

# “Mutual influence of the exchange assets: practical aspects”

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## Mutual influence of the exchange assets: practical aspects

### Abstract

The following article considers the practical use of temporary connections that arise between different exchange assets. The concrete recommendations to build a trading strategy based on the theory of market focuses are proposed.

The main idea in this case is that strong positive correlation between two exchange assets let us make a conclusion that in case of big movement in one asset we can wait for equivalent changes in other exchange asset.

The paper proposes the use of two types of correlations between exchange assets: “slow” (used to determine the presence of relationship between exchange assets) and “fast” (used for the definition of divergence and convergence).

Based on the values of “slow” and “fast” correlation decisions on entry and exit positions can be done.

**Keywords:** exchange assets, correlation analysis, fast correlation, slow correlation, forecast, price dynamic analysis, prediction, market “focus”, arbitrage, speculations.

**JEL Classification:** G10, G12.

### Introduction

This paper considers the practical use of temporary connections that arise between different exchange assets. To evaluate these connections correlation analysis can be used. Using correlation analysis it is possible to determine the presence of connection between different exchange assets, type of this connection, its level and volume of divergence/convergence that appears during price movement. This knowledge gives the opportunities to arbitrage with exchange assets.

The paper is organized in 3 sections. The first one gives a description of arbitrage as a method of trading, using equivalent exchange assets. It is proved that different exchange assets from time to time are connected to each other (dynamics of their movement is almost the same). But mathematically similar exchange assets in short periods of time can diverge in their dynamics. That makes possibilities to arbitrage on these temporary differences.

Section 2 reviews criterions that determine the volume of divergence, as well as confirming the existence of a stable connection between the instruments. It is proposed to use two types of correlation coefficients for these purposes. “Slow” (counted, using daily data, with period of 30 or more) – is to determine the presence of connection between exchange assets, and “fast” (counted, using hourly data, with a period of 12 or less) – used to evaluate temporary differences (divergences). It is proved that normal state of “fast” correlation coefficient is near “slow” coefficient value, but it is always changing, even opposite to “slow” coefficient value. Situation when “fast” correlation differs from “slow” is divergence and the volume of difference is the volume of divergence.

Section 3 is devoted to practical demonstration of trading strategy working. On the concrete example it is

demonstrated how to use strategy to get profit from the arbitrage on market focuses.

### 1. General approaches to trading strategy formation based on market focuses

In the previous research “Mutual influence of the exchange assets: analysis and estimation”, published in *Banks and Bank Systems*, Volume 6, Issue 2, 2011, we’ve shown that at the certain periods of time in the exchange markets establish sufficiently clear connections between different financial instruments. High correlation between them leads a low-risk trading, based on arbitrage.

Arbitrage is a simultaneous purchase and sale of identical or equivalent financial instruments or commodity futures in order to benefit from the mismatch of their price ratios.

Take as an example the currency pair euro/dollar (EUR/USD) and oil futures (their dynamics in 2008). From the point of economic sense these instruments can hardly be called identical or equivalent. However, in terms of mathematics they are temporary almost identical, it is evidenced by the correlation coefficient between them (more than 80%). That means, while the level of correlation between them remains high, we can use arbitrage to earn on divergences in their dynamics.

As for the practical realization of this thesis, we can use the next version of the trading strategy. Firstly, in order to confirm the appropriate level of correlation, we calculate the correlation coefficient, which is based on data from the daily charts. As for the period of time, maximum is a year, but it is more likely to choose smaller period in order to have time to react on the changes of market focuses.

Next step is intraday analysis of the level of correlation between instruments at points when prices diverge (intraday correlation level falls below a certain line) made a simultaneous entry into the

opposite positions – in this case it may be oil buying and the simultaneous sale of an equivalent volume of EUR/USD. Further, when divergence eliminates, at the convergence point (we can also call it the equilibrium point – the moment when the intraday correlation is equal to the average level of correlation between the instruments), the positions are liquidated – with high probability

that one of them will be closed with a loss, and the second – with profit, and, as usual, profit will exceed the losses.

We illustrate a concrete example of how this works. Figure 1 represents price dynamics of oil on December 10, 2008 (hourly chart), Figure 2 shows price dynamics of EUR/USD on December 10, 2008 (hourly chart).

