TRADING SYSTEMS

Woe Canada!

Trading The Loonie

Here's a trading system that exploits the strong correlation between the Canadian dollar and crude oil.

The Canadian dollar (affectionately referred to as "the loonie" by traders because of the appearance of a loon, a bird common in Canada, on the back of the Canadian one-dollar coin), like the Australian dollar, the New Zealand dollar, the South African rand, and the Norwegian krone, is regarded as a *commodity currency* because of the sizable role of commodity production in the Canadian economy. In the case of Canada, the price of oil seems to be especially significant in currency moves.

Loonie and Crude

When you think of major crude oil exporters to the US, Saudi Arabia and other nations in the Middle East come to mind. But the bulk of the imported oil consumed in the US comes from Canada, which is an advantage for Canadian oil producers in that shipping costs are low. The following list represents the four highest dollar–value exports in Canadian global shipments during 2014. Also shown is the percentage share that each export category represents in terms of overall exports from Canada.

- **Oil**: US$128.9 billion (27.2% of total exports)
- **Vehicles**: US$59.8 billion (12.6%)
- **Machines, engines, pumps**: US$32.6 billion (6.9%)
- **Gems, precious metals, coins**: US$21.5 billion (4.5%)

As you can see, crude oil is by far Canada's most exported product and is tens of billions of dollars ahead of the next largest category, automobiles. Since the start of the millennium, oil exports increased substantially due to the massive expansion of the oil sands in Alberta, and today, Canada's oil reserves are third only to Venezuela and Saudi Arabia.

Movements in the price of crude oil, therefore, will have a significant impact on the supply of US dollars into the Canadian economy. High oil prices will increase the amount of US dollars flowing into Canada, resulting in an increase in the value of the Canadian dollar. Conversely, low oil prices will result in a fall in the value of the Canadian dollar.

The price of crude oil will also affect the direction of interest rates because a rise in crude oil prices will increase economic growth, and thus is a reason for the Bank of Canada to raise interest rates, which will of course impact the exchange rate of the currency.

A 10-year correlation analysis between the CAD/USD and oil prices (see the table in Figure 1) shows that there is a strong 0.81 positive relationship, with a value of 1 indicating a perfectly positive relationship. (Note that I am expressing the Canadian dollar and Norwegian krone in terms of US dollars here, which is the inverse of what is traded in the forex

	CAD/USD	CL	XAU	GSG	NOK/USD
CAD/USD	1.00	0.81	0.76	0.43	0.83
CL	0.81	1.00	0.44	0.57	0.75
XAU	0.76	0.44	1.00	0.41	0.71
GSG	0.43	0.57	0.41	1.00	0.67
NOK/USD	0.83	0.75	0.71	0.67	1.00

FIGURE 1: 10-YEAR CORRELATIONS. Here you see the Pearson's 10-year correlation between the Canadian dollar (CAD/USD) and WTI crude oil futures (continuous contract), the Philadelphia Gold & Silver Sector Index (XAU), the iShares S&P GSCI Commodity Indexed Trust ETF (GSG), and the Norwegian krone (NOK/USD). The correlations were calculated using data from January 1, 2005 through September 8, 2015 as provided by Reuters Datalink. Data for the GSG ETF was only available since July 2006. Note that I am expressing the Canadian dollar and Norwegian krone in terms of US dollars here—which is the inverse of what is traded in the forex market—since it's easier to visualize positive correlation this way.

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by Markos Katsanos

market, since it's easier to visualize positive correlation this way.) Notice the weak correlation with commodities (represented by the S&P GSCI index, or GSG). The strong correlation with the Norwegian krone is no surprise, as both countries are heavily dependent on oil exports. Production from the Alberta oil sands is still in its early stages, so you can expect the strong correlation with oil to remain stable or even increase in the future, provided that oil prices recover from their lows.

