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ANALYSIS OF THE RELATION BETWEEN US DOLAR AND EURO EXCHANGE WITH COINTEGRATION TECHIQUE

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Abstract: Developed countries changed fixed exchange rate system to the flexible exchange rate system from the mid 1970s. With the changing to free exchange rate system, exchange rate forecasts gained importance. Applied researches in finance literature showed that; exchange rate series dynamics were in the form of time series which showed unit root behaviour. The cointegration relation between the exchange rates indicates that there is a long term balance relation and shows that there can be Granger causality between exchange rates. On the basis of this information, estimation of the exchange rate's price which will have with other exchange rate may be possible.The aim of our study is to reveal the relationship between Euro and US Dollar exchanges with cointegration analysis. Data used in the study comprise 16 months in total and it was analyzed over the buying and selling prices day to day. In consequence of the analysis, it ensued that series weren't stationary. As for the cointegration test, it was seen that there was no relation in terms of buying and selling prices of USD and EURO.

Key Words: Exchange Rate System, Analysis of Time Series, Cointegration Analysis

DOLAR VE EURO KURLARI ARASINDAKİ İLİŞKİNİN EŞBÜTÜNLEŞME(KOİNTEGRASYON) YÖNTEMİ İLE İNCELENMESİ

Özet: Gelişmiş ülkeler 1970'lerin ortalarından itibaren sabit döviz kuru sisteminden esnek döviz kuru sistemine geçmişlerdir. Serbest döviz kuru sistemine geçişle birlikte döviz kuru öngörüleri de önem kazanmıştır. Finans literatüründe uygulamalı çalışmalar göstermiştir ki; döviz kuru serisi dinamikleri birim kök davranışı gösteren zaman serileri şeklindedir. Döviz kurları arasında eşbütünleşme ilişkisinin varlığı uzun dönem bir denge ilişkisi olduğunu göstermektedir ve döviz kurları arasında Granger nedenselliğin olabileceğini işaret etmektedir. Bu bilgilere dayanarak bir döviz kuru-

nun alacağı değeri diğer döviz kuru ile tahminlemek mümkün olabilecektir. Çalışmamızın amacı Euro ve Dolar kurları arasındaki ilişkiyi eşbütünleşme analizi ile ortaya çıkarmaktır. Çalışmada kullanılan veriler toplam 16 ayı kapsamakta olup gün gün alış ve satış fiyatları üzerinden ayrı ayrı analiz edilmiştir. Analizler sonucunda serilerin durağan olmadığı sonucu ortaya çıkmıştır. Yapılan eşbütünleşme testi sonucunda ise ABD Doları ve Euro'nun alış ve satış fiyatları bakımından bir ilişki olmadığı görülmüştür.

Anahtar Kelimeler: Döviz Kuru Sistemi, Zaman Serileri Analizi, Eşbütünleşme(Kointegresyon) Analizi

1. INTRODUCTION

The analysis of time series are the studies which are done to introduce an analyzed variable's future value might occur in which confidence limit by using now and past observation rates of a variable. Time series are the series which are acquired by arranging statistical data based on the origin time of them.

One of the important aims of time series analysis is that by using changes which happen in any of time series created for multiple variables, changes in other series can be explained. Besides, forecasting about the future is one of the aims of time series analysis.

Modelling by analyzing the time series which are related to economic phenomenon takes place in the scope of econometric studies. Whether there is a balance relation between variables in the economic theory was evaluated by analyzing with different ways. While making these analyses, whether the analyzed time series are stationary or not must be examined.

If the characteristics of a time series (average, variance, covariance and moments from higher degree) do not change in accordance with time, the series is called stationary time series and this situation is called stationarity (Özmen, 1986).

Stationarity separates as trend stationary and difference stationary. Time series related to economic phenomenon generally do not assure stationarity condition. Transformations such as taking logarithm, taking difference, filtration and dispersing the effect of the trend are applied to make stationary and to purify from seasonality for non-stationary series (Işığıçok, 1994).

Non-stationary time series are mostly characterized as problematical in econometric analysis. Granger and Newbold (1974) state that fake regression happens in forecast which is done by using non-stationary series. When the results of regression analysis which was done by using non-stationary series were analyzed, R2 (multiple coefficient

determination) is high enough and t statistics are meaningful; but Durbin-Watson statistical rate is low. If regressions acquired with deferred rates of two variables have unit root (not stationary), usual t and F tests will not be prevalent. Regression equality based on these two variables will be spurious regression (Halaç, 2002).

Whether the analyzed series are stationary or not is also determined with Unit Root tests. The most commonly used of these tests are Dickey-Fuller (1981), Augmented Dickey-Fuller or ADF), and Philips-Perron (1988). Several studies were carried out by using these tests. After the stationary characteristics of analyzed series are determined with unit root test, it is analyzed whether there is a cointegration relation between these series with cointegration analysis. Cointegration Analysis was first suggested by Granger (1981, 1983) and statistical analysis of cointegrated processes was brought to literature by Engle and Granger (1987). By virtue of this study and their contribution to econometrics, Granger, C.W.J. was awarded the Nobel Economy Prize in 2003. Whether there is a long term relation between significant economic time series with cointegration analysis is tried to determine. When the analyzed economic series aren't stationary, cointegration analysis expresses that linear combination of these series can be stationary and this can be determined econometrically. In other words, cointegration is related with linear combination of non-stationary variables (Enders, 1995).

The first one of the appropriate methods for cointegration is Dickey-Fuller, Augmented Dickey-Fuller and Durbin Watson cointegration regressions which are acquired from the Least Squares regression balance and based on remainder terms. Examples about the studies in which cointegration analysis was used are the relations between the nominal exchange rate and relative price; the relations between consumption and disposable income; the relations between long term interest rates and short term interest rates; the relations between currency rate and interest rates; the relations between production and sales volume (Kadılar, 2000).

Most commonly seen implementation areas of cointegration analysis in economic area are;

- Testing of market efficiency hypothesis,
- Testing of long term money demand and,
- Testing of purchasing power parity (Şıklar,2001).

