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## Financial and fiscal crises, prices and the EUR/USD rate of exchange

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### ABSTRACT

#### Purpose

The purpose of this paper is to answer the following question: How did the standard and non-standard ECB policy measures influence the price level and the EUR/USD rate of exchange in the period 2008-2013?

#### Design/methodology/approach:

We formulated the following hypothesis: Depreciation of the Euro versus American dollar exchange rate occurred in the period of financial and fiscal crisis (2008-2014). The main reasons for that included: fiscal crisis in the euro area, implementation of standard and non-standard (quantitative easing) ECB monetary policy measures and growth of money supply in the euro area. In that period, the economically and statistically significant impacts of money supply aggregate M2 and differences between interest rates and rates of inflation in the euro area and USA on changes in EUR/USD rate of exchange were noted. For verification of our hypothesis we used econometric modeling - model of regression estimated using the GARCH (0.1), using the monthly data for the period 1999:01-2013:12. Results of our research confirmed the hypothesis formulated by us.

#### Findings:

Our study confirmed the formulated hypothesis; the ECB monetary policy, both standard and non-standard, in the years 2008-2014 had a significant effect on the EUR/USD exchange rate, contributing largely to the depreciation of the euro in the same period.

#### Research limitations/implications:

The same method of research could be applied to other cases of currency area and central bank monetary policy.

#### Originality/value:

The results support the existence of statistically and economically significant impact of central bank policy on the rate of exchange, by the expansion of money supply, changes of differences between interest rates and rates of inflation inside and outside the currency rate area. Those results confirm conclusion formulated based on the theory of interest rate parity and assets theory of currency rates.

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### Introduction

The financial and fiscal crisis in the euro area has had a crucial impact on prices and the EUR/USD exchange rate. The aim of the research, which has become the basis for this paper was to examine how the standard and non-standard ECB policy measures affected the price level and the EUR/USD rate of exchange in the period 2008-2013?

The monetary policy of the European Central Bank had a considerable impact on changes in the M2 money supply aggregate and interest rates. Those factors, together with the FED monetary policy effects and differences in inflation rates in the euro area and USA

influenced the EUR/USD rates of exchange. Hence the following hypothesis has been formulated in our research: Depreciation of the EUR/USD exchange rate occurred in the period of financial and fiscal crisis (2008-2014). The main reasons for that included: fiscal crisis in the euro area, implementation of standard and non-standard (quantitative easing) ECB monetary policy measures and growth of money supply in the euro area. That period was also characterized by: the economically and statistically significant impacts of the money supply aggregate M2 and differences between interest rates and rates of inflation in the euro area and USA on changes in EUR/USD rate of exchange.

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We have used econometric modeling - models of regression estimated with the use of GARCH (0.1) for verification of the above hypothesis. We have used the monthly data for the period 2008-2014.

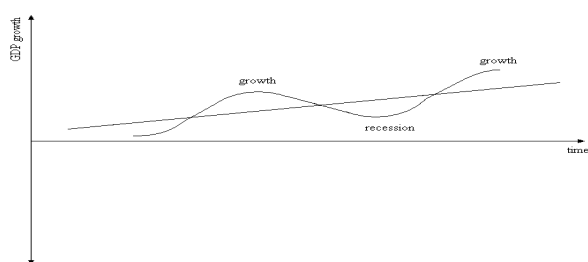
**1. 1 Financial and fiscal crisis in the euro area**

The global recession started in 2008 but already at the end of November and the beginning of December 2007, the top turning point of the business cycle was noted in the American economy. It was accompanied by an equally deep financial crisis.

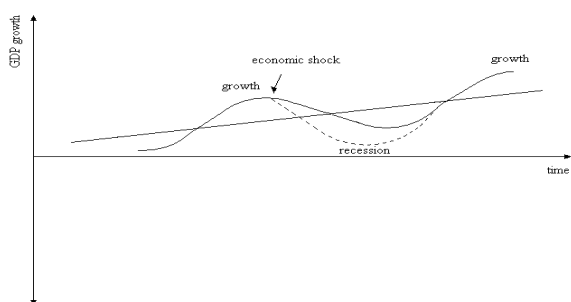
Business cycle, economic expansion and recession are natural phenomena in the market economy, as natural as high and low tides, or the phases of the moon. Recession is a natural mechanism of clearing the economy of inefficient economic units and a mechanism of restoring economic equilibrium after economic growth induced turbulence.