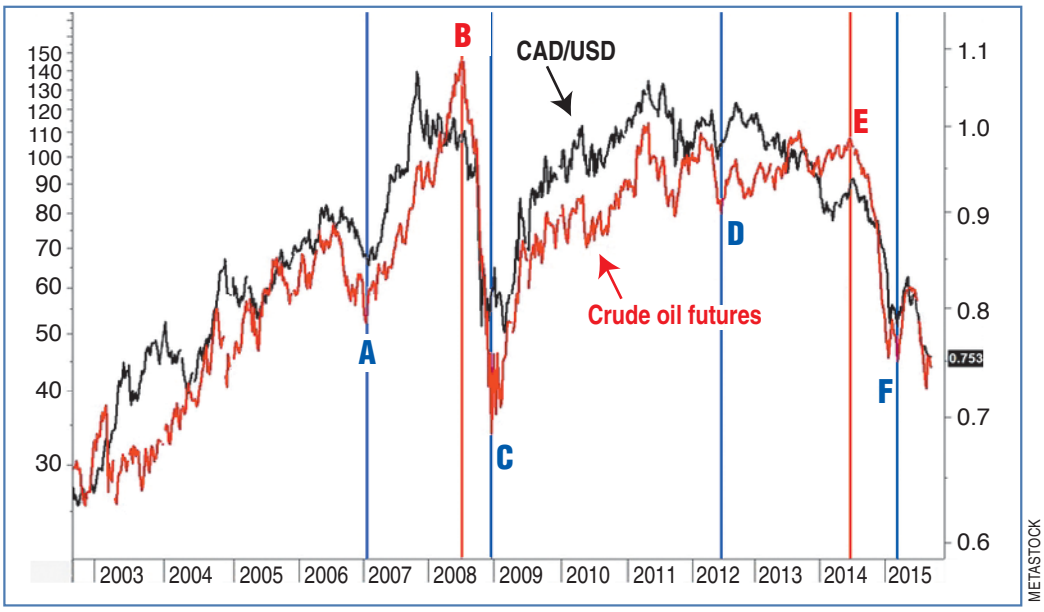

FIGURE 2: CANADIAN DOLLAR VS. CRUDE OIL PRICES. On this weekly chart of the Canadian dollar (CAD/USD) in black and WTI crude oil futures superimposed in red, you can see how the two are closely correlated. The right-hand scale depicts CAD prices and the left-hand scale depicts crude oil prices. Red vertical lines are drawn at crude oil tops and blue vertical lines at bottoms.

In Figure 2 you can see how closely the Canadian dollar tracks crude oil prices. The correlation, however, breaks down for very high or very low prices of oil. From 2007 to 2008 during oil's spectacular rally from $50 in the beginning of 2007 to $145 in July 2008 (see the red vertical line B on the chart), the Canadian dollar made a top almost eight months earlier, in November of 2007, refusing to follow oil any higher.

At the end of 2008 (see blue line C) during the financial crisis, oil fell as low as $33 while the Canadian dollar made a bottom on October 24, 2008, almost two months in advance of the bottom in oil, forming a triple-bottom consolidation pattern and refusing to decline any lower. At other instances, the dollar's tops and bottoms were slightly lagging (see lines A and E), leading (see line D), or coincident (see line F). This is more obvious in the scatterplot in Figure 3. The relationship is approximately linear, as the points fall near the regression line most of the time. Significant deviations from the regression line (in black) are evident for high oil prices (>$115) at the top right of the chart, very low oil prices (<$35) at the bottom left of the chart, and for high CAD/USD prices (>$1.05) at the right-hand side of the chart.

There's some additional useful information from the regression analysis and the scatterplot in Figure 3 that you may find of interest. The coefficient of determination or *r*-squared of the regression is 0.65, which implies that 65% of the variation in the US–Canadian exchange rate can be explained by oil price changes. In addition, the slope of the regression line is 0.003, which means that for every US dollar increase of crude oil, the Canadian dollar should appreciate by about 0.3 cents.

But how can you profit from the above? Now that you understand the strong link between the Canadian dollar and oil prices, can you use this to forecast the Canadian dollar exchange rate? Probably not, because you still have to predict the price of oil. You can, however, take advantage of temporary market

