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## **RELATIONSHIP BETWEEN FEDERAL FUNDS RATE AND ECB MAIN REFINANCING OPERATIONS RATE DYNAMICS**

### **ВЗАЄМОЗВ'ЯЗОК ДИНАМІКИ СТАВКИ ФЕДЕРАЛЬНИХ ФОНДІВ ТА СТАВКИ ОСНОВНИХ ОПЕРАЦІЙ РЕФІНАНСУВАННЯ ЄЦБ**

*The aim of the paper is to study the relationship between interest rate policy of the Federal Reserve Board and correspondent macroeconomic policy of European Central Bank. Study is performed to analyse level of relationship of federal funds rate and ECB main refinancing operations rate and their causality. This study contributes to the statement concerning the impact made by monetary policy of The Federal Reserve Board on the interest rate decisions of other central banks. In the paper main monetary tools used by the Federal Reserve Board are analysed. Basic interest rates set or targeted by the Fed, both lending and deposit, are studied. Main monetary tools of European Central Bank are researched. Key interest rates, used by ECB to implement economic policy within the Euro area are stated. Federal funds rate and ECB main refinancing operations rate are the key interest rates of the United States of America and European Union correspondently. These rates signal the stance of monetary policy, affect investment decisions, and have considerable impact on financial markets. In the study the Pearson's correlation test has been used to analyze the relationship between federal funds rate and ECB main refinancing operations rate. Granger causality test has been used to study causation in the association. Correlation analysis has revealed substantial relationship between federal funds rate and ECB main refinancing operations rate. The association of these interest rates is positive. Leading role of federal funds rate has been verified with Granger causality test. Granger causality test for the period 1999-2018 has revealed that federal funds rate causes ECB main refinancing rate. The research has shown that the strongest impact has been observed in 2 and 3-year lag studies. The findings of this research are consistent with the previous studies (M. Mandler, A. Belke et al).*

**Keywords:** interest rate policy, federal funds rate, the Fed, main refinancing rate, ECB, correlation, causality.

*Мета статті полягає у дослідженні взаємозв'язку відсоткової політики Ради керуючих ФРС та відповідної макроекономічної політики Європейського центрального банку. Дослідження проводилося для аналізу ступеню взаємозв'язку ставки федеральних фондів та ставки основних операцій рефінансування ЄЦБ, а також їх причинно-наслідкових зв'язків. Це дослідження підтверджує твердження щодо впливу монетарної*

політики Ради керуючих ФРС на відсоткову політику інших центральних банків. У статті проаналізовано монетарний інструментарій ФРС, досліджено основні кредитні та депозитні відсоткові ставки, які встановлюються чи таргетуються Радою керуючих ФРС. Проведено дослідження основних монетарних інструментів Європейського центрального банку. Визначено ключові відсоткові ставки, що використовуються ЄЦБ для реалізації монетарної політики у зоні «євро». Ставка федеральних фондів та ставка основних операцій рефінансування ЄЦБ є ключовими відсотковими ставками Сполучених Штатів Америки та Європейського Союзу відповідно. Ці ставки є індикаторами грошово-кредитної політики, впливають на інвестиційні рішення і мають значний вплив на фінансові ринки. У дослідженні для аналізу взаємозв'язку ставки федеральних фондів і ставки основних операцій рефінансування ЄЦБ був використаний кореляційний тест Пірсона. Для вивчення причинно-наслідкових зв'язків був використаний тест причинності Грейнджера. Кореляційний аналіз виявив суттєву залежність між ставкою федеральних фондів та ставкою основних операцій рефінансування ЄЦБ. Зв'язок цих процентних ставок є позитивним. Провідна роль ставки федеральних фондів була перевірена тестом причинності Грейнджера. Тест причинності Грейнджера проведений для періоду 1999-2018 років продемонстрував, що зміна ставки федеральних фондів спричиняє зміну ставки основних операцій рефінансування ЄЦБ. Дослідження показали, що найсильніший вплив спостерігається у випадку аналізу з використання лагу у 2 і 3 роки. Результати цього дослідження узгоджуються з дослідженнями інших науковців (М. Мандлера, А. Белке та ін.).