In the upward phase of the business cycle (economic boom and growth) we deal with a self-stimulation mechanism of the following components: alleviation of financial restrictions, increase in asset prices, currency appreciation as well as growth of economic efficiency at the micro-economic level and growth of the profit rate.

**A. Regular course of the cycle**



**B. Economic shock accelerating recession**

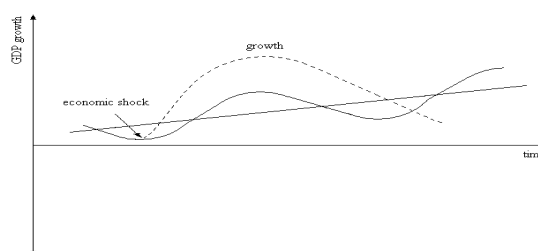


These processes are usually accompanied by a growing inflation rate.

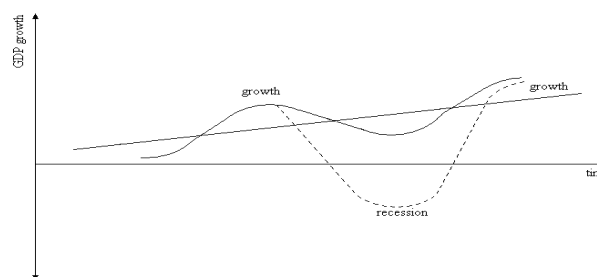
In the downward phase, a fall in production, employment and economic efficiency is observed, as well as losses at the microeconomic level, lower asset prices and currency depreciation. These changes are a natural component of the business cycle. However, in some cases, the above changes can be stronger than in the regular course of the cycle (see: Barczyk, et. al., 2006: 15-14). These cases may concern the occurrence of economic shocks, demand- or supply-side ones, monetary and currency related ones, fiscal ones, etc.

Economic shocks are understood as unpredictable economic and/or political events, either stimulating economic growth (favourable ones), or causing recession. They can lead to a boom in economy which occurs earlier than could be expected from a regular, predictable course of the cycle, a rapid and earlier slump and recession, a higher economic growth rate and longer lasting upward phase, or a deeper and longer recession (see: Fig. 1).

**C. Economic shock accelerating and stimulating economic growth**



**D. Economic shock deepening recession**



**Figure. 1.** Business cycle and impact of economic shocks  
Source: author's own compilation

Shocks of financial nature in the situation when the financial system is liberalized and adjusts easily to the fluctuations in economic activity are particular cases. In

**1.2 Financial crisis**

Financial shocks are a subject of many theoretical concepts. H.P. Minsky formulated the financial instability hypothesis. According to this concept, market economy is a financial system that in essence consists of transforming

such circumstances a tendency to take risks in pursuit of higher return rates on capital is an important factor stimulating changes in economy.

current money into future money. Current money serves the aim of financing a purchase of production factors. Future money consists of profits ascribed to capital assets. The process of financing investments leads to a situation in which control over capital assets is related to liabilities. The financial situation of every economic entity is

determined by its liabilities written down in the balance sheet, as well as predicted revenues (Minsky 1992, p. 2).

H.P. Minsky pointed to the increasing fragility of the financial system before the top point of the cycle. He also argued that in market economy, the period of growth is followed by the emergence of financial structures susceptible to deflation, a decline in the value of assets and deep depression (see: Minsky 1992, p. 6). The problem, however, is rooted in the fact that the amount and structure of liability repayments are explicitly determined, whereas revenues are subject to business cycle fluctuations.

H.P. Minsky points also to two price-setting mechanisms. The first of them is the product and labour market mechanism. The regular price-setting processes occur here. Prices cover current costs of enterprises, are the source of profit, household income and state revenue obtained via the tax system. The second mechanism – the market of capital assets – relies on the fact that prices are determined, not by current, but by the future value of anticipated profits.

