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Understand Your Market

Designing Volatility Breakout Systems

Interested in improving your system's profit factor? Here are some suggestions.

by Paolo Pezzutti

The principle of range expansion/contraction was first studied and analyzed by Toby Crabel in *Technical Analysis of STOCKS & COMMODITIES*. According to Crabel, the market oscillates between contractions and expansions. When the market moves between areas of equilibrium (the balance of supply and demand), it does so quickly through range expansion days. This forms the premise of volatility breakout systems. Since traders focus on these short-term range expansions rather than the longer-term trend, their goal should be to exploit some continuation of the movement after the entry price to lock in profits.

CHARACTERISTICS

Systems are useful when it comes to understanding the dynamics of the marketplace and its underlying forces, such as those that maintain the up- or downtrend in an impressive trend day. The profitability of a system depends on its few big wins, although you may see many trades that result in small wins and losses.

Volatility breakout systems test well on volatile and directional markets, but drawdown builds under choppy conditions. However, these systems are robust and will continue to be profitable as the volatility of the market increases. Typically, you'll see a higher number of winning trades than losing ones when you look at the results of such systems. You may also notice that the average per-trade return (win+loss) is lower than with other types of systems. This is because of their short-term nature, which is a critical factor in assessing performance. To successfully implement a volatility breakout system, you need to select a market and look for volatile conditions where there are many range expansion days with a high minimum-move value, such as stock index futures.



There are different types of systems based on range expansion days. Most have similar results and, statistically speaking, can be traded across many markets. The problem arrives when the market goes through relatively flat periods, which sometimes last up to several months. Ideally, you should apply the system to a portfolio of uncorrelated markets/stocks. I have found the best results for my systems by exploiting market correlations between currencies and bonds. Keep in mind that successful trading systems need more than mere percentages to enter and exit trades. A certain degree of trader discretion is necessary, especially when it comes to interpreting specific market conditions.

FIGURE 1: S&P 500 FUTURES. These results display significant patterns that can be applied to volatility breakout systems.

RULES

The system or method you select is a matter of personal preference, but there are certain rules to keep in mind. A trade is entered, usually via a buy or sell stop, when the market moves a certain percentage off a determined price level. When designing your system, you can choose to place an entry stop off either the opening price or the previous day's closing price. The entry stop can be a function of the previous day's range, a percentage of the previous n days' range, or another of numerous setups. Other entries can be based on channel

breakouts (for example, the highest high/low of the last n days), specific volatility patterns (such as inside days or Bollinger Bands), or chart patterns (perhaps trendline breakouts or triangles). The exit used can be a fixed objective level, a time function (such as the next day's open or close), or some other volatility-related function.

There are times when a market gaps open outside your entry level. Although your trade may end up being profitable (a gap could be a sign of runaway market conditions), gaps tend to add to your equity volatility and drawdown. Thus, you should run accurate tests on your system before deciding to jump on board these high-speed trains.

You should always test your systems for the selected markets without overoptimizing your parameters. What works this year may not work so well next year. The idea is to adapt to market conditions by raising or lowering the sensitivity of your system's entries and exits.

FILTERS

Filters such as trend and volatility indicators like the average directional movement index (ADX) or true range may be used to enhance your system. Different parameters should be applied according to the state of the market. In addition, looking for volatility contraction conditions like inside days and low historical volatility ratios will increase your system's chance of success.

You can also accurately select the pauses during an up- or downtrend and enter the market intending to trade a range expansion day in the direction of the trend. Applying filters improves the profit factor of your system and the percentage of winning trades. Your drawdown will be lower and your average trade (win+loss) will improve, as will the return on your account. However, the overall system may be less

S&P 500: January 2, 1996–January 17, 2002

c>average(13) and h>h[1] 66.94%	c<average(13) and l<l[1] 66.82%
c>average(13) and c>o 63.43%	c<average(13) and c<o 64.35%
c>average(13) and c>c[1] 62.73%	c<average(13) and c<c[1] 63.43%
c>average(13) and o>l+0.5*range[1] 39.49	c<average(13) and o<h-0.5*range[1] 32.25
c>average(13) and c>l+0.5*range[1] 64.60	c<average(13) and c<h-0.5*range[1] 56.79
c>average(13) and c>o and range>1% of average(13) 55.93	c<average(13) and c<o and range>1% of average(13) 79.21
c>average(13) and c<o and range>1% of average(13) 47.06	c<average(13) and c>o and range>1% of average(13) 77.03

profitable because you will be taking fewer trades. Which and how many filters you apply affects both overall profitability and the performance of your system, which can only be determined after being evaluated and tested.

RISK

The amount of risk is determined by how you apply stops. Stops can either be based on a fixed amount (such as a volatility function), or they can be trailing stops that limit your risk and keep you in the market only during trend days. Systems generally test well when wide stops are used.