**Ключові слова:** процентна політика, ставка федеральних фондів, ФРС, ставка основних операцій рефінансування, ЄЦБ, кореляція, причинність.

**Introduction.** Interest rate is one of the most efficient monetary tools. Central banks use it to boost economic growth or to slow it down within macroeconomic business cycles. High level of relationship between key interest rates all over the world is a well-known fact, but there are still discussions on their causalities and reasons. Federal Reserve System makes the most considerable impact on the world economy in general and the global credit markets in particular. Introduction of Euro and establishment of European Central Bank was meant to create new world financial and geopolitical agent able to compete the Fed and its policy. Nevertheless there is still much evidence that Federal Reserve policy rules the global financial market Eurozone including.

The relationship between monetary decisions of central banks is the subject of many studies from all over the world performed by A. Belke, A. Greenspan, V. Katasonoff, M. Khasin, M. Mandler, C. Scotti, J. Stiglitz and many others. Some of them (V. Katasonoff, M. Khasin) focus on political side of this relationship. Many others (A. Belke, M. Mandler) dedicate their studies to economic factors causing the relationship or even deny follower behavior of some central banks (C. Scotti). There are still much discussions on relationship of the Fed's and ECB's monetary decisions, that makes this study important and relevant.

**Setting objectives.** The goal of the study is to analyze relationship between rates set or targeted by central banks. Federal funds target rate is set by the Federal Reserve Board and main refinancing rate is set by Governing Council of the ECB. Thus study is performed to analyze the relationship of federal funds rate (FFR) and ECB main refinancing operations rate.

**Methodology.** In the study the Pearson's correlation test was used to analyze the relationship between Federal funds rate and ECB main refinancing operations rate. Granger causality test was used to study the causation. Calculations were performed by means of Microsoft Excel and Eviews. Data was collected from Federal Reserve Board and European Central Bank official web-pages for the period 1999 - 2018.

**Research results.** The paper is focused on the case of relationship between interest rate policy of the Federal Reserve System and European Central Bank and its causality. There are many studies on the influence of the Federal Funds Rate on the key interest rates of central banks all over the world ECB including. Most economists state that ECB's policy follows the Fed. The research paper of V. Katasonoff [1] shows that many central banks take decisions on their key interest rates right after the holding of Federal Open Markets Committee meeting. Those are the following: Bank of England, ECB, Bank of Japan, Central Bank of the Republic Turkey, Bank of Russia, Riksbank (Sweden's central bank) et al. He assumes that actions of central banks are coordinated. While V. Katasonoff points out the political aspect of monetary policies' synchronization, a lot of his colleagues focus their studies on economic side of this phenomenon.

M. Mandler [2] has focused its research on the relationship of FED's and ECB's policies. He has studied relationship between Federal Funds Rate and EONIA - its counterpart in Euro area and he argues that high correlation between monetary policy in the U.S. and the Euro area can be explained by macroeconomic interdependence between the two regions. To study relationship between FED's and ECB's monetary decisions Ansgar Belke and Yuhua Cui [3] have specified two models: a partial vector error correction model (VECM) and a general VECM. The empirical results of both models indicate interdependence between the ECB and the Fed, but only the general VECM testifies a leader-follower pattern between the two central banks. According to this pattern, the monetary policy of ECB does follow the Fed's decisions. A. Belke and D. Gros [4] have found that the ECB is indeed often influenced by the Fed, but the reverse is true at least as often if one considers longer sample periods.

Some research papers deny follower behavior of European central bank and explain synchronization between the U.S. and ECB monetary policies by output factors. C. Scotti [5] has studied when and by how much the Fed and ECB change their target interest rates. She argues that empirical results support correlation between decisions of these central banks, but they do not support follower behavior. C. Scotti states that inflation rates are important factors, while a major role in US magnitude decisions is played by output.

The Federal Reserve has a variety of policy tools to implement monetary policy [6]:

- discount rate. The discount rate is the interest rate charged to commercial banks and other depository institutions on loans they receive from their regional Federal Reserve Bank's lending facility--the discount window. The Federal Reserve Banks offer three discount window programs to depository

institutions: primary credit, secondary credit, and seasonal credit, each with its own interest rate. All discount window loans are fully secured.

