Entering on the right foot

The second installment of a two-part series compares the performance of different entry signals.

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Traders often focus on entering the market at right spot while neglecting exit rules. While it may seem natural to try to enter the market at the optimal moment, "Exiting on a high note" (*Active Trader*, July 2010) contradicted this notion, showing how exit rules contribute just as much to a strategy's success as its entry signals.

That article examined strategies that entered markets randomly but exited according to different technical rules. The best-performing strategy exited trades with a trailing stop based on the 14-day average true range (ATR).

This article tests the opposite scenario: carefully planned entry rules paired with random exit signals. Can a strategy that exits the market randomly still be profitable?

The entry rules use standard technical indicators, including Bollinger Bands, momentum, moving average convergence-divergence (MACD), and the relative strength index (RSI). The analysis will use continuous daily prices four futures contracts — crude oil (CL), soybeans (S), Euro FX (EC), and the E-Mini S&P 500 (ES) — over the past five years.

Random trades as a benchmark

Before developing entry signals, let's create a strategy with random entry and exit rules to serve as benchmark. We start by generating a list of random numbers; you can find random functions in almost any software format. For example, in TradeStation, you can create a uniformly distributed random number between 0 and x with the function random(x). And in Excel, you can generate random numbers in the same range of values with the following formula:

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=RAND()*(x-0)
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Random trades are divided evenly between long and short signals and are independent of the prior trade's direction. Entry signals occur after a random number of days (from one to 20) have passed since the system exited the previous trade. The trades are held a random number of days, from one to 20, with an average of roughly 10 days.

Over many trials a completely random system should have an average trade of zero, excluding commissions and slippage. Its performance is a useful benchmark for comparing other techniques.

Planned entry signals

The next step is to pair five entry signals with random exits that are triggered up to 20 days later.

The first entry signal is based on Bollinger Bands. It enters long if yesterday's high price was above the upper Bollinger Band, but today's high price is below that band; it sells short if yesterday's low price was below the lower band, but today's low price is above that band. Six parameter values were tested: band length (based on 20-, 30-, and 40-day simple moving averages) and the number of standard deviations (one, two, or three). Each version of the system was tested with random exits 500 times, a total of 4,500 runs for each instrument.

The second entry signal is based on the MACD. It enters long when the MACD line crosses above zero, and sells short when it crosses below zero. Five parameter values were tested for the short-term EMA: six to 30 days in steps of six; the long-term EMA was always twice as long as the fast one. With 500 runs for each combination, there were a total of 2,500 runs per instrument.

The third entry signal is based on price momentum. It enters long when the x-day momentum and acceleration (i.e., the one-day change in momentum) are both greater than zero and today's high is above yesterday's high. Five momentum look-back periods were tested: six to 30 days in steps of six (2,500 runs per instrument).

The fourth entry signal is based on a moving average crossover. Long signals occur when a short-term MA crosses

above its long-term counterpart, while short signals are triggered when the short-term MA crosses below the long-term one. The longer MA length is twice as long as the shorter one, which was tested in lengths of six to 30 days in steps of six. As was the case with the MACD and momentum signals, five parameters were tested for a total of 2,500 runs per instrument.

The fifth entry signal is based on the 14-day RSI. It buys the market when the RSI crosses above the oversold level and sells short when the RSI crosses below the overbought level. We tested three overbought and three oversold levels for a total of 4,500 runs per market (overbought levels of 50,60,70 vs. oversold levels of 30,40,50)

Entry signals are only taken when the system is flat to make sure they don't affect the exits. Also, to ensure performance reflects only the trade signals, and not order type, the strategy uses market orders instead of stop or limit orders, executed at the next day's open.

Random system performance

The first test combined random entries and exits in crude oil, soybeans, Euro, and E-Mini S&P 500 futures from Jan. 1, 2005 to Jan. 1, 2010. No commissions or slippage were included.

