

# Reverse spreads: theoretical foundations and trading model

## Introduction

Those who already faced the Trend following concept know that effective strategies of following the trend suggest dynamic stop loss level movement without profit limitation. The position is kept until the trend is changed and the order is done. With a proper choice of the market entry point the trader switches a position into the breakeven mode and thus relieves the psychological pressure. With this approach, a profit limitation is deliberately not applicable, allowing holding the position for a long time. This approach is also useful as it minimizes the commission fee calculated on the intraday basis that the trader pays to the broker. The Trend-Following strategy uses the market momentum and allows taking profit in the long-term and large-scale trends.

The natural obstacles to this strategy are the long term low volatility in the selected time frame (sideways movement), as well as systematic sudden market changes. We would like to show you a method of pair trading with inverse spread by the example of composite instruments - PCI that allows finding new areas of sustainable trend occurrence and hedging systematic risks at the same time.

## 1. Fundamental hypothesis

Pair trading involves using two competitors belonging to one market segment. The opposition of their values allows minimizing systematic, i.e. market risks. In the table below, we have some examples of correlated pairs listed: COFFEE/COCOA, F/GM, FCATTLE/SOYB, Google/Apple and NATGAS/BRENT. Use of correlated pairs allows reducing the risks associated with food market, car market, or high-tech commodity market correspondingly. Ideally, when both of assets have the same sensitivity to the market, the spread pair is neutral and depends only on the comparative asset performance.

Let's assume that the demand for high-tech products had fallen significantly due to the global economy recession. If we had an open long position on Google, this would fatally lead to a negative transaction balance. If the GOOG/AAPL volume was bought, then both assets would decrease in value, but at the same time, their cross-rate may grow. This can happen in case of higher stability of the Google Company against systematic risks than its competitor's.

Base instrument	Quoted instrument	Market segment
Coffee/COFFEE	Cocoa/COCOA	Food
Ford Motor/F	General Motors/GM	Automotive industry
Beef/FCATTLE	Soybean/SOYB	Food
Google	Apple	Hi-Tech
Natural gas /NATGAS	Oil/BRENT	Natural resources

*Table 1. Examples of correlated pairs*

Here we assume that the assets have a normal relation, i.e. the growth of the base and the quoted assets are positively correlated. Indeed, if the growth in the food market is observed for a long time, this will fatally lead to the higher prices of coffee and cocoa. At the same time, we do not take the competition into account.

The influence of systemic factors is noticeable on monthly longer term scales. We would like to consider the principles of high-frequency trading: W1, D1 or less. For this purpose, we take a look at the anomalous relation of competing assets. All the instruments indicated in the table have a chance of belonging to this group. We are looking for a simple interpretation of the fundamental situation where the competition would have a sharp effect.

### Example 1

Using soybeans as a meat substitute, *ceteris paribus* can create a unique situation where the demand for these two products is replaceable. In case of constant supply, it can lead to inverse relation between the #C-FCATTLE beef futures price change and the #C-SOYB soybean futures. As the supply is inertia and reacts slowly to the food fashion relatively to the demand (production capacity, staff, etc.), it can be assumed that such a situation arises regularly. So, our hypothesis is: in case of stable market supply and substitution demand, rise in soybean futures prices provokes the decrease of the frozen beef futures in value and vice versa. Which way to turn, it depends on consumer income (soy is a cheaper substitute), healthy diet fashion, vegetarian fashion, feeding costs, etc.

The mechanism of all other fundamental factors is not important for trading, as we can consider only comparison factors. Using the method of pair trading with inverse spreads allows significantly simplifying the fundamental analysis.

### Example 2

Let's consider a mixed spread of competing assets: shares of Coca-Cola #S-KO and futures for frozen concentrated orange juice #C-ORANGE. It is worth to note that in volume terms natural orange juice is on average 1.5-2 times more expensive at the moment than carbonated beverages produced by the Coca-Cola Company. It is no surprise that the orange juice concentrate consumption decreased by 14.7% in the crisis beginning and in the period of 2007-2012. And this happened when the Coca-Cola Company revenues started growing faster than they did before the crisis, reaching a 50% growth within 2007-2012. If we compare the growth of the #S-KO price and orange concentrate futures, we will see the situation is sharper. So the #S-KO stocks raised by 46% vs. 2.6% for #C-ORANGE.