2. EXCHANGE AND EXCHANGE RATE

With the increase of international economic relations, transitions from valid fixed exchange rate system to flexible exchange rate system occurred. Stability of exchange rates in fixed exchange rate system is assured with the intervention of the Central Bank as buyer and seller. Central Bank must have enough gold and foreign exchange reserves

for this. According to advocates of fixed exchange rate system, fixed exchange rate system eliminates the international trade and investment flows observed in flexible exchange rate system and daily fluctuations put the specialization in jeopardy (Parasız, 1996; 2001).

After the Second World War, Bretton Woods's system which is similar to fixed exchange rate system in world economies was gotten off the ground. But this system could subsist until 1973 and then collapsed.

Flexible exchange rate system is the applied model of free market mechanism to exchange. Opinions arguing for the system in point out advantages of market mechanism in principle and indicate that market solutions always top the government decisions (Seyidoğlu, 1997; 102). The ones arguing for this system put forward that it is more efficient in assuring the balance of payments equilibrium regarding the fixed exchange rate system. Also because flexible exchange rate system assures for country's balance of payments stand in balance easily, it is emphasized that internal balance and other objectives of country can be assured easily (Parasız, 1996; 210).

For one country having its own currency is one of the most important indicators of this country's full independence. Money of foreign countries is called exchange. Exchange is expressed as "all kinds of account, documents and means enabling the payment with foreign money including effective" in the decision number 32 about Conservation Law of Turkish Money. Effective exchange means cash exchange. Fundamentally, cash businesses in banking administration have a small place. Actual exchange activities are implemented with means such as exchange cheques in foreign banks, order of payments, foreign deposit certificates.

The value of one country's currency with respect to another country's currency is called "exchange rate"(Dinçer, 2005).

Tourism is the most evident area in which exchange is used as cash. Exchange circulation is implemented by the ones going abroad or coming from abroad using their own currency in their destination. Exchange rate concept implemented in that case is the "nominal exchange rate" meaning relative price of two currencies each other (Parasız, 1996, p.210).

Another concept met in exchange rate is "real exchange rate" (Müslümov et all, 2003). When taking into account the changes in price acquired exchange rate is called real exchange rate. Real exchange rate is the adjustment of nominal exchange rate by taking into account the inflation rates of country. Real exchange rate is an economic indicator which reflects the prices of produced goods in foreign country in terms of produced goods in domestic and commonly used for calculating international rivalry (İnandım, 2005).

By affecting the distribution of production and consumption decisions of economic

units among the goods produced at home or abroad, real exchange rate plays a deterministic role on the balance of current account (www.tcmb.gov.tr).

Real exchange rate is an indication of competitiveness of countries in international trade. While other conditions are stable, the increase of real exchange rate increases the competitiveness of country in international trade. If we sample for USD; if USA inflation rate which is calculated with USA general level of prices increases this condition boosts the demand for Turkish goods. This increases the export to USA and decreases the import. Another reason for the increase in real exchange rate may be the decrease in Turkey general level of prices. If real YTL/USD exchange rate increases for this reason, this increase raises a conclusion similar to the result above (Özer, 1992).

The last reason for the increase of real exchange rate may be the increase in nominal exchange rate. Because of the increase in nominal exchange rate, import becomes more expensive and so Turkish goods seem cheaper to foreigners from now on, then it increases the export. As much as real exchange rate is an indication of competitiveness in international trade, it may be a criterion of subsistence level of country regarding a foreign country also. For example, an increase in real YTL/USD exchange rate shows the proportional increase in subsistence level in USA. But however, a decrease in real YTL/USD exchange rate shows that the cost of living in Turkey has increased to USA relatively.

Because one country generally is in both rivalry and trade relation with more than a country in international markets, real exchange rate must be calculated as effective index reflecting this reality. The indication calculated toward this aim is defined as "real effective exchange rate". Real effective exchange rate is the deflated way of nominal effective exchange rate with price indexes and it is an important indication of international price rivalry. According to this definition also used by IMF, real effective exchange rate is calculated as weighted geometric average of proportion of price levels of related country to price levels of countries dealing with.

2.1 APPROACHES DİRECTED TO DETERMINING THE EXCHANGE RATE

There are several theories and approaches about determining the exchange rate in literature. Some of them;

a. Purchasing Power Parity,

b. Monetary Approach,

c. Contemporary Monetary Approach,

d. Portfolio Approach,

e. Approach based on Productivity,

f. Balance of Payments Approach,

g. Kamin and Rogers Model,

h. Early Keynesian Approach,

i. New Keynesian Approach ; the most accepted ones of these approaches are these:

2.2 EXCHANGE RATE SYSTEMS

In principle there are three different exchange rate policies for determining the exchange rate. It is seen more types of exchange rate policy implementations with the implementation of three basic exchange rate policies shortly mentioned below with different components (Müslümov, 2003).

a. Free Exchange Rate System: Being unregulated for domestic monetary units in accordance with all other currencies.

b. Fixed Exchange Rate System: Fixing the value of currency to another currency of a country or a means

c. Hybrid System: While being authorized for the value of free float of currency, interfering in excessive fluctuation.

2.2.1 Free Float (Arat, 2003)

It is the exchange rate system which can change freely depending on the supply and demand of market and without any intervention of government to exchange rates. It is also known as Flexible Exchange Rate System or Free Floating.

Rates of exchange might change daily even momentarily in free floating. Balance of payments can be assured easily with this exchange rate system and it is enabled for governmental entities having a voice in monetary policies much more. Because of sudden appraisal or depreciation created as a result of speculations, there is no question about increase or decrease in country reserve. So countries can implement independent financial and monetary policies.

Disadvantages of the system exist also. Fixed exchange rate systems may cause uncertainty in foreign trade, high inflation or over valuation of domestic currency. Uncertainty arose because of not being fixed for the rates of exchange boggles exporting people and investors.