As expected, the average profit per trade for the four futures markets was roughly zero. However, individual equity curves and maximum drawdowns varied quite a bit. Figure 1 shows the equity curves of 10 of the 500 random runs in soybean futures, while Figure 2 shows their drawdowns. The goal now is to find strategies with planned entries that beat the random system's performance.

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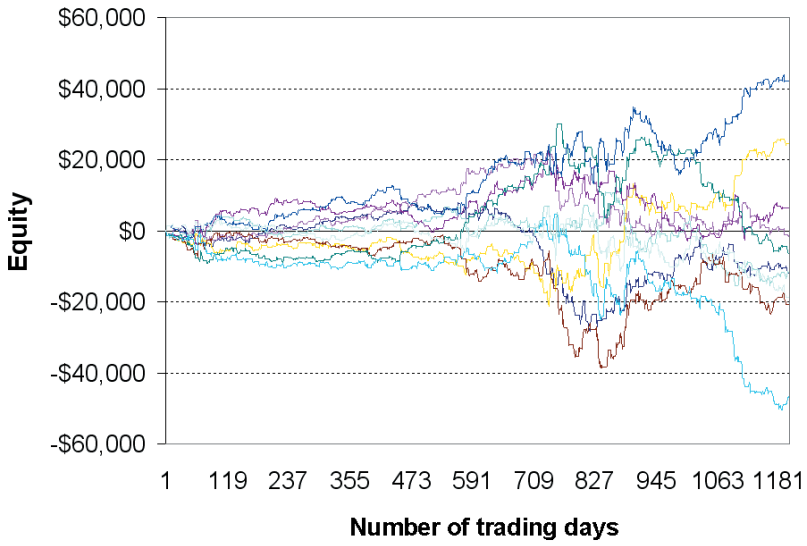
KC *Go to "Key concepts" on p. 76 for more information about:*

- *Bollinger Bands*
- *Exponential moving average*
- *MACD*
- *Momentum*
- *Optimization*
- *Relative strength index*
- *Simple moving average*

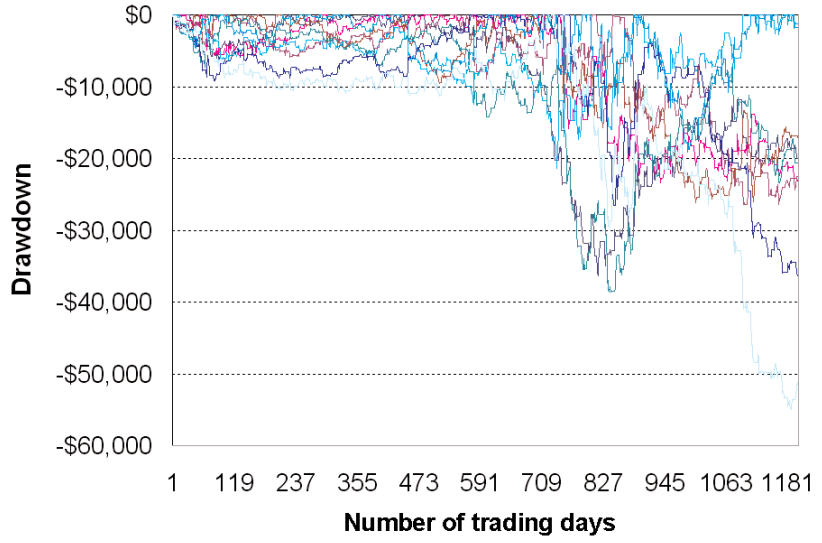
FIGURE 1: RANDOM SYSTEM EQUITY CURVES



These 10 equity curves, selected from among 500 random trials, show the range of performance of the random system.

Source for all figures and tables: TradeStation

FIGURE 2: RANDOM SYSTEM DRAWDOWNS



The random system's drawdowns were all over the map, as expected.