The demand substitution effect is most clearly manifested in the healthy lifestyle macro trend strengthening. The opposite situation is possible when the fast food demand grows, for example, during systemic economic crisis. One of these tendencies may lead to inverse relation increase for the #S-KO and #C-ORANGE.

## **2. Statistical hypothesis testing: asset movement correlation**

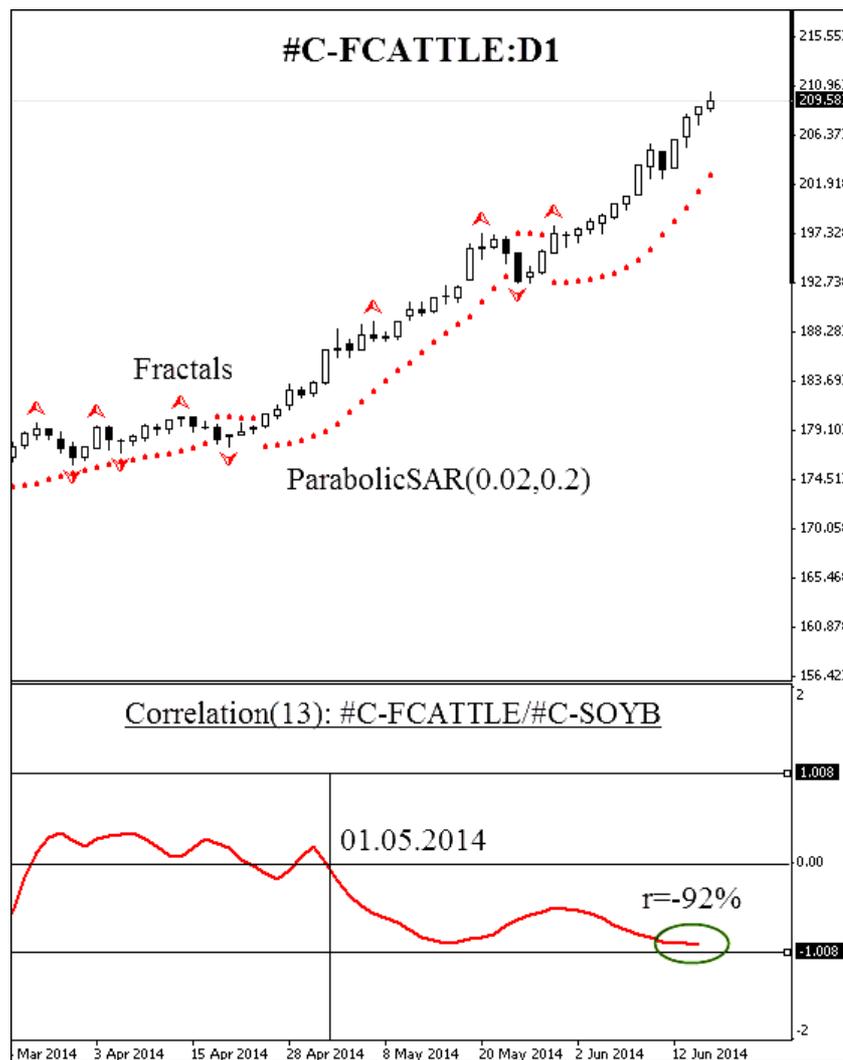
After figuring the main hypothesis out, we try to find the optimum market situation where the position on the pair instrument could be opened. Our task is to determine the period where the inverse relation between the dynamics of competing assets is expressed in the sharpest way. The pair correlation coefficient can be used as the simplest indicator here.

A correlation  $r$  evaluates the linear dependence degree of the analyzed assets. The  $r$  coefficient is located in the range  $[-1, 1]$ , or from -100% to 100%, in terms of percentage points. When the values are close to 1 the dependence of the price change for the assets can be approximately described by the following equation:

$$\Delta A_2 = \Delta A_1 \cdot k \quad (1)$$

Here we have  $\Delta A_1$  as the absolute price change of the Asset 1 and  $\Delta A_2$  as the absolute price change of the Asset 2. In this case, the  $k$  coefficient is a positive constant:  $k > 0$ .

For  $k < 0$  the base asset price growth leads to the quoted asset price fall and vice versa. Thus, if the  $r$  coefficient is close to -1, the price changes are expressed by the same equation, but  $k < 0$ . This is the case that is the most interesting for spread trading using a trend following technique. A small deviation of the spread pair prices leads to the further movement in this direction - the synthetic instrument has a predisposition to the trend - this effect will be explained below.