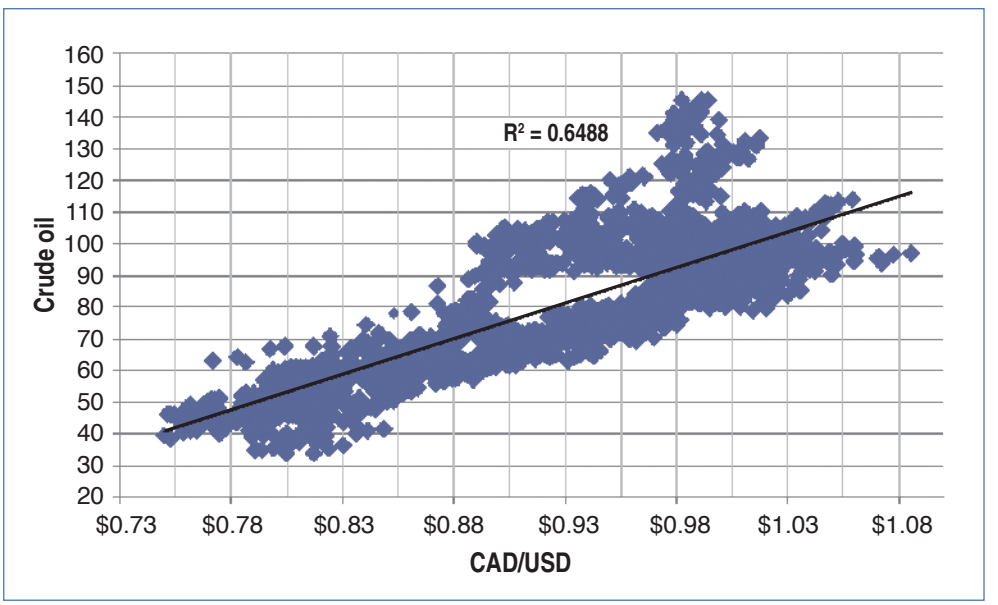

FIGURE 3: SCATTERPLOT OF THE CAD/USD AND CRUDE OIL FOR THE LAST 10-YEAR PERIOD THROUGH SEPTEMBER 2015. The relationship is approximately linear, as the points fall generally along the regression line in the middle. The correlation breaks down for high or very low values (>$115 or <$35) of oil.

inefficiencies to calculate divergences between the actual and predicted exchange rate and hope that it will eventually revert to normal. You can also apply technical analysis indicators on both the dollar and oil and wait for one indicator to confirm the other before executing a trade.

TRADING THE LOONIE

The Canadian dollar is traded in the forex markets and is expressed in US dollars in terms of Canadian dollars (USD/CAD). You can also trade Canadian dollar futures on the CME GLOBEX system under the symbol 6C. The lowest increment (pip) is 0.0001, the contract size is $100,000, the overnight margin is $2,608, and the intraday margin is $2,086. A mini Canadian dollar futures contract is also available under the symbol MCD and a contract size of $10,000. The Currency Shares Canadian Dollar Trust (NYSE:FXC), which tracks the loonie's daily performance, can also be used by investors who do not have an account with a forex or futures broker.

For the test I ran for this article, I used Canadian dollar futures continuous data provided by Reuters. The default trade size was one contract per trade and the trade duration was 20 years from September 1995 to September 2015. Signals were executed the next day at the open. The commission charged by discount brokers of $2.40 was deducted from each trade and no interest was credited to the account when out of the market, as this was assumed to cancel out additional slippage costs. The system did not reinvest profits. The total return would obviously be far larger if the returns were compounded.

To calculate the divergence between the loonie and oil I used the Bollinger Band divergence indicator as discussed in my book *Intermarket Trading Strategies*. Here's how you can use this indicator to calculate the divergence between a security and a related market.

First, the relative position of both securities in the Bollinger Bands is calculated and the divergence is then derived by subtracting the relative position of the base security from the intermarket security. Values less than zero indicate negative divergence and above zero indicate positive divergence. Buy signals are generated when the indicator reaches a peak above a certain level (usually 10 to 30%) and subsequently declines. Similarly, sell signals are triggered when the indicator reaches a bottom below a certain level (usually -10 to -30%) and rises.

Here's how the final system can be summarized.

Buy condition:

If the maximum BB divergence rose above 20 and then reversed direction, a buy signal will be generated. I used the default Bollinger Band parameter (20 days and two standard deviations) with no optimization. To filter out trades when oil and the dollar were in a downtrend, I added two additional conditions: the direction of oil's 40-day moving average should be up and the dollar should have been trending up during the last two days. An additional filter eliminated trades during negative correlation between the dollar and oil.

Sell (close long) conditions:

In addition to the sell short signals described here (which reversed the trade), I decided to add the following three conditions:

1. **Overbought**. A combination of the stochastic and moving average convergence/divergence (MACD) indicators were used to close the trade when the MACD crossed under its signal line but only on extremely overbought conditions indicated by the stochastic indicator.

2. **Divergence**. The second sell signal was generated on negative divergence (below -20) on falling oil prices (below -3% in the last three days).