- open market operations -the purchase and sale of securities in the open market by a central bank--are a key tool used by the Federal Reserve in the implementation of monetary policy. The short-term objective for open market operations is specified by the Federal Open Market Committee (FOMC).
- interest on required reserve balances and excess balances paid by The Federal Reserve Banks. The interest rate on required reserves (IORR rate) is determined by the Board and is intended to eliminate effectively the implicit tax that reserve requirements used to impose on depository institutions. The interest rate on excess reserves (IOER rate) is also determined by the Board and gives the Federal Reserve an additional tool for the conduct of monetary policy.
- reserve requirements. Reserve requirements are the amount of funds that a depository institution must hold in reserve against specified deposit liabilities. The Board of Governors has sole authority over changes in reserve requirements. Depository institutions must hold reserves in the form of vault cash or deposits with Federal Reserve Banks.
- term deposit facility. Term deposits facilitate the implementation of monetary policy by providing an additional tool by which the Federal Reserve can manage the aggregate quantity of reserve balances held by depository institutions. Funds placed in term deposits are removed from the reserve accounts of participating institutions for the life of the term deposit and thereby drain reserve balances from the banking system. Reserve Banks offer term deposits through the Term Deposit Facility (TDF), and all institutions that are eligible to receive earnings on their balances at Reserve Banks may participate in the term deposit program.
- overnight reverse repurchase agreement facility. It intended to use an overnight reverse repurchase agreement (ON RRP) facility as needed as a supplementary policy tool to help control the federal funds rate and keep it in the target range set by the FOMC.

Federal Reserve uses a set of interest rates to provide effective monetary policy. The most important one is the federal funds rate – the key interest rate, which depository institutions use to lend excess reserves to other depository institutions overnight. Next key interest rate is the discount rate - the interest rate, which is used by regional Federal Reserve Bank's to extend loans to commercial banks and other depository institutions. The Federal Reserve offers three lending programs to banks and other depository institutions: primary credit, secondary credit, seasonal credit (interest rates differs for each program). According the primary credit program, loans are offered to financially healthy commercial banks and other depository institutions for a very short term (mostly overnight). Those depository institutions that cannot apply for primary credit may ask for secondary credit to tackle short-term liquidity gaps or to solve financial problems. Seasonal

credit is lend to banks or other depository institutions that have seasonal changes in funding needs (for instance in agriculture or tourism) [7].

Deposit rates, used by the Federal Reserve to reach its economic targets, are the following. Substantial impact on both the U.S. and the world financial markets is made by Overnight reverse repurchase agreement (ON RRP) offering rate. ON RRP offering rate is the maximum interest rate the Federal Reserve is willing to pay in an ON RRP operation. It intended to use an overnight reverse repurchase agreement facility as needed as a supplementary policy tool to help control the federal funds rate and keep it in the target range [7]. The other one is a reverse repurchase agreement (known as reverse repo or RRP). This is a transaction in which the New York Fed under the authorization and direction of the Federal Open Market Committee sells a security to an eligible counterparty with an agreement to repurchase that same security at a specified price at a specific time in the future [8]. The next rate that makes substantial impact on the U.S. economy is Term Deposit Facility Rate. It is set equal to the sum of the interest rate paid on excess reserves plus a fixed spread of 1 basis point. The Federal Reserve intends to use other supplementary tools, such as the TDF, as needed to help control the federal funds rate and move it into the target range [7]. The Term Deposit Facility is a program through which the Federal Reserve Banks offer interest-bearing term deposits to eligible institutions. The next one is the interest rate on excess reserves (IOER rate). The Federal Reserve intends to set the IOER rate equal to the top of the target range for the federal funds rate. The last, but not the least is interest rate on required reserves (IORR rate), that is determined by the Board and is intended to eliminate effectively the implicit tax that reserve requirements used to impose on depository institutions [7].

ECB uses a variety of monetary tools to implement economic policy within the Eurozone: open market operations (see table 1); standing facilities (this tool includes reverse transactions and deposits and has overnight maturity); minimum reserve requirements. The Fed uses the following reserve ratios: 1. A reserve ratio of 0 % shall apply to the following liability categories: deposits with agreed maturity over two years, deposits redeemable at notice over two years, repos, debt securities issued with an agreed maturity over two years. 2. A reserve ratio of 2,0 % shall apply to all other liabilities included in the reserve base.