**Fig. 1.** The correlation between the movements of frozen beef and soybeans futures

To find the inverse spread we use the indicator of the  $r$  correlation coefficient attached to the main chart of the instrument in the MetaTrader 4 trading platform. For example, if we have the #S-KO/#C-ORANGE cross pair considered, then, we open the “The Coca-Cola Company” daily price chart in the upper window. The correlation indicator is placed in the window below. We specify the time period we calculate the correlation coefficient for – i.e. the number of bars required for statistical analysis.

The statistical volume is primarily determined by the investment horizon and corresponding parameters of other indicators. FCATTLE/SOYB (frozen beef /soy) cross pair example is considered above. We use the 13-days period of correlation. Since May 2014, the indicator signal dropped below the critical level of 0% to -92% in early June. We will consider the asset pair having a correlation coefficient less than 0% as an inverse spread. The presented chart confirms the inverse relation of assets on the 13-day horizon and it allows counting on the intensive trend movement.

Let's consider the price change of a cross pair composed as the ratio of the base asset price and the corresponding price of the quoted asset, providing that both assets have a correlation coefficient close to 1 (e.g., above 0.9):

$$\Delta Spread = \left( \frac{A_2}{A_1} \right) = \frac{\Delta A_1}{A_1} \cdot \left( k - \frac{A_2}{A_1} \right) \quad (2)$$

If the basic asset price rises within the analyzed period, and the quoted asset price falls then  $k < 0$  and the inverse spread absolute price change is expressed by the equation (3):

$$|\Delta Spread| = \frac{|\Delta A_1|}{A_1} \cdot \left( |k| - \frac{A_2}{A_1} \right) \quad (3)$$

Thus, the volatility of the pair instrument is higher than the corresponding relative volatility of the quoted asset in  $\alpha$  times where  $\alpha$  is defined as following:

$$\alpha = \left( |k| - \frac{A_2}{A_1} \right) \quad (4)$$

The closer an absolute correlation to the 1 limit value, the higher the pair instrument volatility vs. the quoted instrument volatility is. The  $\alpha$  - effect is what allows using the trend-following strategy effectively in case of spread instruments and quitting the sideways corridor as quickly as possible.

But what makes the trend movement sustainable after the corridor is left? Let us assume that the correlation of  $\Delta A_2$  and  $\Delta A_1$  is close to -1, while the quoted asset price leaned down for fundamental reasons:  $\Delta A_2 < 0$ . This will fatally lead to the rise in prices of the base asset  $A_1$  and the  $\alpha$  coefficient respectively. A small deviation of one of the assets leads to a nonlinear volatility increase and the trend beginning. In this situation, the trend following strategy becomes effective.

### 3. Reverse spread analysis

According to Figure 1 a crossing of 0% correlation critical level has been recorded in the beginning of May, 2014. Till June 14, the coefficient has been falling down to the historic low of -92%, which fatally led to the pair instrument volatility increase (See relation (3)) and the development of a new trend.