3. **Stop-loss**. The stop-loss was introduced to take care of cases when the dollar decoupled from oil and the divergence condition failed to close the trade. In this case, when the correlation between the dollar and oil turned negative (below -0.4), a channel stop-loss condition closed the trade if the dollar fell below the lowest low of the last 15 days.

Sell short condition:

This was the reverse of the buy condition described earlier. Short signals were triggered if the divergence fell below -20 while oil was in a downtrend.

Buy to cover conditions:

Again, these were the opposite of the sell conditions described earlier except for the first condition, which was triggered only when the oversold condition indicated by the stochastic and MACD was confirmed by a short-term bottom in oil prices as well. This eliminated some premature exits and improved the results. You can find the MetaStock code for this trading system in the sidebar "MetaStock Code."

EVALUATION OF RESULTS

The backtest results are summarized in Figure 4. In the accompanying chart in Figure 5 you can see the most recent trades. During the course of the 20-year simulation, the system produced an annualized 129% return, producing 123 trades that were roughly 70% accurate. The profit factor, which is defined as gross profits divided by gross losses, was 4.7. A profit factor above 3 is considered excellent.

The average win was $1,512 over 86 trades and the average loss was $754 over 37 trades. There were 10

consecutive winners and five consecutive losers that produced only small losses during a string of whipsaw trades in 1997. During that time, oil prices were relatively flat, and thus the variation in the Canadian dollar was driven by other factors.

Somewhat worrisome, however, were the drawdowns. The maximum drawdown occurred in November 2011. In this case, the stop-loss failed to close the trade as the dollar decoupled from oil only briefly, but the correlation never turned negative. Removing the correlation requirement from the third exit condition reduced the maximum drawdown by about $1,000, but at the same time, the profitability deteriorated dramatically (the winning trades fell from 70% to 54% and the profit factor to 2.25).

Nevertheless, the timing of the exits was not the best or most efficient, and some signals were late to materialize when needed, as some winning trades suffered large adverse price movements before becoming profitable. This is because intermarket-generated signals can fail in cases of temporary decoupling of the base security from its related intermarket. More stringent exit rules, however, failed to improve on profitability, as they tended to close out trades far short of their maximum profit potential. Obviously, your exit conditions will depend on your risk tolerance. Minimizing drawdowns can result in early trade exits and less profits.

But what about the efficiency of the entry signals? Did the filters improve results? Entry conditions relied on only intermarket divergence, with the addition of a couple of filters, to generate signals.

A problem with divergence indicators is they always produce signals, even in declining markets. In other words, in a downtrend, if the intermarket security declines less than the base security, there is the danger that a divergence signal will be generated, but the trade will end up losing money. To take this into account I introduced an additional filter to eliminate long trades when the intermarket security (oil) was below its 40-day moving average and to short trades when it was above the moving average. This additional condition improved profitability and drawdown considerably, but the number of trades fell rather dramatically. Regardless, most of the discarded trades were unprofitable or produced large drawdowns before becoming profitable.

The second filter dealt with trades during periods of negative correlation between the dollar and oil. But did it improve results? My first choice of correlation parameters (30-day correlation < 0) eliminated a lot of trades, reducing profits without improving performance. By optimizing the correlation parameters, however, this filter managed to improve profitability for negative correlations below -0.4. The optimized parameters (20-day correlation < -0.4) improved the overall profitability, the percentage of winning trades, and drawdowns.

Although some trades were a little later than the ideal unfiltered trades, you could avoid most of the trades that would have been executed during choppy markets. Another interesting statistic is the distribution of profits throughout the duration of the test. The bulk of the profits were realized during the most recent period from 2002 to 2015. This is no surprise, since in the preceding period and especially in the 1990s, oil prices were not the primary drivers of the exchange rate, as the price

Test Results: CAD Futures	
Trading Amount	1 contract
Req. account size	$3,943
Net Profit	$102,150
Compounded Annual Return	129.5%
Total Number of Trades	123
Percent Profitable	69.9%
Average Profit	$1,512
Average Loss	$-754
Avg. Win/Avg. Loss	2.01
Profit Factor	4.66
Highest Loss	$-2,425
Highest Profit	$13,885
Max Intraday drawdown	$-4,115
Avg. Trade Length (Bars)	26
From	9/14/95
To	9/14/15

FIGURE 4: PROFIT/LOSS REPORT FOR THE 20-YEAR PERIOD FROM SEPTEMBER 14, 1995 TO SEPTEMBER 14, 2015. During the course of the 20-year simulation, the system produced an annualized 129% return, producing 123 trades which were roughly 70% accurate. The profit factor was 4.7, which is considered excellent.