Even when using stops, systems will still have some risk. The overnight gap is one example. Others include slippage at your entry stop when volatility is high or exits with stop orders at the next day's open. These risks, coupled with the low-profit average trade typical of short-term systems, can result in an untradable system.

MARKET STRUCTURE

Now that you have all the components in place, you are ready to create a trading system. Your first step is to analyze the structure of a selected market. I will use the Standard & Poor's 500 as an example. The statistics of the S&P 500 index future can be seen in Figure 1. The structure is similar to those observed in other markets such as the Nasdaq 100, crude oil, and Treasury bond markets. From these you can identify significant structure elements to take into account when developing a volatility breakout system. From the statistics, I can determine that the S&P 500, in an uptrend, has a tendency to:

- Have higher consecutive closes
- Retest the previous day's high

- Open in the lower and close in the higher part of the range
- Have range expansions in up days and contractions in down days.

Similar results apply to a market that is trending down.

AN APPLICATION

I will now build a simple application of a volatility breakout system for the S&P 500. The EasyLanguage code can be seen in Figure 2. The application will use the market structure to trigger buy and sell signals. A buy signal will be generated after a pause in an uptrend, as momentum in the predominant direction resumes, and a sell signal will be generated at the previous day's high retest. I have included a simple trend indicator to decide which direction to take the trade. The buy strategy is described below. Similar rules can also be applied to the sell strategy.

Buy strategy

- a Trend indicator: $\text{close} > \text{average}(\text{close}, 13)$
- b Setup: $\text{close} < \text{previous day's close}$; this setup spots a pause in the uptrend
- c Trigger: buy-stop next day at $\text{close} + 0.5(\text{high} - \text{low})$ if the entry point is higher than the open. Enter only if momentum resumes in the trend direction
- d Exit limit at previous day's high; exit at the previous day's high retest.

A display of the system report of this core application can be seen in Figure 3.

I went one step further and added another trend filter to indicate the strength of the trend, as well as a simple volatility filter that will allow the system to trade only during volatile conditions in the markets. After adding the ADX as the trend filter and/or the average true range (ATR) as the volatility filter, the profit factor and/or the average trade were significantly improved.

- e Trend filter: $\text{ADX}(14) > 18$; you do not want to trade in a choppy market.
- f Volatility filter: $\text{average true range}(13)/\text{average}(\text{close},$

$) > 1\%$; you want to make sure you trade in volatile conditions.

Adding the trend filter (Figure 4) increased the profit factor from 3.53 to 4.14. The average trade increased from \$339.91 to \$367.72. Adding the volatility filter (Figure 5) increased the profit factor to 4.46 and the average trade to \$399.98. Combining both filters improves both even further

```
Input: p(13),s(13),f(0.5);

IF c < c[1] and c > average(c,p) Then Buy c+f*(h-l) Stop;
ExitLong at high limit;

IF c > c[1] and c < average(c,s) Then Sell c-f*(h-l) Stop;
ExitShort at low limit;
```

FIGURE 2: EASILANGUAGE CODE. Here you see a simple volatility breakout system.

Performance summary: all trades

Total net profit	\$84,977.50	Open position P/L	\$0.00
Gross profit	\$118,560.00	Gross loss	(\$33,582.50)
Total # of trades	250	Percent profitable	94.00%
Number winning trades	236	Number losing trades	14
Largest winning trade	\$7,175.00	Largest losing trade	(\$7,800.00)
Average winning trade	\$502.37	Average losing trade	(\$2,398.75)
Ratio avg win/avg loss	0.21	Avg trade (win & loss)	\$339.91
Max consec. winners	44	Max consec. losers	2
Avg # bars in winners	0	Avg # bars in losers	3
Max intraday drawdown	(\$13,475.00)		
Profit factor	3.53	Max # contracts held	1
Account size required	\$13,475.00	Return on account	630.63%

FIGURE 3: PERFORMANCE SUMMARY OF THE CORE APPLICATION. Without adding any filters, the system displays solid performance.

Performance summary: all trades

Total net profit	\$68,027.50	Open position P/L	\$0.00
Gross profit	\$89,690.00	Gross loss	(\$21,662.50)
Total # of trades	185	Percent profitable	96.00%
Number winning trades	177	Number losing trades	8
Largest winning trade	\$7,175.00	Largest losing trade	(\$7,800.00)
Average winning trade	\$506.72	Average losing trade	(\$2,707.81)
Ratio avg win/avg loss	0.19	Avg trade (win & loss)	\$367.72
Max consec. winners	47	Max consec. losers	1
Avg # bars in winners	0	Avg # bars in losers	3
Max intraday drawdown	(\$13,475.00)		
Profit factor	4.14	Max # contracts held	1
Account size required	\$13,475.00	Return on account	504.84%

FIGURE 4: PERFORMANCE SUMMARY WITH A TREND FILTER. The profit factor and average trade improve with the addition of a trend filter.

