 means that you are 10% of the band width above the upper band. Knowing your position within the bands as a mathematical quantity allows you to compare your position in a logical manner to a bounded indicator such as Wilder's RSI or an oscillator such as Chaikin's 21 day Money Flow %. The result of such a logical comparison can then be molded into trading rules or even trading systems. An example of %b in action would be an "M" top where %b = 1.1 on the first high and 0.9 on the second high and 21 day Money Flow % was greater at the first high than at the second. In this case we have combined a pattern recognition technique/ indicator confirmation. In addition, we have used an indicator derived from volume, an independent variable not included in the pattern recognition process. That is the surest approach to making money I know of.

There is another interesting aspect of this; the use of banded stock prices to forecast the prices of commodities. The gold market provides a good example. The Gold & Silver Mining Index is an average of seven precious metals stocks. At turning points in he market, this index often turns before bullion and it does so in a manner easily diagnosable with the pattern recognition and confirmation technique described above. Thus, if we can identify a transition in the stocks, we can use that information to forecast a similar turn in the price of gold bullion. This technique can be applied to many, but not all, commodities. For example, oil has proved to be resistant to this approach.

The road forward offers many possibilities for this approach, each waiting to be converted into an opportunity. Be brave, be original, persevere and profit.

John Bollinger
May, 1994

ANNOTATED BIBLIOGRAPHY

BOOKS:

Elder, Alexander, *TRADING FOR A LIVING*, John Wiley & Sons, 1993: 251-253. Terms Bollinger Bands *"Standard Deviation Channels."* Explains the calculation and illustrates usage. Comments that Bollinger Bands are especially useful for options traders, since volatility swings are so crucial to options trading and Bollinger Bands are volatility based. The associated WORKBOOK/STUDY GUIDE: 101/179 (Question 180) covers Bollinger Bands.

Eng, William, *THE DAY TRADER'S MANUAL*: 144-145. John Wiley & Sons, 1992. Brief mention of Bollinger Bands and how they may be utilized in day trading.

Hurst, J.M., *THE PROFIT MAGIC OF STOCK TRANSACTION TIMING*, Prentice Hall, Inc. 1970. This classic book, written over 20 years ago, was the first to describe trading bands. It is considered by many to be one of the finest technical analysis books ever written.

LeBeau, Charles, and Lucas, David, *COMPUTER ANALYSIS OF THE FUTURES MARKET*: 19, 52-54. Brief but very helpful insight and comments in an absolutely superb book, which we highly recommend for all computerized futures traders.

Wagner, Gary, and Matheny, Bradley, *TRADING APPLICATIONS OF JAPANESE CANDLE STICK CHARTING*, John Wiley & Sons, 1994: 48-49. Brief comments on how to use Bollinger Bands in conjunction with candlestick patterns to act as leading indicators for reversals.

MAGAZINES:

Bollinger, John, "Using Bollinger Bands," *Technical Analysis of Stocks and Commodities* (February, 1992). This is the most comprehensive and the most complete reference that could be found on the subject of Bollinger Bands. With the kind permission of the publisher, it is reprinted herein in its entirety. This article contains one of my favorite quotes applicable to technical analysis: "Asking the market what is happening is always a better approach than telling the market what to do."

Wilbur, Harley, "A Twist on the Arms Index," *Technical Analysis of Stocks and Commodities* (November 1992). Shows a method of using Bollinger Bands in conjunction with the venerable Arms Index (TRIN).

Hartle, Tom, "John Bollinger of Bollinger Capital Management," *Technical Analysis of Stocks and Commodities* (July 1993). Extensive interview with Bollinger covering a wide range of topics, from discussion of Bollinger Bands to his philosophies on going long and going short.

Davies, D.W., "Trading Options with Bollinger Bands and the Dual CCI," *Technical Analysis of Stocks and Commodities* (September 1993). Shows how to use a technique which provides a timing tool for options trading by combining the commodity channel index and Bollinger Bands. Includes detailed descriptions of how Bollinger Bands can be calculated on Excel.

PERIODICALS AND MISCELLANEOUS:

Computrac TAG X Seminar Notes, J.W. Marriott Hotel, Washington D.C. (October 28-30, 1988). John Bollinger was one of 23 featured speakers. John's brief 14 page treatment of Bollinger Bands in the material (mostly charts) is the earliest recorded reference material on the subject that this author was able to locate.

FutureSource Technical Version 3.5 Update Bulletin: 15. Offers a brief explanation. FutureSource uses default values of a 20 day moving average of the close, with band lines plotted two standard deviations above the moving average and another two standard deviations below. The user is permitted to vary all factors: the number of periods in the M.A., the percent of one standard deviation (200% is standard), and whether the M.A. is calculated using the open, high, low, close, midpoint, or average. Since Bollinger Bands are included in many different software packages, this writer would assume that the documentation in the FutureSource manual is comparable to that in others.

John Bollinger's CAPITAL GROWTH LETTER, Investment Monograph, BOLLINGER BANDS (1991). Four page illustrated article reprinted herein in its entirety.

MTA (Market Technician's Association) Newsletter (March 1990). An interview with John Bollinger conducted by Jack Cahn, ("Technical Pro-File"), in which John explains and illustrates Bollinger Bands by charted examples. Includes his comments on interpretation and usage including an interesting comment that he feels they aid in the interpretation of other indicators.

Technical Traders Bulletin, Volume 2, Number 4 (April 1990). Includes an extensive analysis of trading envelopes and channels, with significant discussion and coverage of Bollinger Bands within the article.