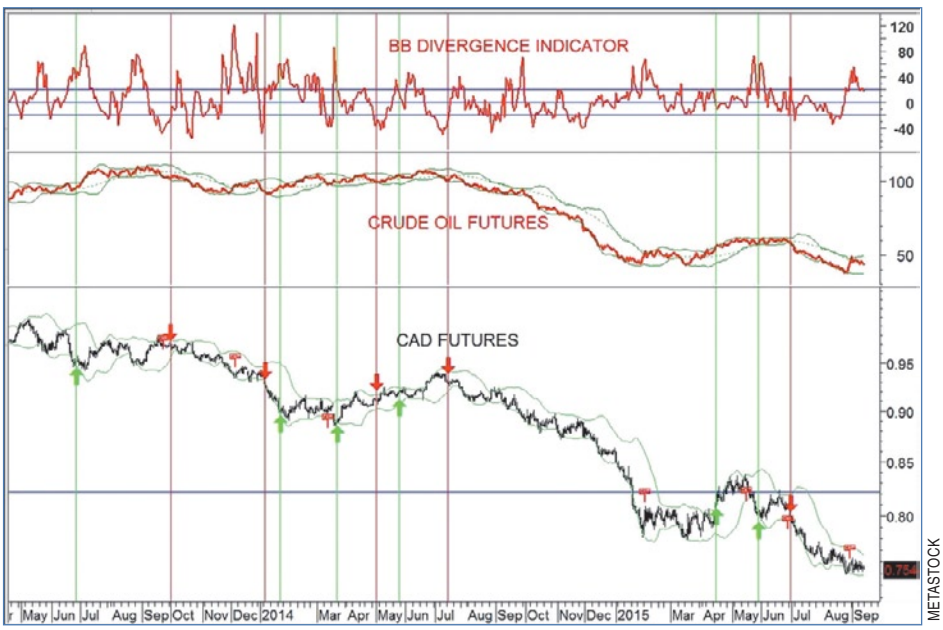

FIGURE 5: CHART OF CANADIAN DOLLAR FUTURES, MAY 2013–SEPTEMBER 2015. Test signals generated by the intermarket Bollinger Bands (BB) divergence method are superimposed on the chart. The 20-day BB divergence is plotted on the top and crude oil futures in the middle window. Bollinger Bands (in green) are included in both charts. Buy signals were generated when the divergence crossed over 20 and turned down; short signals were generated when the 20-day BB divergence crossed below -20 and turned up. Note the position of the Canadian dollar and oil in the Bollinger Bands at each signal.

of oil was relatively stable and crude oil extraction from the oil sands was still in its infancy. The system produced the most profits during periods of high volatility. In fact, the most profitable years were 2007, 2008, and 2014, which were also the most volatile years in the dollar's history. This is because of larger movements between the high and low range captured by trades.

Movements in the price of crude oil have a significant impact on the supply of US dollars into the Canadian economy.

IN CONCLUSION

Given that this simple intermarket divergence system performed consistently well for such a long period of time, I'm convinced that the relationship between the Canadian dollar and oil can provide the basis for a successful trading system.

A problem with intermarket divergence systems is that they do not produce a lot of trades. That is because these systems take advantage of temporary market inefficiencies to generate signals, and these inefficiencies do not occur often. However, the addition of classic technical analysis conditions developed specifically to work together can add value and increase trade turnover.

Keep in mind, however, that intermarket analysis relies on the premise that relationships in the past will be the same in

METASTOCK CODE

■ Bollinger Band Divergence Indicator

```
D1:=Input("BB DAYS " ,1 ,200 ,20 );
SEC2:=Security("ONLINE:CLc1",C); {Users of locally stored Data
   should substitute this line with: SEC2:=Security("C:\Metastock
   Data\@:CLc1",C);}
sec1BOL:= 1+((C- Mov(C,D1,S)+2*Stdev(C,D1))/
   (4*Stdev(C,D1)+.0001));
sec2BOL:=1+((SEC2- Mov(SEC2,D1,S)+2*Stdev(SEC2,D1))/
   (4*Stdev(SEC2,D1)+.0001));
DIVERG:=(sec2BOL-sec1BOL)/sec1bol*100;DIVERG
```

