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ECONOMETRIC ANALYSIS OF INDICATORS OF DEVELOPMENT OF FINANCIAL AND REAL ECONOMIC SECTORS ¹

Abstract. *Introduction.* The instability of the domestic economy and the influence of external factors lead to the deviation of the basic macroeconomic indicators from the normative equilibrium values. This requires the development of a qualitatively new integrated approach to the analysis of the main macroeconomic indicators of the development of the economy sectors in order to identify the effective institutional and financial foundations for stimulating economic progress of our state.

The purpose of the work is to study the theoretical positions of the financial and real sectors of the economy and conduct an econometric analysis of the indicators of their development.

Results. Theoretical positions about the place of the real and financial sectors of the economy in the general economic system of the state has been systematized in the article. The main indicators (KPIs — key performance indicators) of the studied sectors of the economy has been revealed. The econometric analysis of the main indicators of the development of the economy sectors has been based on real (actual) values corrected for inflation and has been presented in the classical theoretical Hix-Hansen equilibrium model on commodity and money markets (IS-LM).

The data of the National Bank of Ukraine on the dynamics of the monetary base (B) and monetary aggregates (M0 — M3), and the State Statistics Service of Ukraine on GDP (Y) and inflation (CPI) has been used in the research. The econometric analysis has showed a significant correlation between the nominal and real GDP, money supply and money base indicators, which are almost synchronized during 2001—2017. The presence of strong interdependence between the real values of these indicators has been confirmed by very high correlation values, which are ranged from 0.94 to 0.99. Almost functional dependence of the money supply on the monetary base has been explained by the availability of the existing mechanism of monetary multiplication, and the money

¹ Стаття підготовлена в рамках НДР «Теорія та методологія трансформаційних процесів у фінансовому секторі країни» (номер державної реєстрації 0117U002441), що виконується за рахунок видатків з загального фонду держбюджету.

market multiplier tends to increase. The high statistical dependence between the real NBU discount rate and the weighted average rate on all instruments has been revealed. It proved the effectiveness of the main instrument for implementing the discrete monetary policy of macroeconomic regulation. The negative significance of the correlation coefficients between the interest rates and the quantitative indicators of the real and financial sectors of the economy has shown that the traditional theoretical compromise in choosing the main problems to be solved in the economy to ensure macroeconomic stability is also typical for Ukraine. The application of the «expensive money» policy to combat high inflation negatively affects the real money supply, but taking into account the very high dependence between it and GDP, slows down the growth of the real sector of the economy, and vice versa.

The obtained two-factor regression equation with very high reliability has explained by the retrospective changes in the real money supply. The most important factor for it is real GDP. This confirms the strong interconnection between the real and financial sectors of the economy in the process of developing the economic system. Quantitative indicators of development of both sectors are under the influence of long-term trends. They have their own nature and often depend on trends in the development of the world economy and finance as well as internal problems that are often predictable.

Conclusions. The results has been obtained suggest that the synchronous long-term dynamics of real GDP, money supply and money base, as well as the statistical interdependence between them, firstly, signal that in Ukraine the rules of a market economy have already been formed and can be applied effectively in such conditions of the methods and tools of macroeconomic regulation, and secondly, processes occurring in one of the specified sectors of the economy will necessarily reflect on another. Therefore, solving macroeconomic problems requires a balanced and integrated approach taking into account the nature and strength of the interdependence between different processes and phenomena.

Keywords: econometric analysis; financial and real sector of the economy; Gross Domestic Product; money supply; money base; national economic model of Ukraine.

JEL Classification C22, E01, E58

Formulas: 0; fig.: 6; tabl.: 2; bibl.: 15.