2.2.2 Managed Float (Yıldırım, 2003)

The intervention of governmental entities to exchange rate according to the market state at that moment not to the monetary policies which wasn't determined beforehand is called managed float. So disadvantages of free exchange rate are prevented partially

2.2.3 Floating within a Band

In this type of exchange rate system, it is allowed for fluctuation of exchange rates in a certain range. It can be thought as the combination of free rate and fixed rate. So it is tried to profit from the advantages of both systems. If the regular intervention of government is needed for keeping of rates in determined range, it means there are some problems in monetary policies of country. In this situation, disadvantages of system remove (Özdemir and et all, 2000).

2.2.4 Sliding Band

Mean value of range was fixed in this system different from the fluctuation in range. It is generally used in high inflationary environments. Over valuation of rate is obstructed with this system. But not knowing when it will be intervened for fixing the mean value of rate may crate uncertainty.

2.2.5 Crawling Band

The value of domestic currency fluctuates in certain limits according to fixed value which was explained beforehand in this exchange rate system. It is more flexible in comparison with fixed exchange rate system. The difference is that when the pressure on fixed rate increases manipulations are implemented periodically and frequently not suddenly (Müslümov and et all, 2003).

2.2.6 Crawling Peg System

The value of domestic currency was fixed in crawling peg system. This fixed value can be regulated according to economic indicators of country and changes in balance of payments. Exchange rates are adjusted in ranges which are determined frequently and clearly in the notified amount or percentage in this system (Arat, a.g.e.).

For example if 8% of devaluation is needed in country, instead of doing this in one go, the devaluation in 2% percentage in each month by dividing to 4 months can be done. It is stricter regarding crawling band but more flexible in accordance with the fixed exchange rate systems.

2.2.7 Adjustable Peg Exchange Rate System (Bretton Woods System) (Dinçler, 2000)

It is a system in which determined exchange rate can be changed periodically. It is an adjustable fixed exchange rate system which enables for readjusting the exchange rate when coming across fundamental disequilibrium. Current account deficit or surplus which recognize some years in a row can be showed as a fundamental disequilibrium. Because being the expectation of a constant devaluation or revaluation may cause uncertainty in markets it may cause economic crisis.

2.2.8 Fixed Rate (Müslümov and et all, 2003)

Parasız; In this system, after exchange rates are fixed once, stability of rates are assured with buying and selling of central bank regardless of supply and demand in market. It is needed enough exchange and gold stocks in the central bank's reserves for the implementation of this system. When the rate of exchange increases central bank sells exchange to the market in other words it buys the domestic currency from the market against exchange. When the rate of exchange decreases from the fixed value it buys exchange by giving domestic currency to the market.

Facilities of economies can be anticipated in this system. Because risks and uncertainties decrease, market can work easily. Inflation can be prevented.

Despite this, the opinion for fixed rates aren't much successful in developing countries dominates among economists. Governments may be obliged to increase interests and slowdown the economy for maintaining fixed rate against possible speculations.

After it had been faced with Asian Crisis 1997, emerging market economies withdrew from the fixed rate implementations and started to use other systems. For example, until the February 2002 crisis in Turkey fixed rate had been implemented and rates of exchange had ranged between a narrow bandwidth. After the crisis, rates of exchange doubled suddenly with the decontrolling the rate. The effects of this crisis haven't gotten off yet. The economies implementing flexible exchange rate system in different ways instead of fixed rate in Asian crisis affected less from the crisis.

2.2.9 Usage of Foreign Currency (Formal Dollarization)25

The countries implementing this system leave their currency which is an important indicator of full independence and uses the currency of another country. The countries implementing this system lose the opportunity of implementing the independent monetary policy completely. Because central banks can't coin the money of another country, they can't implement the monetary policy independently**.**

2.3 Exchange Rate Targeting

As well as exchange can be fixed at a stationary value, it can be adopted in a way letting the domestic currency decrease in value at a stationary rate. Tracking of exchange transactions to avoid the effects of inflation in the countries to live with inflation for a long time has strengthened the relationship between the exchange rate and inflation, retrospective indexation has turned into a common conduct and has also caused dollarization at high level. Due to these reasons, exchanges can be used as intermediate objective to dishearten the inflationist expectations and decrease inflation without causing too much economic constriction with less expenditure. However, the disadvantage of the regimes in which exchange rates are fixed is that it makes these countries open to any speculative attacks (Obstfeld and Rogoff, 1995: 74-75).

Any speculative attack directed to the currency of the country applying targeting, at least, will cause an increase not only in the expected but also in the actual inflation and will strengthen the effects of financial crisis by increasing the interest rates severely. In case of concentration of the loan agreements in the short term in an economy fixing exchange rate of its own currency to an another currency, interaction between the increase in the interest rate and short-term loans causes an ample increase in the interest payment and weaken the position and so balance-sheet of cash flow. As a result, a sharp relapse may emerge both in the loan volume and economic activities (Telatar, 2002:200).

Especially, in the second half of 1990's, many countries which adopted the nominal anchor exchange were exposed to speculative attacks and their stabilization program failed. In the light of these experiences, the strategies of nominal anchor exchange have lost its popularity nowadays.

2.4 Exchange- Effective Market Transactions

Buying and selling of exchange and effective of central bank has a direct effect on both rates and domestic currency liquidity in the market. When Central bank sells exchange and effective, domestic currency liquidity will decrease; when central bank buys them, domestic currency liquidity will increase. Central banks do not primarily use the buying and selling of exchange and effective with the aim of controlling domestic currency liquidity in the market. That's why, despite their effects on liquidity, buying and selling of exchange and effective are not taken into account between the standard money policy appliances.

3. IMPLEMENTATION

TESTING THE USD AND EURO EXCHANGE RATES BY USING COINTEGRATION AND UNIT ROOTS

It is aimed to analyze Dollar and Euro exchange rates in Turkish Lira terms and find out correlations between them.

3.1. Data Structure

In this study, USA Dollar buying, USA Dollar selling, Euro buying and Euro selling variables were used as data. The analysis term which belong to the used data is 16 monthly term between 02.01.2008 and 31.04.2009.