To provide effective monetary policy ECB uses the following interest rates. The main refinancing operations (MRO) rate is the interest rate banks pay when they borrow money from the ECB for one week. When they do this, they have to provide collateral to guarantee that the money will be paid back. The next one is the rate on the marginal lending facility. It is the rate at which banks can borrow from the ECB overnight (this costs them more than if they borrow for one week). These rates are accompanied by the rate on the deposit facility. It defines the interest banks receive – or have to pay in times of negative interest rates – for depositing money with the ECB overnight [9].



Table 1 – Basic features of ECB open market operations

Type	Maturity	Instruments
main refinancing operations;	1 week	reverse transactions - an instrument used in conducting open market operations and when providing access to the marginal lending facility whereby a national central bank buys or sells eligible assets under a repurchase agreement or conducts credit operations in the form of collateralised loans.
longer-term refinancing operations;	3 months	reverse transactions;
fine-tuning operations;	Non-standardized	<ul style="list-style-type: none"> <li>– reverse transactions;</li> <li>– foreign exchange swaps for monetary policy purposes; It is an instrument used in conducting open market operations whereby the Eurosystem buys or sells euro spot against a foreign currency and, at the same time, sells or buys it back in a forward transaction on a specified repurchase date.</li> <li>– the collection of fixed-term deposits;</li> </ul>
structural operations.	Non-standardized, but less than 12 month	<ul style="list-style-type: none"> <li>– reverse transactions;</li> <li>– the issuance of ECB debt certificates - a monetary policy instrument used in conducting open market operations, whereby the ECB issues debt certificates which represent a debt obligation of the ECB in relation to the certificate holder.</li> <li>– outright transactions. It is an instrument used in conducting open market operations, whereby the Eurosystem buys or sells eligible marketable assets outright in the market (spot or forward), resulting in a full transfer of ownership from the seller to the buyer with no connected reverse transfer of ownership.</li> </ul>

Source: developed by author on the basis of [10]

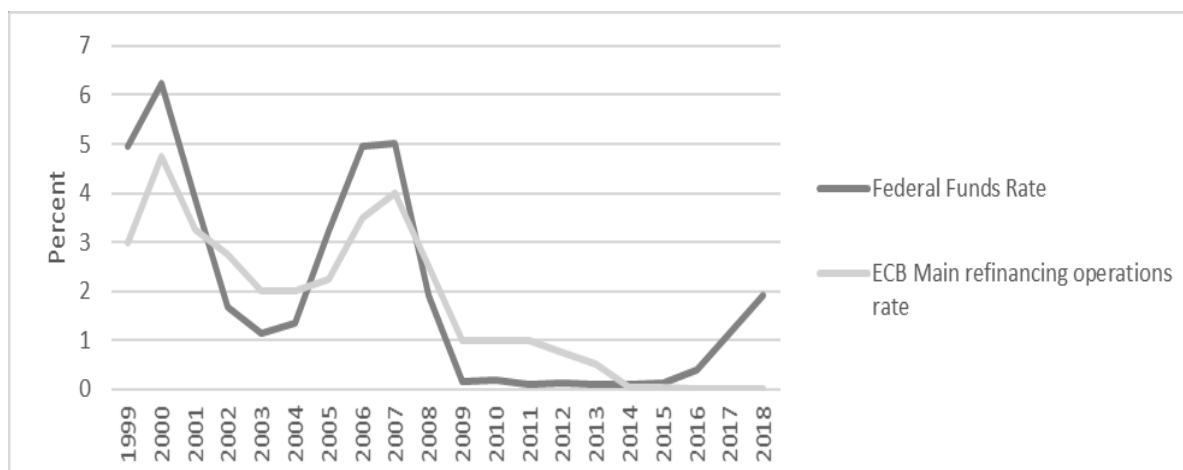


Figure 1 - Federal funds rate and ECB lending rates dynamics in 1999-2018.