TABLE 1: ENTRY SIGNAL PERFORMANCE

Entry	Best parameters	Best avg. trade	Worst parameters	Worst avg. trade
Bollinger Bands	MA = 10 days Standard deviation = 3	$97	MA = 20 days Standard deviation=3	-$555
MACD	Short-term EMA = 30 days Long-term EMA = 60 days	$42	Short-term EMA = 24 days Long-term EMA = 48 days	-$222
Momentum	Look-back period = 30 days	$203	Look-back period = 6 days	-$2
MA crossover	Short-term MA = 12 days Long-term MA = 24 days	$370	Short-term MA = 30 days Long-term MA = 60 days	-$216
RSI	Oversold = 50 Overbought = 70	-$181	Oversold=30 Overbought=70	-$495

The best momentum and moving-average crossover entry signals performed much better than random. However, the worst Bollinger Band and RSI signals performed terribly. Could these signals be improved by reversing their direction?

Planned-entry performance

Table 1 shows each strategy's average trade for its best- and worst-performing parameter values. For the momentum and moving-average crossover entries, the best parameters beat the random strategy by a wide margin. For example, the best version of the MA crossover entry signal had an average trade of $370, while the top version of the momentum entry signal had an average trade of $203.

In contrast, the worst-performing versions of the Bollinger Bands, RSI, and MACD signals were dismal. The worst versions of the Bollinger Bands and RSI entries had average trade losses of $555 and $495, respectively — larger than the top-performing signals' gains.

Reversing these signals might be more profitable than the best-performing versions from Table 1, a step we can take because commissions and slippage are excluded. Retesting the Bollinger Band and RSI signals with inverted rules did, in fact, produce positive performance. For example, by reversing the Bollinger Bands entry signal, the strategy earned an average profit of roughly $525, almost the exact opposite of its original worst-performing version (-$555).

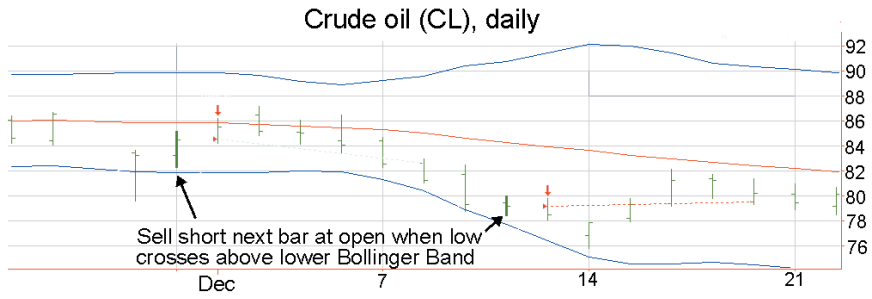
The best-performing strategies actually turned out to be the inverted version of the worst-performing versions of Bollinger Band and RSI entry signals. Figure 3 shows two short trades in crude oil futures in December 2009 that were triggered by the reverse Bollinger Bands signal (20-day SMA, three standard deviations). The only drawback is the signals appeared infrequently, triggering roughly 10 trades per year. This increases the possibility that performance isn't statistically significant.

Time-based exits

Before we select the reverse Bollinger Band and RSI entry signals as the winners, let's examine how they performed up to 20 days later. If the entry signal is too early, the system's average trade will be small or negative after the first few days. But if it is well-timed, the system's average trade should remain positive during this period.

Figure 4 shows the average profit size of the reverse Bollinger Band and RSI signals according the number of days they are held. Both entry signals are immediately profitable and gained ground in the first 10 days. The Bollinger Band signal earned an average profit of $414 on day 1, climbing to