E-Views 5.1 packaged software and SPSS15.0 packaged software were used in econometric techniques and statistic tests that are implemented in the following chapters.

3.2. Method

Distributions which belong to each rate were analyzed in 'The Basic Statistics' chapter at the beginning of the study, the skewness and kurtosis values belonging to each rate were evaluated according to the case N (0,3), which is a normal distribution assumption, and the results were rendered generally in order to make a situation assessment related with the efficiency of the market where the index occurs. The descriptive statistical results, which are obtained in the sense that markets which demonstrate the normal distribution function are closer to the efficient market structure, will be evaluated in this respect.

The 'unit root test' was used in implementation of the test for weak form efficiency. For, the unit root test is used to determine whether the average or auto-covariance of a time series changes depending on time. In other words, it is used to determine whether the series is stationary or not.

The random walk model is a first-degree stochastic process and a special form of non-stationary series. Whether the series is stationary or not comes out after the unit root test.

3.3. Basic Statistical Data

Arithmetic average, mode, median, skewness and kurtosis criteria were used as the basic statistical data. By the help of these data, whether the distribution is normal or not and how much it is far from normality was researched.

Expected value of a distribution is known as the first moment and is measured with arithmetic average of the yields. Variance, which is the square of the standard deviation, is known as the secondary moment or central moment and measures the distribution of observations around the average.

If the distribution is normal, data distribute symmetrically around the arithmetic average, and the median and mode values are equal to the arithmetic average (M. Semiz. Practical Statistics, 2007).

Besides, normal distribution has a standard degree of the skewness. That is why; it can be used in estimation of the distribution of arithmetic average and standard deviation.

Financial yields are assumed to be normal at large (Damodar, 1999, p.771). Generally speaking, looking to its descriptive statistical results, a series that demonstrates normal distribution can be said to be close to the efficient market criteria.

Skewness shows the asymmetric situation of a series in its distribution. If the distribution has a positive skew, a one-sided intensity is seen at the right of the histogram. At this stage, the arithmetic average is lower than the median value, and the median value is lower than the mode value.

Skewness value of a normal distribution is 3 (*Tufan*). If the skewness value of a distribution is lower than 3, it is called 'platykurtic' (flat); if higher than 3, called 'leptokurtic' (thin); and if it is equal to 3, it is called 'mesocurtic' (normal) (Damodar, 1999, p.7).

The Jarque-Bera normality test is also a statistical measure, which demonstrates the skewness and kurtosis character. The test statistics formula belonging to Jarque-Bera is as follows:

$$JB = \frac{N-k}{6}\left(S^2 + \frac{1}{4}(K-3)^2\right) \qquad (3.1)$$

'S' stands for skewness, 'K' stands for kurtosis and 'k' stands for the number of the estimated coefficient that is used to form the series. It was observed that the JB coefficient, computed in the formula under the null-hypothesis where the terms are distributed normally, is in accord with the chi-square distribution which degree of freedom in the large sample is 2.

If probability of the value of chi-square statistics that is computed in an implementation is low enough (lower than 0.05), the null-

hypothesis which claims error terms have normal distribution is rejected. But if the probability value is high, normality hypothesis can't be rejected[29].

Beside these, by the index data, we can make evaluations on whether the series have normal distribution function or not and accordingly, on the market indirectly.

3.3.1. Descriptive Statistics Belonging to the Series of the US Dollar Buying

It was determined whether the series which belongs to the series of the US Dollar Buying has normal distribution by looking to results of the skewness, kurtosis and JB test statistics. The number of the observations that were used is 314 for the entire tested index. Those observations consist of the daily data.

1. CASE

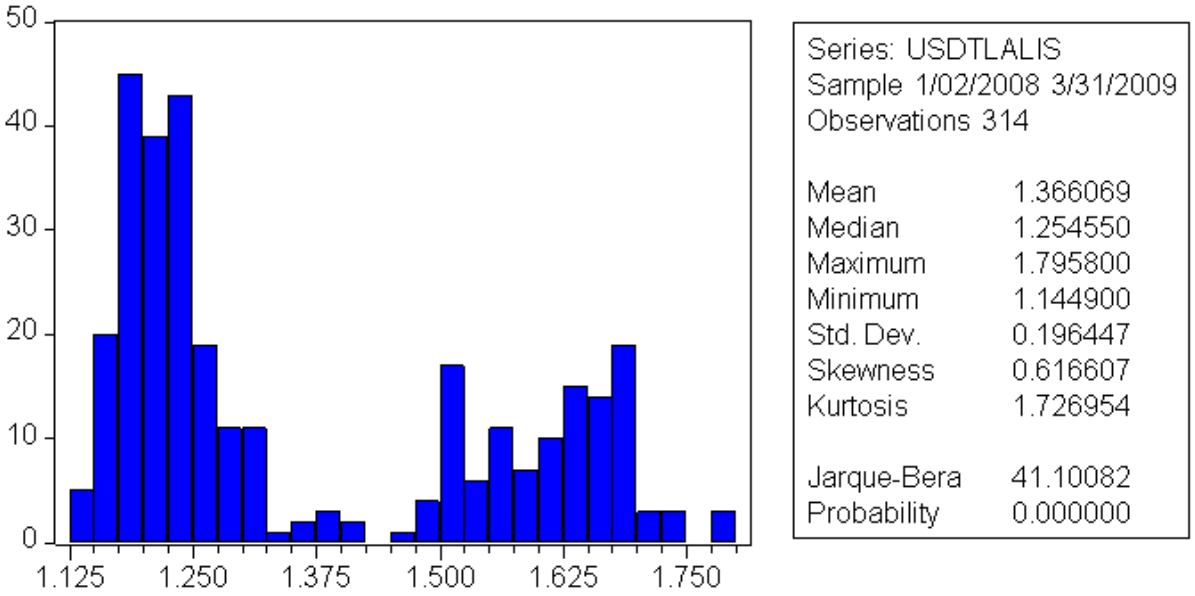
It raises curiosity that whether Skewness value which belongs to the series of the US Dollar Buying equals 0 and the series is distributed normally.