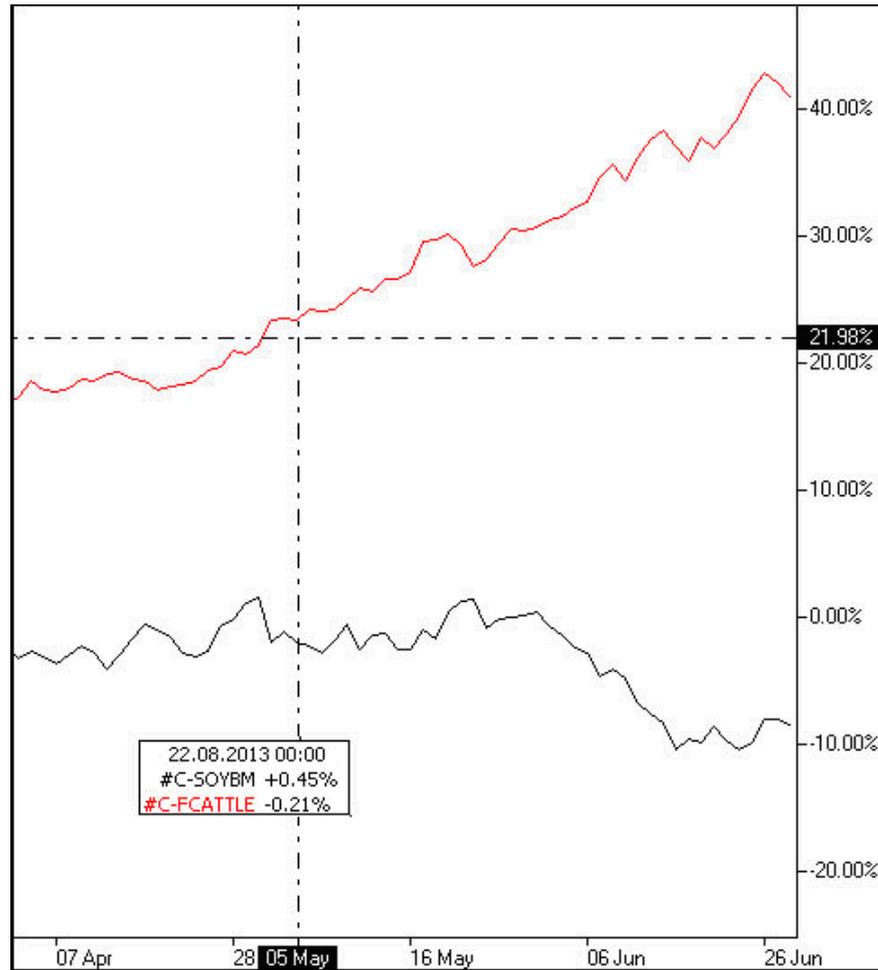
The #C-FCATTLE/#C-SOYB daily chart has been composed with a use of NetTradeX trading platform automatically. This software allows building only candle bodies, i.e. open and close prices. However this minimal data can be applied for the elementary trend analysis. We can note that the Bill Williams fractal, defining a key resistance of 0.72541, has been broken through on May, 5. This movement corresponds to the crossing of correlation zero level (See Fig.1).



**Fig. 2.** The daily chart of FCATTLE/SOYB spread

From the fundamental point of view the reverse spread growth may be defined by a substitution of the demand in a post crisis recovery: a returning to natural products, including a substitution of soy products by meat is observed.

However a quantitative analysis discloses a nonlinear  $\alpha$  – effect influence. In Fig.3 the percentage price changes of #C-FCATTLE and #C-SOYB are represented according to close prices. We observe that a frozen beef is the main spread growth driver (red line). A certain delay is fixed until the SOYB failure after May 16. Then the pair instrument growth rate gets accelerated unlike the #C-FCATTLE elementary instrument. This is due to the alpha – effect nonlinear influence, discussed above, as the correlation coefficient is close to 100%. A long position can be opened after crossing the price resistance and zero correlation levels. Thus, the correlation indicator is used as an additional oscillator - filter. Once the indicator value returns to the upper semi plane of positive values, we quit the market. This strategy is necessary for several reasons. Firstly, only negative values make the instrument work more effective than any of the elementary instruments included in the spread. Secondly, only negative correlation values make hedge of systematic risks effective.



**Fig. 3.** #C-FCATTLE and #C-SOYB percentage relative movement

Indeed, let us assume that the commodity futures market experiences system changes occurred (the humanitarian crisis, recession of the world economy, etc.), which leads to a sudden drop in demand for grains and meat. In this case, each of the traded instruments is determined by the change of the market index  $M_0$ :

$$\Delta A_1 = \Delta M_0 \cdot \beta_1, \Delta A_2 = \Delta M_0 \cdot \beta_2 \quad (5)$$

Each of  $\beta_1$  and  $\beta_2$  factors has to be a positive number:  $\beta_1 > 0, \beta_2 > 0$ . The relation between the absolute yields is then expressed by the equation (6):

$$\Delta A_1 = \Delta A_2 \cdot \frac{\beta_1}{\beta_2} \quad (6)$$

This relation is obviously impossible for reverse spread assets defined by the relations (1-3). In this regard, using the reverse spread correlation analysis allows effectively hedging the systemic risks and preventing dangerous situations on the market.

The further trend following occurs by the means of moving the stop loss level in the trend movement direction. We can choose a new Bill Williams bullish fractal, or move the stop loss following the ParabolicSAR indicator. Once the price crosses the stop loss level, the position is closed.