A prerequisite of the undisturbed functioning of economy is an efficient flow of money along the line: depositors – banks – companies, and back.

The financial system stimulates consumer and investment demand leading to full employment and a high growth rate, but these processes are accompanied by a deteriorating structure of financing. Additionally, safe financing, which is observed when cash inflows from companies' operations permanently exceeding operational expenditure, gradually give place to speculative financing and a Ponzi scheme. The essence of speculative financing is the capability of settling all liabilities before the date of crediting elapses. Difficulties occurring in the repayment of liabilities usually do not pose a problem if creditors understand and agree to extend the repayment period. The Ponzi scheme consists of repayment of previous debts with new debts. In this case, limiting the inflow of financial resources entails the bankruptcies of companies (see: Bukowski 2009).

Fragility of the financial system is also revealed by the fact that seemingly small disturbances can lead to a sudden economic collapse.

An expansive economic (fiscal and monetary) policy can be a factor strengthening negative tendencies and leading to speculative bubbles, especially in the real estate market. On the other hand, a stricter monetary policy leading to bursting of the speculative bubble usually causes an immediate collapse of the business cycle. Allegedly, this, among others, may have been the case in the American economy when the FED raised interest rates in the years 2004–2006.

It must be emphasized that the financial crisis, which grows together with recession, is made more severe by phenomena such as: development of financial engineering, or lack of ownership supervision over the return on capital to risk ratio.

F. Mishkin draws attention to the significance of information asymmetry in the financial market and its consequences in the form of adverse selection and moral hazard. He defines the financial crisis as a financial market disturbance as a result of adverse selection and moral hazard becoming such strong phenomena that

financial markets are no longer efficient channels of investment financing. Consequently, the financial crisis causes the economy to depart from the state of equilibrium with high output and head towards rapid recession (Mishkin 1991, pp. 10–14).

It seems that the above-mentioned concepts are a good depiction of mechanisms for the impact of financial system disturbances on the course of the business cycle. It must also be emphasized that the state plays an adverse role in financial market disturbances if it keeps up appearances or creates real opportunities making managers feel that budgetary restrictions imposed on their companies are less strict. This can occur as a result of past government support to troubled financial enterprises and institutions. Another case is a government policy which reinforces the conviction that because of the particular role of the financial sector in maintaining employment, the government will not let enterprises go bankrupt (they are “too big to be allowed to fail”). Such a situation actually encourages managers to make risky decisions in pursuit of high rates of return on capital, which itself is profitable for managers owing to the system of corporate rewards and bonuses (Bukowski 2009).

In summary, the recession occurred in the years 2007–2012 due to a natural consequence of the business cycle logic. Yet, its severity was determined by a large scale of the financial crisis. The causes of the crisis should be looked for in the nature of the system and the market economy's financial mechanism. Still, its severity results from the following:

- expansive monetary policy of the US government;
- exacerbation of monetary policy by raising the FED interest rates on federal funds in the period July 2004 to July 2006 in the USA;
- development of financial engineering and its large-scale usage (ABS, CDO, etc.) in poor risk-assessment undertaken by the rating agencies;
- creation by the state of an impression of less strict budget limitations for companies and related higher expectations of companies,
- detachment of corporate management from the ownership supervision and related to this, the pursuit of high return rates at a price of high risk. (Bukowski 2009).

The occurrence of another recession in the 21<sup>st</sup> century between 2007 and 2012 (the first having occurred in the period of 2001–2003) was a natural course of events in accordance with the course of the business cycle. Globalization processes and increased international-scale economic interdependence accelerated transmission of economic disturbances from the USA to other countries of the world, including the European Union. Unfortunately, recession was deepened by a financial shock caused by the US real-estate market collapse that impacted on other countries in which the construction industry's share in the creation of added value and employment was particularly high (Ireland, Greece, Portugal, Spain). As a result, a collapse in the market of structured securities (CDOs) followed, as well as the financial crisis in the majority of developed countries manifesting itself as lower financial market

capitalization, a decline in financial liquidity, and the high losses of financial institutions including banks, some of which faced bankruptcy, while others went bankrupt (see: Bukowski 2011).