2. CASE

According to the JB statistics, it is studied that the series which reflects the series of the US Dollar Buying is distributed normally or not.

The chart that demonstrates distribution belonging to the series of US Dollar Buying and the descriptive statistics that belongs to the index are as follows:

Chart1 – The chart that demonstrates distribution belonging to the series of the US Dollar Buying and the result of Jarque-Bera



When we evaluate the hypotheses below, skewness value which belongs to the series of the US Dollar Buying was computed as 0.616607. At this stage, according to the criteria (S=0), the series is not distributed normally.

According to the test statistics of Jarque-Bera, when we make evaluation on the 2. case, it is found that the p value belonging to the series is p=0.000000. As a result, according to the Jarque-Bera statistics, the series is not distributed normally.

It was analyzed that whether Kurtosis that belongs to the series of the US Dollar Buying ≠ 3 and the series is distributed normally or not .

Since coefficient of the kurtosis that belongs to the series of the US Dollar Buying is computed as 1.726954, the series is not distributed normally. The series has platykurtic (flat) distribution.

3.3.2. Descriptive Statistics Belonging to the Series of the US Dollar Selling

It was determined whether the series which belongs to the series of the US Dollar Selling has normal distribution by looking to results of the skewness, kurtosis and JB test statistics. The number of the observations that were used is 314 for the entire tested index. Those observations consist of the daily data.

1. CASE

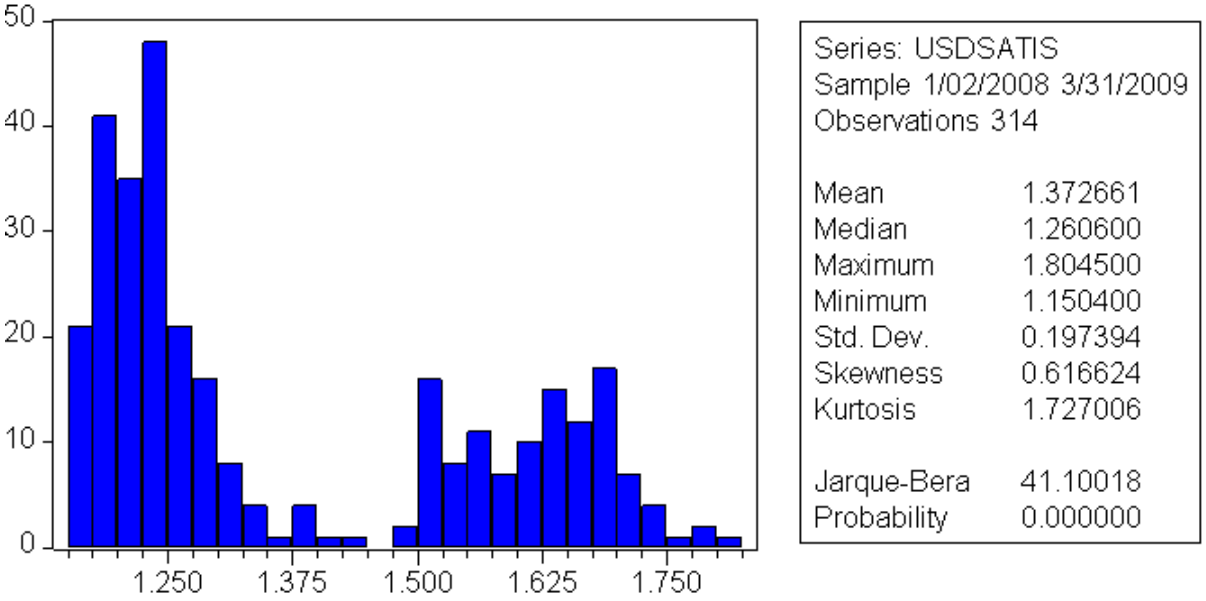
Skewness value which belongs to the series of the US Dollar Selling ≠ 0 and the series is not distributed normally.

2. CASE

According to the JB statistics, the series which reflects the series of the US Dollar Selling is not distributed normally related to whether there is a normal distribution or not.

The chart that demonstrates distribution belonging to the series of US Dollar Selling and the descriptive statistics that belongs to the index are as follows:

Chart2 – The chart that demonstrates distribution belonging to the series of the US Dollar Selling and the result of Jarque-Bera



When we evaluate the hypotheses below, skewness value which belongs to the series of the US Dollar Selling was computed as 0.616624. At this stage, according to the criteria (S=0), the series is not distributed normally.

According to the test statistics of Jarque-Bera, when we make evaluation on the 2. case, it is found that the p value belonging to the series is p=0.000000. According to these results and Jarque-Bera statistics, the series is not distributed normally.

For the kurtosis situation belonging to the series of the US Dollar Selling;

Kurtosis that belongs to the series of the US Dollar Selling ≠ 3 and whether the series is distributed normally or not raised curiosity.

Since coefficient of the kurtosis that belongs to the series of the US Dollar Selling is computed as 1.727006, we can say that the series is not distributed normally. The series has platykurtic (flat) distribution.

3.3.3. Descriptive Statistics Belonging to the Series of the Euro Buying

It was determined whether the series which belongs to the series of the Euro Buying has normal distribution by looking to results of the skewness, kurtosis and JB test statistics. The number of the observations that were used is 314 for the entire tested index. Those observations consist of the daily data.