Performance summary: all trades

Total net profit	\$82,775.00	Open position P/L	\$0.00
Gross profit	\$106,707.50	Gross loss	(\$23,932.50)
Total # of trades	207	Percent profitable	95.00%
Number winning trades	196	Number losing trades	11
Largest winning trade	\$7,175.00	Largest losing trade	(\$7,800.00)
Average winning trade	\$544.43	Average losing trade	(\$2,175.68)
Ratio avg win/avg loss	0.25	Avg trade (win & loss)	\$399.88
Max consec. winners	42	Max consec. losers	2
Avg # bars in winners	0	Avg # bars in losers	3
Max intraday drawdown	(\$13,475.00)		
Profit factor	4.46	Max # contracts held	1
Account size required	\$13,475.00	Return on account	614.29%

FIGURE 5: PERFORMANCE SUMMARY WITH A VOLATILITY FILTER. The profit factor and average trade improve with the addition of a volatility filter.

Performance summary: all trades

Total net profit	\$64,900.00	Open position P/L	\$0.00
Gross profit	\$81,887.50	Gross loss	(\$16,987.50)
Total # of trades	150	Percent profitable	96.00%
Number winning trades	144	Number losing trades	6
Largest winning trade	\$7,175.00	Largest losing trade	(\$7,800.00)
Average winning trade	\$568.66	Average losing trade	(\$2,831.25)
Ratio avg win/avg loss	0.20	Avg trade (win & loss)	\$432.67
Max consec. winners	35	Max consec. losers	1
Avg # bars in winners	0	Avg # bars in losers	3
Max intraday drawdown	(\$13,475.00)		
Profit factor	4.82	Max # contracts held	1
Account size required	\$13,475.00	Return on account	481.63%

FIGURE 6: PERFORMANCE SUMMARY WITH TREND AND VOLATILITY FILTER. Adding both filters improves results significantly.

(Figure 6). The buy and sell signals generated by applying both filters are displayed in Figure 7.

CONCLUSIONS

The system I have described is only intended to show how a simple volatility breakout system can be applied. The parameters are not optimized, and stop-losses have not been applied. Other additions that would be useful include more sophisticated indicators, enhanced filters, adaptive parameters based on functions, exits based on intraday conditions, and money management techniques. You might also look for significant intermarket correlations. There's a lot of room for flexibility, and you can have fun experimenting with different tools and techniques. Volatility breakout systems will help you understand the marketplace and its dynamics. Most important, they can be quite profitable.

Paolo Pezzutti, a commander specializing in telecommunications in the Italian navy, is also a member of the Italian Technical Analysis Association (STAT).

SUGGESTED READING

Crabel, Toby [1988]. "Playing The Opening Range Breakout," *Technical Analysis of STOCKS & COMMODITIES*, Volume 6: September.

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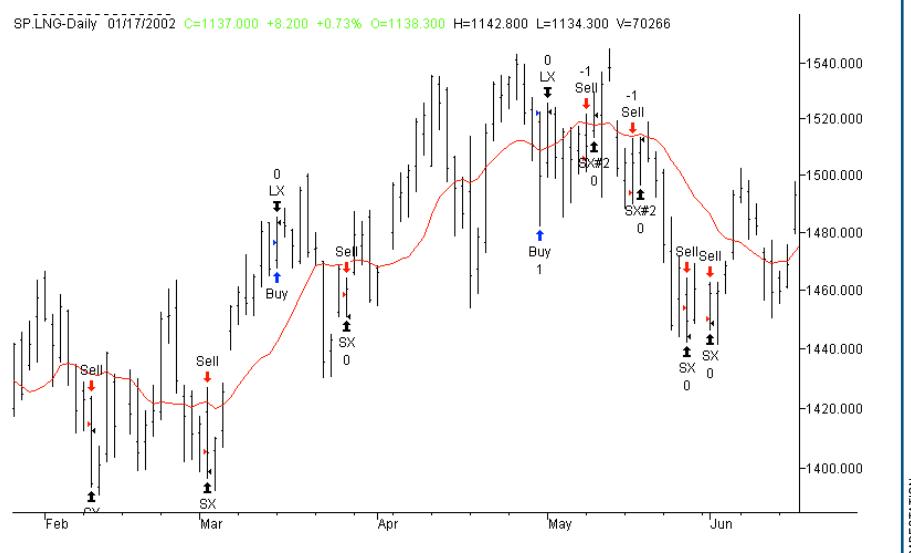
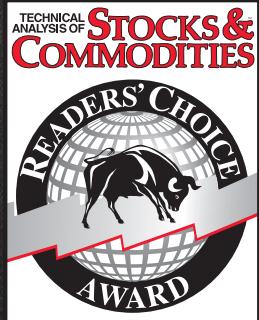


FIGURE 7: S&P 500 DAILY CHART. Here you see the volatility breakout system in action.

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