### **1.3 Fiscal crisis**

The fiscal problems of the euro area countries were a result of the impact of four groups of factors:

- abandonment of public finance reforms and structural changes enhancing market efficiency as an adjustment mechanism,
- non-compliance with the Stability and Growth Pact imposed regimes,
- high tendency for budget deficits and public debt increase since the very beginning of the euro area existence, especially in Greece, Italy, Portugal and Spain,
- procyclical easing of fiscal policy in many countries in the period of the 2002-2007 boom,
- increase in fixed expenses in total budget expenditure and GDP,
- economic recession in the years 2008-2009 which caused a sharp decline in the economic growth rate and in some countries practically a drop in the absolute value of GDP which resulted in lower budget revenues (see: Table 1),
- end of the boom in the market of assets including, in particular, the real estate market in the USA and other developed countries affected by the financial crisis. An adverse impact of this collapse was felt most by the countries characterized by a high share of the construction sector in economy; the crisis resulted also in the financial aid costs for financial institutions, especially in the countries characterized by a weak banking system and poor bank supervision (e.g. in Ireland),
- implementation of fiscal packages which were to stimulate economic growth.
- relatively low international competitiveness of some economies (Cyprus, Greece, Spain, Portugal, Italy) (Bukowski 2011).

The countries characterized by a large share of fixed expenses in budget expenditure and high budget debt in relation to GDP, using public debt rollover, are particularly vulnerable to public finance crisis and long-term recession. Financial market responses to all kinds of signals concerning the macroeconomic market of the country in connection with the increasing budget deficit and debt are violent. Growing public debt in relation to GDP as a result of growing budget deficit, leads to a higher risk of investment in treasury bonds and more difficulties in placing new issues on the market. This means also growing yield of the bonds in the financial market and more difficulties in raising capital for debt servicing and repayment on the maturity date due in a given year. Higher interest rates become necessary to encourage investors to purchase treasury bonds in the situation of higher investment risk and macroeconomic risk of the country. This, in turn, leads to increased public debt and further difficulties in debt repayment, necessity to issue successive treasury bonds and, in the case where it is impossible to place them on the market, to insolvency (Bukowski 2011).

All this is accompanied by the contagion effect: lower rating for subsequent countries which reveal a high debt and budget deficit to GDP ratio, higher costs of debt servicing and difficulties in placing new issues indispensable to raise capital for debt repayment in the case of more and more countries.

### **1.4 European Central Bank monetary policy against financial and fiscal crisis**

In the period of the financial and fiscal crises (2008-2013) the euro versus dollar exchange rate, as well as inflation rates in the euro area, fluctuated considerably. Their values were affected by many factors of both economic and non-economic nature.

The financial crisis in Europe was revealed only in mid-September 2008, immediately after a collapse of the Lehman Brothers investment bank in the USA. In the same period the euro area experienced a crisis of confidence and related to it, a liquidity crisis in the inter-bank sector which resulted in rapid growth of short-term interest rates in the market. Low activity and high risk occurring in the banking sector meant that financing the real sphere was limited, which contributed to a decline in consumption and investment demand. For this reason the European Central Bank undertook activities aiming at restoring equilibrium in the inter-bank market. Initially these were standard activities consisting of using basic monetary policy measures referring mainly to official interest rate developments. In the period from October 2008 to May 2009, the European Central Bank reduced interest rates to a level close to zero, which limited any further active use of this instrument. The interest rate policy implemented by the ECB did not bring about the expected effects and for this reason the ECB decided to implement non-standard monetary policy measures consisting mainly of modification of classical monetary policy instruments in this phase of the crisis which contributed to a reduction in short-term interest rates in the inter-bank market. Considering the events which took place at the time of the financial crisis and actions undertaken by the ECB, the financial crisis in the euro area can be divided into several phases where one can distinguish the period of market disturbances, the financial crisis as well as fiscal crisis (Cassola, Durre, Holthausen 2011, p. 281). With reference to particular phases of the crisis, one can identify the following non-standard measures used by the monetary authorities of the euro area:

- a) phase I – market disturbances
  - implementing additional fine-tuning operations,
  - increasing liquidity provision at the beginning of the period of maintaining the required cash reserve ratio,
  - extending maturity dates of open-market basic and long-term operations,
  - ensuring liquidity in US dollars – TAF (*Term Auction Facility*) programme,
- b) phase II – financial crisis
  - conducting re-financing operations in the form of public procurement with full allocation of resources and a fixed interest rate,

- further modification of maturity dates of long-term re-financing operations,
- extending the list of assets permissible as a collateral,
- ensuring liquidity in US dollars and Swiss francs,
- Covered Bond Purchase Programme (CBPP),
- c) phase III –fiscal crisis
- extending the period of conducting re-financing operations in the form of public procurement with full allocation of resources and a fixed interest rate,
- implementation and further modification of maturity dates of additional long-term re-financing operations,
- further extending the list of assets permissible as collateral,
- ensuring additional liquidity in US dollars,
- implementation of the Securities Markets Programme (SMP),
- resuming the Covered Bond Purchase Programme II (CBPPII),
- launching the *Outright Monetary Transactions* (OMT) programme of government bond buyout.

All activities, both standard and non-standard, undertaken by the ECB aimed at improvement of liquidity in the inter-bank market which, to some extent, was successful. However, it did not manage to completely eliminate disturbances in functioning of the monetary policy impulse transmission mechanism. The liquidity crisis in the inter-bank sector resulted in limited financing of the real sphere.

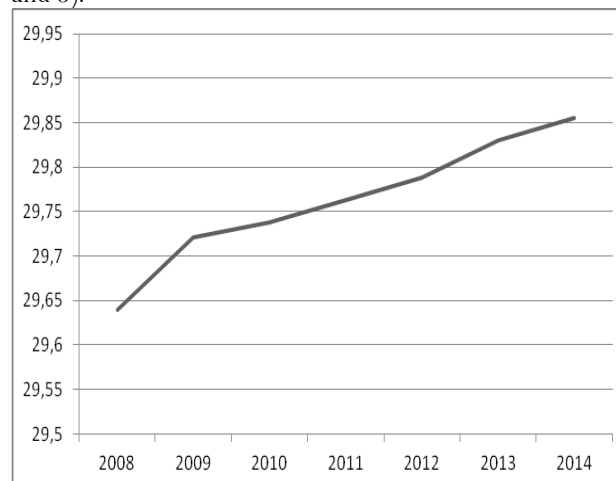
In the period 2008-2009, a dramatic fall in growth of the monetary aggregate M2 occurred, as well as a dramatic fall in the inflation rate in the euro area (see: Figures 1 and 2).

The situation changed considerably in May 2010 when the financial crisis evolved into fiscal crisis. This was a result of excessive public debt and high deficit in the public sector in some euro area countries. The financial problems faced by the euro area countries was a result of, among others, a lack of financial discipline in the period of favorable circumstances that preceded the crisis, abandonment of necessary public finance reforms, increase in public debt that was a consequence of high budget deficits, as well as non-compliance with the principles of the Stability and Growth Pact<sup>1</sup>. The situation deteriorated further due to overlapping of the financial and fiscal crisis. Economic slowdown and limited efficiency of monetary policy implemented by the ECB caused the euro area countries to use hugely active and passive fiscal policies. Implementation of fiscal packages to stabilize the financial system and stimulate the economic situation, increase in fixed expenses in total budget spending as well as reduction in budget revenues being the effect of economic slowdown, were additional stimuli having adverse effects on the situation of public finance and an increase in the deficits of some euro area

<sup>1</sup> According to the principles of the Stability and Growth Pact, the euro area member states are obliged to prevent excessive state budget deficits and adhere to their levels of 3% GDP. It is the so called budget criterion.