1. CASE

The skewness hypothesis which belongs to the series of the Euro Buying is as follows;

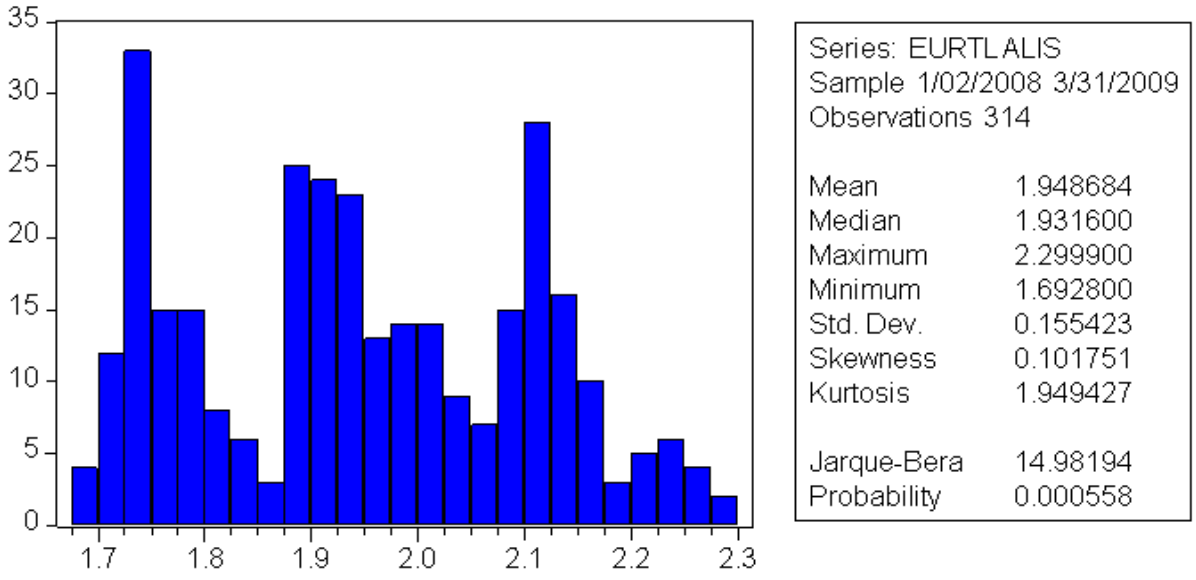
Skewness value which belongs to the series of the Euro Buying ≠ 0 and the series is not distributed normally.

2. CASE

The hypotheses regarding whether normal distribution exists according to the JB statistics or not are as follows; whether the series which reflects the series of the Euro Buying is distributed normally or not.

The chart that demonstrates distribution belonging to the series of Euro Buying and the descriptive statistics that belongs to the index are as follows:

Chart3 – The chart that demonstrates distribution belonging to the series of the Euro Buying and the result of Jacque-Bera



When we evaluate the hypotheses below, skewness value which belongs to the series of the Euro Buying was calculated as 0.101751. At this stage, according to the criteria (S=0), the series is not distributed normally.

According to the test statistics of Jarque-Bera, it is found that the p value belonging to the series is p=0.00058. As a result, according to the Jarque-Bera statistics, the series is not distributed normally.

The hypotheses which were made for the kurtosis character belonging to the series of the Euro Buying are as follows:

Kurtosis that belongs to the series of the Euro Buying ≠ 3 and whether the series is distributed normally.

Since coefficient of the kurtosis that belongs

to the series of the Euro Buying is computed as 1.949427, we can say that, the series is not distributed normally. The series has platykurtic (flat) distribution.

3.3.4. Descriptive Statistics Belonging to the Series of the Euro Selling

It was determined whether the series which belongs to the series of the Euro Selling has normal distribution by looking to results of the skewness, kurtosis and JB test statistics. The number of the observations that were used is 314 for the entire tested index. Those observations consist of the daily data.

1. CASE

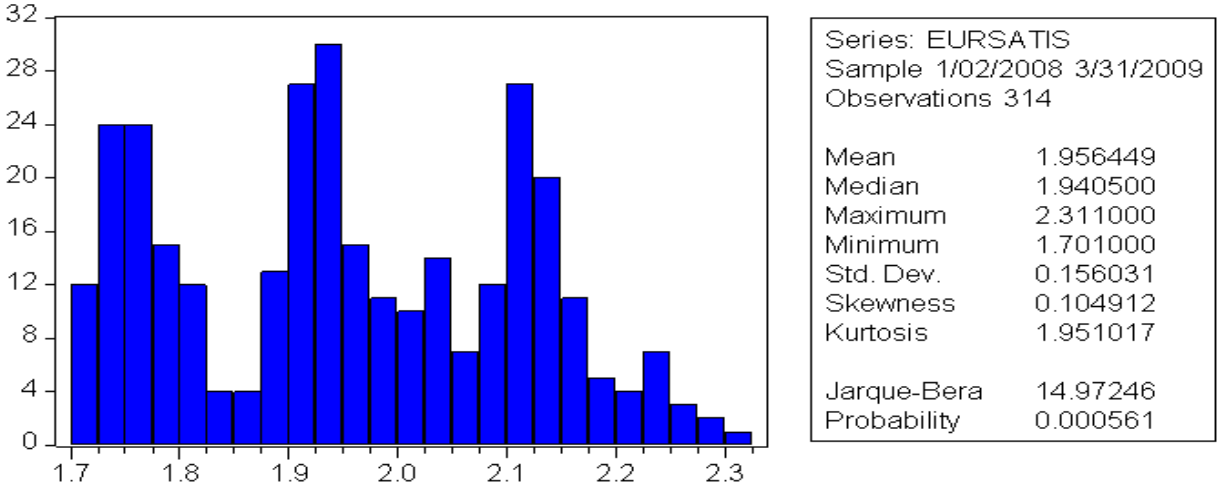
The skewness hypothesis which belongs to the series of the Euro Selling; skewness value which belongs to the series of the Euro Selling ≠ 0 and whether the series is distributed normally.

2. CASE

The hypotheses regarding whether normal distribution exists according to the JB statistics or not are as follows: whether the series which reflects the series of the Euro Selling is distributed normally.

The chart that demonstrates distribution belonging to the series of Euro Selling and the descriptive statistics that belongs to the index are as follows:

Chart4 – The chart that demonstrates distribution belonging to the series of the Euro Selling and the result of Jarque-Bera



When we evaluate the hypotheses below, skewness value which belongs to the series of the Euro Selling was calculated as 0.104912. At this stage, according to the criteria (S=0), the series is not distributed normally.