*Developed by the author on the basis of [7], [11].*

This study contributes to the statement concerning the impact made by The Fed's monetary policy on the interest rate decisions of other central banks. Federal funds rate and ECB main refinancing operations rate are the key interest rates of US and EU correspondently. These rates signal the stance of monetary policy, affect investment decisions, and have considerable impact on financial markets. The Federal Open Market Committee implements its monetary policy decisions by changing its target for the federal funds rate (FFR), which is the rate at which depository institutions borrow and lend reserves to and from each other overnight. Although the Federal Reserve does not control the FFR directly, it can do so indirectly by varying the supply of reserves available to be traded in the market. The key interest rate of ECB is the rate applied to main refinancing operations, which provide the bulk of liquidity to the financial system. It is set by the Governing Council of the ECB [11].

Correlation analysis revealed substantial relationship between federal funds rate and ECB main refinancing operations rate ( $R=0.925901208852909$ ). The association of these interest rates is positive. Thus federal funds rate decline is accompanied by ECB interest rate decrease and vice versa (see figure 1). The figure 1 shows that in 1999-2018 key interest rates of USA and EU changed mostly the same way, but ECB main refinancing rate lagged behind the federal funds rate for approximately year and a half.

Leading role of federal funds rate is verified with Granger causality test. This test for the period 1999-2018 has revealed that Federal funds rate (FFR) causes ECB main refinancing rate (MRR). Analysis has been performed on the basis of 1,2,3, and 4-year lags. The research shows that the strongest impact has been observed in 2 and 3-year lag studies (see Table 2).

Table 2 – Pairwise Granger Causality Tests

Number of lags	Number of observations	Null Hypothesis	F-statistic	Probability
1	17	FFR does not Granger cause MRR	5.49351	0.0344
		MRR does not Granger cause FFR	2.59073	0.1298
2	16	FFR does not Granger cause MRR	9.75672	0.0037
		MRR does not Granger cause FFR	2.93633	0.0951
3	15	FFR does not Granger cause MRR	8.91991	0.0062
		MRR does not Granger cause FFR	3.63160	0.0642
4	14	FFR does not Granger cause MRR	5.39785	0.0465
		MRR does not Granger cause FFR	2.08537	0.2204

Source: calculations were performed by the author on the basis of [7], [11].

The findings of this research are consistent with the previous studies. M. Mandler has studied the relationship between Federal Funds Rate and EONIA. ECB main refinancing operations rate sets the upper limit for the EONIA rate – FFR's counterpart in Euro area. That is why we assume, that these two studies can be compared. M. Mandler [2] has also revealed that monetary policy in the Euro area follows that of the U.S. with a lag. A. Belke [3; 4] has also found strong relationship between monetary decisions on The Fed and ECB and states that monetary policy of ECB does follow the Fed's decisions.

**Conclusions.** Monetary decisions of the Federal Reserve Board and European Central Bank make essential impact on the global economy. Central banks all over the world observe their moves to perform their own monetary policy and provide descent economic development of their countries. Many studies focus on economic and political impact made by the Fed upon the world. This study contributes to the statement concerning strong relationship between monetary decisions of the Federal Reserve Board and European Central Bank. The novelty of the paper lies in the following. Correlation analysis revealed substantial relationship between federal funds rate and ECB main refinancing operations rate. Leading role of federal funds rate is verified with Granger causality test. Granger causality test for the period 1999-2018 revealed that Federal funds rate (FFR) causes ECB main refinancing rate (MRR). The research shows that the strongest impact has been observed in 2 and 3-year lag studies. The following studies will be focused on economic reasons of synchronization of central banks' monetary decisions.

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## ПОДОЛАННЯ ДИСПРОПОРЦІЙ ЗОВНІШНЬОЇ ТОРГІВЛІ В КОНТЕКСТІ ДЕРЖАВНОГО РЕГУЛЮВАННЯ СТРУКТУРНИХ ЗМІН

### OVERCOMING IMBALANCES FOREIGN TRADE IN THE STATE REGULATION OF STRUCTURAL CHANGES

Дослідження присвячено обґрунтуванню інструментів та заходів щодо подолання структурних диспропорцій зовнішньої торгівлі як важливої складової підвищення ефективності державного регулювання структурних змін у національному господарстві. На основі аналізу показників обсягу та структури експорту України визначено, що