FIGURE 3: TRADE EXAMPLES

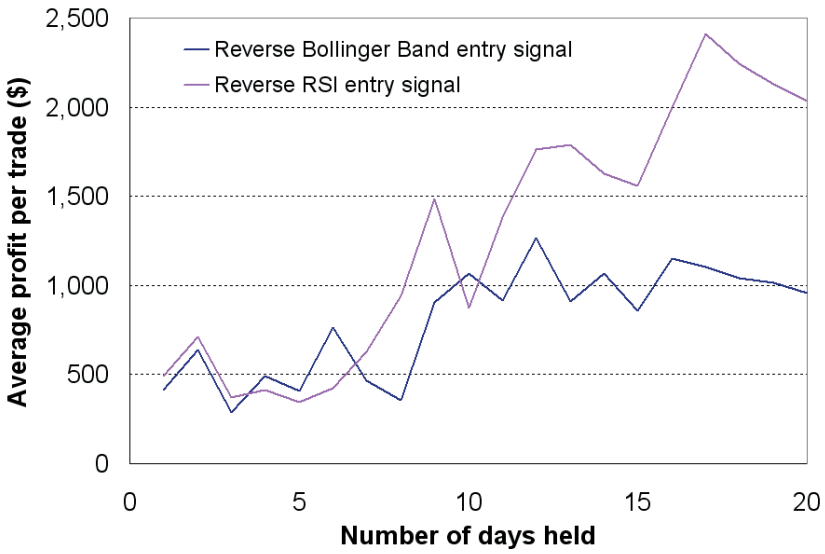


The reverse Bollinger Band entry signal caught the downtrend in crude oil in early December 2009. However, the mid-December signal lost money.

TradeStation code

You can copy TradeStation code for these tests at www.activetradermag.com: Click on Web Only > Strategy Code

FIGURE 4: MEASURING TIME-BASED EXITS



Both entry signals were increasingly profitable when held up to 10 days.

$1,069 by day 10. Similarly, the reverse RSI signal earned an average profit of $492 on day 1, rising to $873 by day 10. This pattern suggests holding on to winning trades from these signals is a good idea.

Out-of-sample tests

The last step is to confirm the reverse Bollinger Bands and RSI signals haven't been optimized to perform well solely over the past five years. We retested both entry signals in each futures market with 500 random runs in the five years before 2005 — Jan. 1, 2000 to Jan. 1, 2005.

In this time period, the reverse Bollinger Band signal had an average trade of $6, while the reverse RSI signal had an average trade of $252. The out-of-sample Bollinger Band performance is basically random, suggesting the entry signal either has no predictive ability, was over-optimized, or the character of the markets changed between the two periods. For the RSI signal, the average trade was about half as large as its in-sample performance. This is still promising, but probably not good enough to trade.

Obviously, different entry signals can impact strategy performance. But which is more important — entry or exit signals? The best-performing entry signals stalled in out-of-sample data, a drop in performance that mirrors the behavior of exit signals from "Exiting on a high note."

The point is to check if entry and exit signals are really better than random. This is critical because many traders combine entries with exits without checking if either side is predictive by itself.

For information on the author, see p. 6.

Related reading

Kevin J. Davey articles:

"Exiting on a high note," *Active Trader,* July 2010.
The first installment of a two-part series tests whether some exit signals are better than random.

"Improving both ends of a system," *Active Trader,* April 2010.
How do you know if an apparently second-rate strategy has hidden potential?

"Refining crude oil breakouts," *Active Trader,* March 2010.
A guide to improving trading strategies without adding extra rules or filters.

"After testing, before trading," *Active Trader,* January 2010.
Even after successful walk-forward testing, there's a great deal you can — and should — learn about your system before risking money on it.

"From cliché to strategy," *Active Trader,* December 2009.
A gold-based system shows how effective trading requires moving beyond vague concepts to tested concepts.

Other articles:

"Scaling out as an exit technique," *Active Trader,* September 2009.
Analyzing how scaling out of trades and moving stops to breakeven impacts a simple trading technique.

"Scaling in as an entry technique," *Active Trader,* October 2009.
Testing whether scaling into trades really improves performance.

"System design, part 5: Searching for the exit," *Active Trader,* June 2009.
In the firth installment of our system design series, we use a 10-year data period to develop settings for our entry and exit rules.