■ CAD Futures System

BUY

```
SEC2:=Security("ONLINE:CLc1",C);
D1:=20;
sec1BOL:= 1+((C- Mov(C,D1,S)+2*Stdev(C,D1))/
   (4*Stdev(C,D1)+.0001));
sec2BOL:=1+((SEC2- Mov(SEC2,D1,S)+2*Stdev(SEC2,D1))/
   (4*Stdev(SEC2,D1)+.0001));
DIV1:=(sec2BOL-sec1BOL)/sec1bol*100;

HHV(DIV1,3)>20 AND DIV1<REF(DIV1,-1) AND ROC(C,2,%)>0
AND MOV(SEC2,40,S)> REF(MOV(SEC2,40,S),-2) and
   CORREL(C,SEC2,20,0)>-.4
```

SELL

```
SEC2:=Security("ONLINE:CLc1",C);
D1:=20;
sec1BOL:= 1+((C- Mov(C,D1,S)+2*Stdev(C,D1))/
   (4*Stdev(C,D1)+.0001));
sec2BOL:=1+((SEC2- Mov(SEC2,D1,S)+2*Stdev(SEC2,D1))/
   (4*Stdev(SEC2,D1)+.0001));
DIV1:=(sec2BOL-sec1BOL)/sec1bol*100;
(CROSS(MOV(MACD(),9,E),MACD()) AND STOCH(30,3)>85) OR
(LLV(DIV1,3)<-20 AND ROC(SEC2,3,%)<-3 ) OR
(C<REF(LLV(L,15),-1) and CORREL(C,SEC2,60,0)<-.4)
```

SELL SHORT

```
SEC2:=Security("ONLINE:CLc1",C); D1:=20;
sec1BOL:= 1+((C- Mov(C,D1,S)+2*Stdev(C,D1))/
   (4*Stdev(C,D1)+.0001));
sec2BOL:=1+((SEC2- Mov(SEC2,D1,S)+2*Stdev(SEC2,D1))/
   (4*Stdev(SEC2,D1)+.0001));
DIV1:=(sec2BOL-sec1BOL)/sec1bol*100;

LLV(DIV1,3)<-20 AND DIV1>REF(DIV1,-1) AND ROC(C,2,%)<0
AND MOV(SEC2,40,S)< REF(MOV(SEC2,40,S),-2) and
   CORREL(C,SEC2,20,0)>-.4
```

COVER

```
SEC2:=Security("ONLINE:CLc1",C); D1:=20;
sec1BOL:= 1+((C- Mov(C,D1,S)+2*Stdev(C,D1))/
   (4*Stdev(C,D1)+.0001));
sec2BOL:=1+((SEC2- Mov(SEC2,D1,S)+2*Stdev(SEC2,D1))/
   (4*Stdev(SEC2,D1)+.0001));
DIV1:=(sec2BOL-sec1BOL)/sec1bol*100;

 (CROSS(MACD(),MOV(MACD(),9,E)) AND STOCH(30,3)<25 AND
   SEC2>=(1+4/100)*LLV(SEC2,4) ) OR
 (HHV(DIV1,3)>20 AND ROC(SEC2,3,%)>4.5 ) OR
(C>REF(HHV(H,15),-1) and CORREL(C,SEC2,60,0)<-.4 )
```

NOTE: Users of locally stored data from Reuters Datalink should substitute the first line of the code of all the above orders with:

```
SEC2:=Security("C:\Metastock Data\@:CLc1",C);
```

—M. Katsanos

the future, which is not always the case. Markets may decouple for a prolonged amount of time, and a strategy based on that assumption might produce considerable drawdown. Therefore, having a good exit strategy should be an essential part of your trading system.

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The code given in this article is available at the Subscriber Area at our website, www.Traders.com, in the ***Article Code*** *area.*

See our ***Traders' Tips*** *section beginning on page 49 for commentary on implementation of Katsanos's technique in various technical analysis programs. Accompanying program code can be found in the Traders' Tips area at Traders.com.*

FURTHER READING

Katsanos, Markos [2008]. *Intermarket Trading Strategies,* John Wiley & Sons.

_____ [2009]. "Trading The Aussie," *Technical Analysis of* STOCKS & COMMODITIES, Volume 27: February.

‡MetaStock