According to the test statistics of Jarque-Bera, when we make evaluation on the 2. case, it is found that the p value belonging to the series is p=0.000561. At this stage, according to the Jarque-Bera statistics, the series is not distributed normally.

The hypotheses which were made for the kurtosis character belonging to the series of the Euro Selling are as follows: kurtosis that belongs to the series of the Euro Selling ≠ 3 and whether the series is distributed normally.

Since coefficient of the kurtosis that belongs to the series of the Euro Selling is computed as1.951017, we can say that the series is not distributed normally. The series has platykurtic (flat) distribution.

3.4. Testing Stationarity of the Series

The unit root test was used in order to test stationarity of the series of the US Dollar Buying, US Dollar Selling, Euro Buying and Euro Selling.

3.4.1.Testing the Stationarity of the Series of US Dollar Buying

The value was computed as -0.658625. In ADF test statistics, the critical value that was computed for 5% mean level belonging to US Dollar Buying is -2.870561. Concerning the absolute value of the figures which are obtained, as a result, the value of the ADF test statistics is lower than the value of the MacKinnon criterion which is computed for 5% mean level. At this stage, H_0 cannot be rejected. That is to say, the series isn't distributed normally and has autocorrelation. So, it seems possible to estimate the future prices by using the old prices.

The table that demonstrates the results of ADF test statistics for the series of the US Dollar Buying is as follows:

USD Buying Unit Root

Null Hypothesis: USDTLALIS has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic based on SIC, MAXLAG=15)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-0.658625	0.8539
Test critical values:	1% level		-3.451078	
	5% level		-2.870561	
	10% level		-2.571647	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(USDTLALIS)				
Method: Least Squares				
Included observations: 313 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
USDTLALIS(-1)	-0.004178	0.006343	-0.658625	0.5106
C	0.007318	0.008747	0.836627	0.4034
R-squared	0.001393	Mean dependent var		0.001615
Adjusted R-squared	-0.001818	S.D. dependent var		0.021941
S.E. of regression	0.021961	Akaike info criterion		-4.792724
Sum squared resid	0.149991	Schwarz criterion		-4.768786
Log likelihood	752.0612	F-statistic		0.433787
Durbin-Watson stat	1.964952	Prob(F-statistic)		0.510624

3.4.2. Testing the Stationarity of the Series of the US Dollar Selling

The value of the ADF (Augmented Dickey-Fuller) test statistics which belong to US Dollar Selling was calculated as -0.658980. In ADF test statistics, the critical value that was computed for 5% mean level belonging to US Dollar Selling is -2.870561. Concerning the absolute value of the figures which are obtained, as a result, the value of the ADF test statistics is lower than the value of the MacKinnon criterion which is computed for 5% mean level. At this stage, H_O cannot be rejected. That is to say, the series is not stationary. It does not demonstrate normal distribution and has autocorrelation. So, it seems possible to estimate the future prices by using the old prices.

The table that demonstrates the results of ADF test statistics for the series of the US Dollar Selling is as follows:

USD Selling Unit Root

Null Hypothesis: USDSATIS has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic based on SIC, MAXLAG=15)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-0.658980	0.8538
Test critical values:	1% level		-3.451078	
	5% level		-2.870561	
	10% level		-2.571647	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(USDSATIS)				
Method: Least Squares				
Included observations: 313 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
USDSATIS(-1)	-0.004180	0.006344	-0.658980	0.5104
C	0.007357	0.008790	0.836946	0.4033
R-squared	0.001394	Mean dependent var		0.001623
Adjusted R-squared	-0.001817	S.D. dependent var		0.022049
S.E. of regression	0.022069	Akaike info criterion		-4.782901
Sum squared resid	0.151472	Schwarz criterion		-4.758963
Log likelihood	750.5239	F-statistic		0.434254
Durbin-Watson stat	1.964808	Prob(F-statistic)		0.510396

3.4.3. Testing the Stationarity of the Series of the Euro Buying

The value of the ADF (Augmented Dickey-Fuller) test statistics which belong to the Euro Buying was computed as -1.441500. In ADF test statistics, the critical value that was computed for 5% mean level belonging to Euro Buying is -2.870561. Concerning the absolute value of the figures which are obtained, as a result, the value of the ADF test statistics is lower than the value of the MacKinnon criterion which is computed for 5% mean level. At this stage, H_0 cannot be rejected. That is to say, the series is not stationary. It does not demonstrate normal distribution and has autocorrelation. So, it seems possible to estimate the future prices by using the old prices.

The table that demonstrates the results of ADF test statistics for the series of the Euro Buying is as follows:

EURO BUYİNG UNIT ROOT

Null Hypothesis: EURTLALIS has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic based on SIC, MAXLAG=15)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.441500	0.5620
Test critical values:	1% level		-3.451078	
	5% level		-2.870561	
	10% level		-2.571647	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(EURTLALIS)				
Method: Least Squares				
Included observations: 313 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EURTLALIS(-1)	-0.014081	0.009768	-1.441500	0.1504
C	0.029057	0.019086	1.522380	0.1289
R-squared	0.006637	Mean dependent var		0.001630
Adjusted R-squared	0.003443	S.D. dependent var		0.026777
S.E. of regression	0.026731	Akaike info criterion		-4.399601
Sum squared resid	0.222227	Schwarz criterion		-4.375663
Log likelihood	690.5375	F-statistic		2.077923
Durbin-Watson stat	1.979224	Prob(F-statistic)		0.150450

3.4.4. Testing the Stationarity of the Series of the Euro Selling

The value of the ADF (Augmented Dickey-Fuller) test statistics which belong to the Euro Selling was computed as -1.3961. In ADF test statistics, the critical value that was computed for 5% mean level belonging to Euro Buying is -2.870561. Concerning the absolute value of the figures which are obtained, as a result, the value of the ADF test statistics is lower than the value of the MacKinnon criterion which is computed for 5% mean level. At this stage, H_O cannot be rejected. That is to say, the series is not stationary. It does not demonstrate a normal distribution and has autocorrelation. So, it seems possible to estimate the future prices by using the old prices.