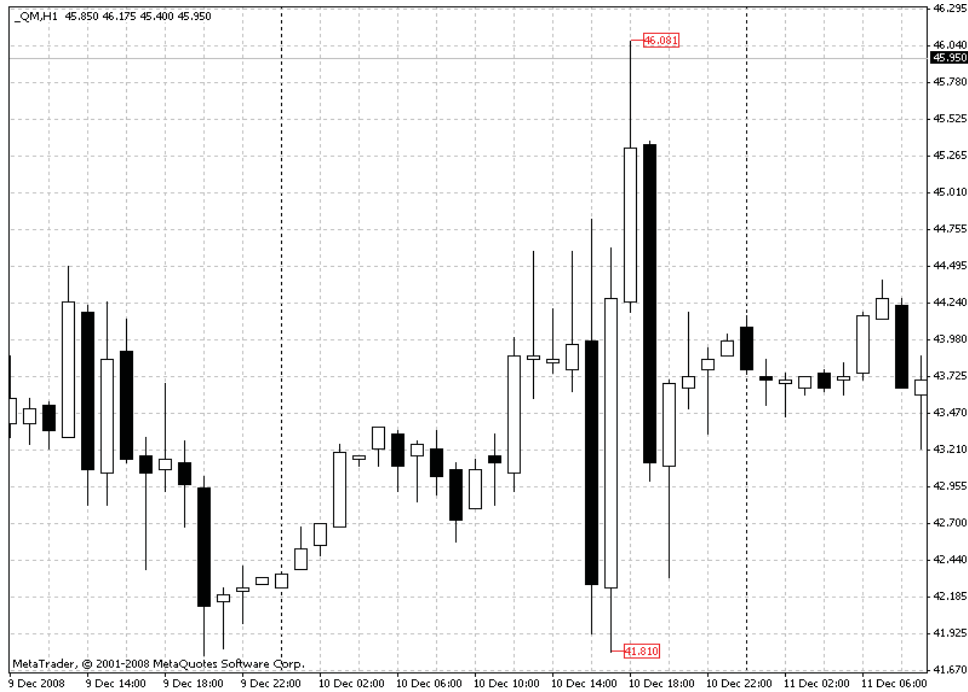


Fig. 1. Price dynamics of oil on December 10, 2008 (hourly chart)

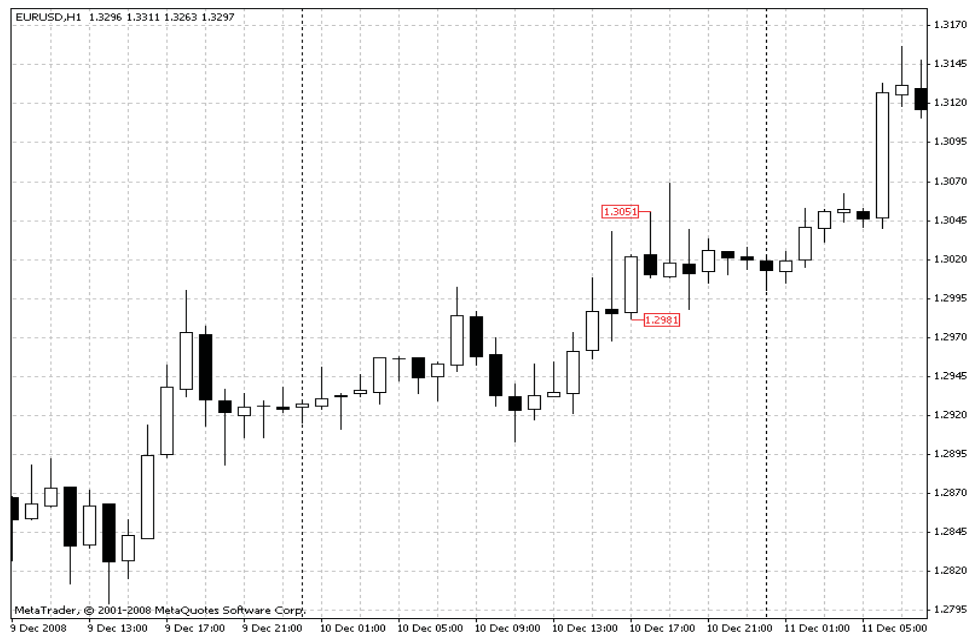


Fig. 2. Price dynamics of currency pair EUR/USD on December 10, 2008 (hourly chart)