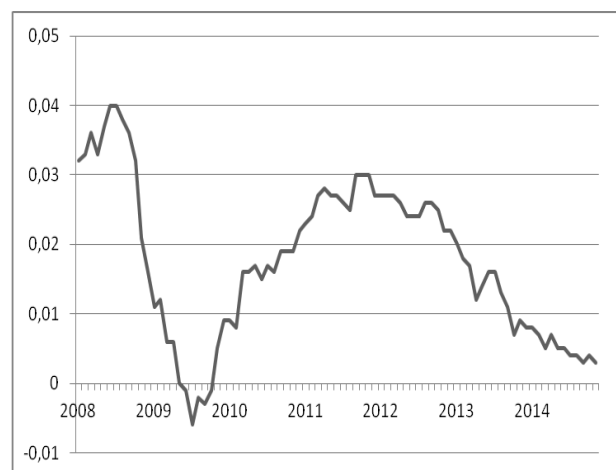
countries. Upon escalation of disturbances resulting from the euro area fiscal crisis, the European Central Bank decided to use more decisive non-standard programme actions, such as: the *Securities Markets Programme*, *Covered Bond Purchase Programme* and *Outright Monetary Transactions*, all aiming at long-term liquidity. Additionally, the countries having particularly high budget deficits were covered by the aid programmes of the European Union and International Monetary Fund.

In the period of fiscal crisis which started in mid-2010, the dynamics of the monetary aggregate M2 and inflation rate increased in the euro area (see: Figures 2 and 3).



**Figure 2.** Dynamics of monetary aggregate M2 (*lnM2*) in the euro area for the period 2008-2014

Source: author's own compilation based on the data from: ECB Statistical Data Warehouse, <http://sdw.ecb.europa.eu/> (access: 7.03.2016)



**Figure 3.** Rate of inflation in the euro area in the period 2008-2014.

Source: author's own compilation based on the data from: ECB Statistical Data Warehouse, <http://sdw.ecb.europa.eu/> (access: 7.03.2016)

Both the European Central Bank's non-standard monetary policy and the euro area fiscal crisis had a

Moreover, the member states are also obliged not to exceed the public debt level of 60% of GDP. It is the so called fiscal criterion.

considerable effect on the EUR/USD rate of exchange. In the period 2008-2013 the euro exchange rate underwent depreciation (see: Fig.4).

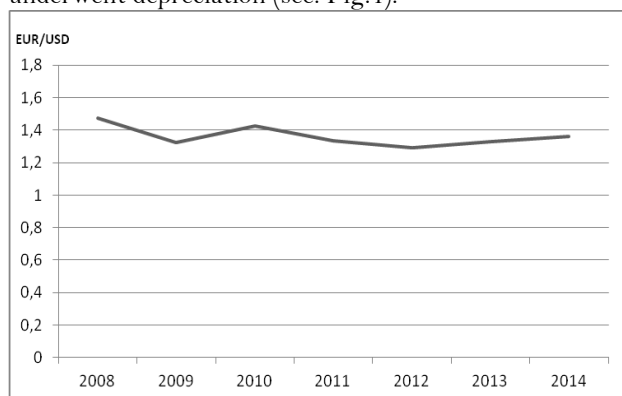


Figure 4. EUR/USD rate of exchange in the period 2008-2014.

Source: author's own compilation based on the data from: ECB Statistical Data Warehouse, <http://sdw.ecb.europa.eu/> (access: 7.03.2016)

Other factors affecting the euro exchange rate during the financial and fiscal crises were of non-economic character – they were of psychological nature. High risk and uncertainty that were observed in financial markets during that period resulted in the capital flight to safe and liquid assets in the currency, ensuring relative stability of its purchasing power.

## 2. Financial and fiscal crisis versus prices and EUR/USD rate of exchange

### 2.1 Statistical data

In our research we used monthly data from the period 2008-2014. The data regarding the EUR/USD nominal exchange rates, inflation rates in the euro area and monetary aggregate M2 are taken from the ECB Statistical Data Warehouse. The data on United States inflation rates and the USA monetary aggregate M2 come from the Federal Reserve Statistical Releases. The data referring to short-term, 3-month interest rates in

the inter-bank market in the euro area and the United States were taken from the OECD database.