The table that demonstrates the results of ADF test statistics for the series of the Euro Selling is as follows:

Euro Selling Unit Root

Null Hypothesis: EURSATIS has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic based on SIC, MAXLAG=15)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.396108	0.5845
Test critical values:	1% level		-3.451078	
	5% level		-2.870561	
	10% level		-2.571647	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(EURSATIS)				
Method: Least Squares				
Included observations: 313 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EURSATIS(-1)	-0.013654	0.009780	-1.396108	0.1637
C	0.028371	0.019186	1.478704	0.1402
R-squared	0.006228	Mean dependent var		0.001669
Adjusted R-squared	0.003033	S.D. dependent var		0.026900
S.E. of regression	0.026859	Akaike info criterion		-4.390085
Sum squared resid	0.224352	Schwarz criterion		-4.366147
Log likelihood	689.0482	F-statistic		1.949118
Durbin-Watson stat	1.980411	Prob(F-statistic)		0.163678

3.5. Cointegration Test between the Exchange Rates

If the residuals, which belong to the regression between the two homogenous series that are non-stationary but with the same grades, are I (0)-like stationary; these are 'cointegrated series'. The two series have the same wave length and trends convey one another. Method used in equivalence of the regression is 'The Smallest Squares Technique'.

The hypotheses regarding the cointegration test are as follows:

Ho: There is no cointegration relation between the variables.

H_1: There is a cointegration relation between the variables.

The cointegration test was made for the US Dollar Buying-Euro Buying and US Dollar Selling-Euro Selling.

Johansen's Cointegration Technique will be used in the cointegration test that will be made. The book (λ_{trace}) and maximum eigen (λ_{mak}) value with results of the test was given in order to determine the existence of cointegration.

3.5.1. Cointegration Analysis between the Series of US Dollar Buying-Euro Buying

According to the book statistics in Johansen cointegration test which was made between the series of US Dollar Buying-Euro Buying, the empty hypothesis (r=0) in which there no cointegration relation between the variables is accepted against the alternative hypothesis (r>0) in which there is a cointegration relation between the variables. For, the book value (8.370119) is lower than 5% critical value (15.49). At this stage, it is concluded that there is no cointegration relation between the variables in 5% critical value. Consequently, the hypothesis Ho is accepted and the hypothesis Ha is rejected (0,44>0,05). Related table is as follows;

Buying Cointegration

Trend assumption: Linear deterministic trend				
Series: USDTLALIS EURTLALIS				
Lags interval (in first differences): 1 to 4				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.023539	8.370119	15.49471	0.4267
At most 1	0.003262	1.009557	3.841466	0.3150
Trace test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.023539	7.360563	14.26460	0.4474
At most 1	0.003262	1.009557	3.841466	0.3150
Max-eigenvalue test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):				
USDTLALIS	EURTLALIS			
-9.035409	13.44886			
5.268273	-0.122679			
Unrestricted Adjustment Coefficients (alpha):				
D(USDTLALIS)	-0.001998	-0.001007		
D(EURTLALIS)	-0.004029	-0.000289		
1 Cointegrating Equation(s):		Log likelihood	1546.486	
Normalized cointegrating coefficients (standard error in parentheses)				
USDTLALIS	EURTLALIS			
1.000000	-1.488461			
	(0.27489)			
Adjustment coefficients (standard error in parentheses)				
D(USDTLALIS)	0.018051			
	(0.01141)			
D(EURTLALIS)	0.036403			
	(0.01381)			

3.5.2. Cointegration Analysis between the Series of US Dollar Selling-Euro Selling

According to the book statistics in Johansen cointegration test which was made between the series of US Dollar Selling-Euro Selling, the empty hypothesis (r=0) in which there no cointegration relation between the variables is accepted against the alternative hypothesis (r>0) in which there is a cointegration relation between the variables. For, the book value (7,188260) is lower than 5% critical value (15.41). At this stage, it is concluded that there is no cointegration relation between the variables in 5% critical value. Consequently, the hypothesis Ho is accepted and the hypothesis Ha is rejected. Related table is as follows;

SELLING Cointegration

Included observations: 309 after adjustments				
Trend assumption: Linear deterministic trend				
Series: USDSATIS EURSATIS				
Lags interval (in first differences): 1 to 4				
Hypothesized		Trace	5 Percent	1 Percent
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None	0.020950	7.188260	15.41	20.04
At most 1	0.002088	0.646013	3.76	6.65
Trace test indicates no cointegration at both 5% and 1% levels				
*(**) denotes rejection of the hypothesis at the 5%(1%) level				
Hypothesized		Max-Eigen	5 Percent	1 Percent
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None	0.020950	6.542247	14.07	18.63
At most 1	0.002088	0.646013	3.76	6.65
Max-eigenvalue test indicates no cointegration at both 5% and 1% levels				
*(**) denotes rejection of the hypothesis at the 5%(1%) level				
Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):				
USDSATIS	EURSATIS			
-9.094200	13.31237			
4.915976	0.383824			
Unrestricted Adjustment Coefficients (alpha):				
D(USDSATIS)	-0.001703	-0.000839		
D(EURSATIS)	-0.002183	0.000466		
1 Co integrating Equation(s):		Log likelihood	1546.252	
Normalized co integrating coefficients (standard error in parentheses)				
USDSATIS	EURSATIS			
1.000000	-1.463830			
	(0.28988)			
Adjustment coefficients (standard error in parentheses)				
D(USDSATIS)	0.015489			
	(0.01144)			
D(EURSATIS)	0.019857			
	(0.00951)			

6. CONCLUSION

According to the results of the cointegration tests that were made, there is no cointegration relation among selected indices. In conclusion, it is concluded that there has been no long-term stable relationship between these non-stationary time series, which were selected as variables.

If the result is evaluated in terms of implementation goal, that there has been no long-term balance relationship between the selected variables according to the result of the cointegration test demonstrates that these variables do not move together in the long term.

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