According to suggested approaches, on December 10, 2008, nearly 7 p.m, a situation of divergence in oil and EUR/USD price dynamics appears. The driver of divergence was oil, which demonstrated significant reduction in the absence of a similar

reaction from the currency pair EUR/USD. Thus there was a situation of divergence. According to our assumptions, this divergence should be eliminated within a certain period of time. It could be reached by:

1. The faster growth of oil prices relative to the price dynamics of EUR/USD.
2. The bigger fall of the currency pair EUR/USD relative to the price of oil.

On this basis it was possible to make a decision about entering the following positions:

1. Buy oil at a price of 41.8 volume of 0.1 standard lot (volume 0.1 of standard lot called mini lot).
2. Sell EUR/USD at a price of 1.2980 volume of 0.1 lot.

For the next hour there was a convergence, i.e., the alignment of price dynamics. As a result, at the point of maximum convergence the existed positions were closed.

1. Purchase of oil was closed with profit at the price of \$46. The financial result of this transaction is 420 pips, or \$210 (volume of oil mini lot = 50 barrels, so, the financial results in U.S. dollars =  $420 * 50 / 100 = 210$ ).
2. Sell of 0.1 EUR/USD was closed at a price of 1.3050 and brought losses of 70 pips or 70 dollars (for EUR/USD mini lot 70 pips are equivalent to \$70).

So, the overall financial result amounted to  $210 - 70 = +\$140$ . This example characterizes the trader's optimal action, which in practice probably will not be realized so effectively. Nevertheless, as a first approximation of efficiency of assumptions about divergence/convergence, in our opinion, are confirmed.

This is the basis. Practical implementation should be carried out by developing a trading strategy, which parameters should be determined by retrospective testing.

Thus, we have a general idea – trading on temporary differences in exchange assets, which have rather similar dynamics for a certain period of time.

## 2. Criteria of convergence/divergence determination

We need a criterion that determines the volume of divergence, as well as confirms the existence of a stable relation between the instruments. Earlier in our research, to substantiate the connection between different types of assets we use the correlation coefficient as a relatively simple, but at the same time, an effective tool for assessing the degree of connection between the instruments, as well as the type of connection (direct or reverse).

In our opinion, the use of correlation coefficients as a criterion for convergence/divergence is simple and effective tool that can be put into the basis for constructing a trading strategy.

It is clear that, on the one hand, we should have information about the general level of correlation between certain instruments, and also there should be information about the current divergence/convergence between exchange assets. General level of correlation tells us that assets are “equal” and arbitrage can be used. Current divergence/convergence between exchange assets shows the volume of imbalance and gives signal to open/close positions.

We propose as a general level of correlation use the correlation coefficient, calculated on the basis of daily price changes with an analysis of data within a certain period (this may be a month (period = 30), quarter (period = 90), half of a year (period = 180), etc. – this parameter – is necessary to determine during the strategy testing). This correlation will be called “slow”.

As an indicator of convergence/divergence correlation coefficient with short time intervals (hour for example), combined with a relatively short period (5, 7, 12, etc. – similar to the previous indicator, the period is necessary to determine during the strategy testing) can be used. This correlation coefficient will be called “fast” correlation.

If the level of overall correlation (slow correlation) between two instruments exceeds, for example, 0.5, the analysis of divergences should be made. And if, for this situation, the coefficient of fast correlation falls below zero – it will be a clear signal about the presence of divergence and signal to enter the positions. When after a certain period of time “fast” correlation reaches the level of the “slow” one, there will be alignment (convergence), it will be a signal to close opened positions.

Before building a strategy, we analyze the principled efficiency of the proposed scheme (algorithm). For this, we demonstrate the dynamics of hourly correlation coefficient (“fast” correlation) between the currency pair EUR/USD and oil with a period of 12 (see Figure 3 and Figure 4).

As we can see, the range of hourly correlation is rather wide and from time to time there appear divergences with the “slow” correlation (the overall level of correlation). Moreover, we note that hourly coefficient tends to eliminate the divergence, i.e., return to equilibrium, which is located in the level of general correlation (“slow” correlation).