### 2.2 Model

In order to examine whether and how the changes in money supply (monetary policy effect) in the euro area, changes in price levels (inflation rate) and in interest rates in the euro area in relation to these magnitudes in the United States affected the euro exchange rate (the price of euro expressed in US dollars) in the period of the financial and fiscal crises (2008-2014), the following model was formulated:

$$\ln E_t = a_{1t} + a_{2t} \ln Me_{2t-1} + a_{3t} \Delta P_t + a_{4t} \Delta P_{t-1} + a_{5t} ie_{t-1} + a_{6t} iu_{t-1} + \varepsilon_t$$

where:

$\ln E_t$  - logarithm of the USD/EUR nominal exchange rate,

$\ln Me_2$  - logarithm of the monetary aggregate M2 in the euro area,  $Pe, Pu$  - inflation rates in the euro area and United States, respectively,

$\Delta P$  - first differences from the difference in inflation rates in the euro area and United States, where:

$$\Delta P_t = \Delta(Pe_t - Pu_t)$$

$\Delta ie, \Delta iu$  - first differences in short-term interest rates in the euro area and United States, respectively,

$a$  - constant (intercept)

$\varepsilon$  - residuals,

$t$  - current period,

$t - 1$  - the period lagged by 1 month,

$t - 2$  - the period lagged by 2 months.

Estimation: GARCH (0.1).

The model was estimated using the GARCH (0.1) method.

## 3. Results

The conducted Engel-Granger co-integration test shows that the examined time series are co-integrated (see: Table 1A).

Table 1. GARCH, using observations 2008:03-2014:11 (T = 81) Dependent variable: lE, QML standard errors

	Coefficient	Std. Error	Z	p-value	
const	21.5543	1.35114	15.9527	<0.0001	***
l_Me2_1	-0.713326	0.0454081	-15.7092	<0.0001	***
d_P	-4.4104	0.652543	-6.7588	<0.0001	***
d_P_1	-1.45133	0.632048	-2.2962	0.0217	**
d_ie_1	15.6518	1.10936	14.1089	<0.0001	***
d_iu_1	-6.22052	0.7323	-8.4945	<0.0001	***
alpha(0)	0.000338735	8.6963e-05	3.8952	<0.0001	***
alpha(1)	0.732598	0.169082	4.3328	<0.0001	***
Mean dependent var	0.305427		S.D. dependent var	0.058151	
Log-likelihood	172.3816		Akaike criterion	-326.7633	
Schwarz criterion	-305.2132		Hannan-Quinn	-318.1171	

Unconditional error variance = 0.00126676

\*The variable is statistically significant at the 10% significance level, \*\* the variable is statistically significant at the 5% significance level, \*\*\* the variable is significant at the 1% significance level.

Source: authors' own calculations with the use of GRETLL program.

**Table 1A.** Engle-Granger's Co-integration Test. Augmented Dickey-Fuller test with constant and linear trend for uhat including 0 lags of (1-L)uhat (max was 12, criterion AIC) sample size 82

unit-root null hypothesis: $a = 1$
model: $(1-L)y = (a-1)*y(-1) + e$
estimated value of $(a - 1)$ : -0.259001
test statistic: $\tau_{ct}(6) = -3.49288$ , critical value with significance level 0.05 = -3.45.
p-value 0.6594
1st-order autocorrelation coeff. for e: -0.011

Source: authors' own calculations with the use of GRETTL program.

Analysis of the model estimation results (see: Table 1) shows that all variables are statistically significant and have signs in line with the economic theory.

#### 4. Conclusions

Conducted analysis allows us to formulate the following conclusions:

a) The use of standard and non-standard ECB monetary policy measures as a reaction to the financial crisis in the euro area caused a dramatic reduction in interest rates in the inter-bank market and higher money supply expressed, among others, in higher aggregate M2; that was the main reason for the euro versus US dollar depreciation in the period 2008-2014.

b) there was a statistically significant and fairly strong relationship between short-term interest rates in the euro area and USA which affected the nominal EUR/USD exchange rate in the period 2008-2014,

c) there was a statistically significant, negative and fairly strong relationship between growing differences in interest rates in the euro area and the United States and the nominal USD/EUR exchange rate in the years 2008-2014,

d) there was a statistically significant, negative and strong relationship between the money M2 supply in the euro area and the nominal USD/EUR exchange rate in the years 2008-2014.

Thus, in summary, the EBC monetary policy, both standard and non-standard, in the years 2008-2014 had a significant effect on the EUR/USD exchange rate, contributing largely to the depreciation of the euro in the same period.

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