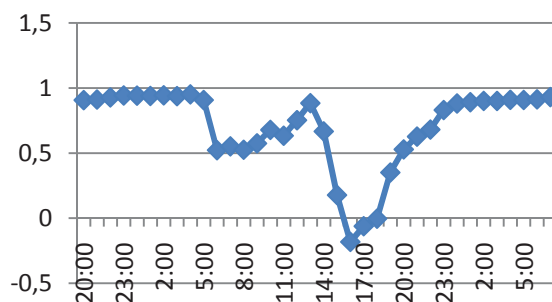


Fig. 3. Dynamics of hourly correlation coefficient during the period of August 19-21, 2008

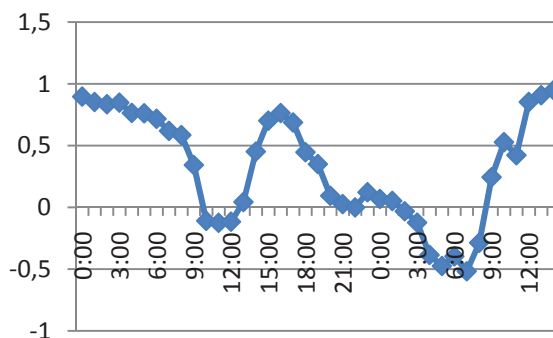


Fig. 4. Dynamics of hourly correlation coefficient during the period of August 25-26, 2008

At this time the level of daily correlation (“slow”) in August 2008 was the following, see Figure 5 (period of correlation = 30 days).

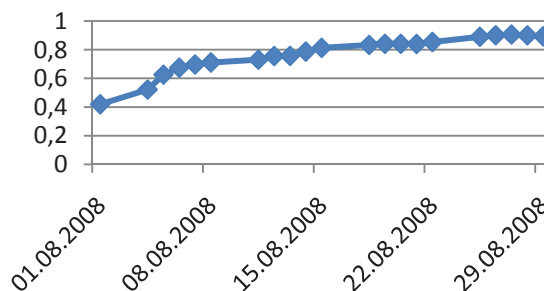


Fig. 5. Dynamics of daily correlation coefficient during the period of August 2008 (period 30 days)

As we see, daily correlation coefficient showed a clear tendency to increase from the level of 0.5 at the beginning of the month to 0.85 at the end. Correlation coefficient indicates the presence of strong connection between these two instruments and this connection only increased in time.

Nevertheless, hourly correlation coefficient periodically showed opposite (to daily correlation) trends, going even into the negative zone. That was abnormal and should have been short-lived. As we can

see from the graphs, they were short-lived. Knowing that the market is periodically exposed to abnormal dynamics, knowing that these anomalies are short term, and most importantly – having the tools to determine their presence, we can build a successful strategy for earning on such situations. Consider the concrete example of such work.

### 3. Example of trading strategy working

Divergence situation emerged on August 25, 2008. Data on it is shown in Table 1.

Table 1. Data for analysis of the anomaly which appeared on August 25, 2008

| Date            | Time | EUR/USD | Oil     | Fast correlation (hourly, period = 12) | Slow correlation (daily, period = 30) |
|-----------------|------|---------|---------|--|---------------------------------------|
| August 25, 2008 | 0:00 | 1.4786  | 114.125 | 0.90                                   | 0.89                                  |
| August 25, 2008 | 1:00 | 1.4781  | 114.5   | 0.85                                   | 0.89                                  |
| August 25, 2008 | 2:00 | 1.4725  | 114     | 0.83                                   | 0.89                                  |

Table 1 (cont.). Data for analysis of the anomaly which appeared on August 25, 2008

| Date            | Time  | EUR/USD | Oil     | Fast correlation<br>(hourly, period = 12) | Slow correlation<br>(daily, period = 30) |
|-----------------|-------|---------|---------|---|--|
| August 25, 2008 | 3:00  | 1.4738  | 114.175 | 0.85                                      | 0.89                                     |
| August 25, 2008 | 4:00  | 1.4736  | 114.525 | 0.76                                      | 0.89                                     |
| August 25, 2008 | 5:00  | 1.4718  | 114.475 | 0.76                                      | 0.89                                     |
| August 25, 2008 | 6:00  | 1.4717  | 114.425 | 0.72                                      | 0.89                                     |
| August 25, 2008 | 7:00  | 1.4713  | 114.725 | 0.62                                      | 0.89                                     |
| August 25, 2008 | 8:00  | 1.4735  | 115     | 0.58                                      | 0.89                                     |
| August 25, 2008 | 9:00  | 1.4742  | 115.475 | 0.34                                      | 0.89                                     |
| August 25, 2008 | 10:00 | 1.4742  | 115.025 | -0.11                                     | 0.89                                     |
| August 25, 2008 | 11:00 | 1.4762  | 115.425 | -0.13                                     | 0.89                                     |
| August 25, 2008 | 12:00 | 1.4771  | 115.425 | -0.12                                     | 0.89                                     |
| August 25, 2008 | 13:00 | 1.4761  | 115.1   | 0.04                                      | 0.89                                     |
| August 25, 2008 | 14:00 | 1.4789  | 115.6   | 0.45                                      | 0.89                                     |
| August 25, 2008 | 15:00 | 1.4797  | 114.975 | 0.70                                      | 0.89                                     |
| August 25, 2008 | 16:00 | 1.4777  | 114.325 | 0.76                                      | 0.89                                     |

The level of daily correlation on August 25, 2008 was 0.89, indicating a very strong connection between the analyzed assets (oil and EUR/USD). The fast correlation (hourly calculated with a period of 12) varied from the level of 0.9 to -0.13. In fact, signal of anomaly has arisen at 10:00, when the level of “fast” correlation became negative. At this point we have a divergence situation and have to open the positions. The question is what kind of a deal (buy or sell) do we have to do and with which instrument. Since the divergence arose over the last 12 hours (fast correlation), we analyze the dynamics of the instruments during this time. The EUR/USD has fallen from the level of 1.4786 to 1.4742, and oil – rose from 114.12 to 115. Thus, to eliminate the anomaly there must have been drop of oil prices, outstripping the EUR/USD potential fall or rise of EUR/USD at a fixed price of oil. So we can go back to the equilibrium state of the system, which has been breached.

Accordingly, at 10:00 we were supposed to sell oil at a price of 115 and buy EUR/USD at 1.4742.

The situation reached normal state around 15:00, when the fast correlation coefficient exceeded 0.5. At that time the price of EUR/USD was 1.4797, and oil – 114.98. At these prices we had to close opened positions.

The financial result of the transactions amounted to 55 dollars for a currency pair EUR/USD and 2.5 dollars profit from the transaction with oil. Thus, on this transaction, we could earn U.S.\$57.5 (assuming of 0.1 lot in a deal, with the volume = 1 lot, the financial result amounted to \$U.S.575, etc.).

Such situation is not unique. If we take “fast” hourly correlation we will take hourly with a period of 12, during the month these divergences/convergences usually appear more than ten times. Considering the variety of currency pairs and potential market fo-

cuses, a strategy that will be build on this approach will produce a sufficiently more signals.

Also this approach gives wide opportunities to predict movements in the cross-currency rates. In fact the presence or absence of significant correlation between the currency pairs that constitute the basis of cross-currency rate gives us the answer to the question – is there a trend or not? In addition, we have the numerical value of trend strength and direction. We can make conclusions about the dynamics of this power (increases or decreases). In essence, this approach eliminates the major weaknesses of most trend indicators – such as the lack of specifics and explicit limits. It gives basis to the formation of a new class of indicators that will be a symbiosis between trend indicators and oscillators, without being in a pure form.

## Conclusion

The analysis showed the practical aspects of using “market focuses” theory, generally stated by us in the previous article (“Mutual influence of the exchange assets: analysis and estimation”, *Banks and Bank Systems*, Volume 6, Issue 2, 2011). Using the theory of market focuses, we can determine the exchange assets which are mathematically equivalent. Nevertheless, because of different nature and other specifics, the dynamics of their movement is not always the same (especially on short time intervals). Defining moments of divergence, we can arbitrage – buy and simultaneously sell similar assets to benefit from the mismatch of their price ratios.

The paper sets out specific recommendations for determining the focuses of the market, as well as the mechanism for determining divergence/convergence what gives opportunities for the practical use of theoretical principles outlined in the paper.

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