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ЕКОНОМЕТРИЧНИЙ АНАЛІЗ ПОКАЗНИКІВ РОЗВИТКУ ФІНАНСОВОГО І РЕАЛЬНОГО СЕКТОРІВ ЕКОНОМІКИ

Анотація. Нестабільність вітчизняної економіки і значний вплив зовнішніх (глобальних) чинників, який характеризується відхиленням базових макроекономічних показників від нормативних рівноважних значень, потребує вдосконалення і розроблення якісно нового збалансованого (комплексного) підходу до аналізу основних макроекономічних показників розвитку секторів економіки з метою виявлення дієвих інституційних і фінансових підвалин стимулювання економічного прориву нашої держави.

Метою роботи є дослідження теоретичних положень і проведення економетричного аналізу показників розвитку фінансового і реального секторів економіки.

Проведено систематизацію уявлення щодо місця реального і фінансового секторів економіки в загальній економічній системі держави, виявлено основні показники (KPI — key performance indicator), які характеризують розвиток досліджуваних секторів економіки. Економетричне дослідження основних KPI розвитку секторів економіки проведено на основі реальних (фактичних) значень, що скориговані на інфляцію та представлені у класичній теоретичній моделі Хікса — Хансена взаємної рівноваги на товарному і грошовому ринках (IS — LM).

У дослідженні використано дані Національного банку України щодо динаміки грошової бази (В) і грошових агрегатів (M0 — M3) та Державної статистичної служби України щодо ВВП (Y) та інфляції (CPI). Економетричний аналіз показав значну залежність між номінальними і реальними показниками ВВП, грошової маси і грошової бази, які майже синхронно змінювалися протягом 2001—2017 рр. Наявність сильної взаємозалежності між реальними величинами зазначених показників підтверджується дуже високими значеннями кореляції, які становлять від 0,94 до 0,99. Майже функціональна залежність грошової маси від грошової бази пояснюється наявністю чинного механізму грошової мультиплікації, причому мультиплікатор грошового ринку має тенденцію до збільшення.

Виявлена висока статистична залежність між реальними обліковою ставкою НБУ та середньозваженою ставкою за всіма інструментами засвідчила дієвість основного інструменту реалізації дискретної монетарної політики макроекономічного регулювання. Від'ємне значення коефіцієнтів кореляції між процентними ставками і кількісними показниками розвитку реального та фінансового секторів економіки засвідчило, що традиційний теоретичний компроміс у виборі основних проблем, які потрібно розв'язувати в економіці для забезпечення макроекономічної стабільності, є характерним і для України. Застосування політики «дорогих грошей» для боротьби з високою інфляцією негативно впливає на реальну грошову масу, а враховуючи дуже високу залежність між нею і ВВП, уповільнює й зростання реального сектору економіки і — навпаки.

Отримане рівняння двофакторної регресії з дуже високою достовірністю пояснює ретроспективні зміни реальної грошової маси. Найбільш важливим фактором впливу на неї є реальний ВВП, що підтверджує сильний взаємозв'язок реального і фінансового секторів економіки у процесі розвитку економічної системи. Кількісні показники розвитку обох секторів перебувають під впливом довгострокових трендів, що мають свою власну природу й часто залежать від трендів розвитку світової економіки та фінансів, а також внутрішніх проблем, що часто мають передбачувану природу.

Отримані результати дозволяють стверджувати, що синхронна довгострокова динаміка реальних ВВП, грошової маси та грошової бази і виявлений статистичний взаємозв'язок між ними, по-перше, сигналізують про те, що в Україні вже сформовані засади ринкової економіки і можуть застосовуватись ефективно в таких умовах методи та інструменти макроекономічного регулювання, а по-друге, процеси, що відбуваються на одному з вказаних секторів економіки, обов'язково відобразяться на іншому. Тому розв'язання макроекономічних проблем потребує збалансованого та комплексного підходу з урахуванням характеру і сили взаємозв'язку між різними процесами та явищами.

Ключові слова: економетричний аналіз; фінансовий і реальний сектори економіки; валовий внутрішній продукт; грошова маса; грошова база; національна економічна модель України.

Формул: 0; рис.: 6; табл.: 2; бібл.: 15.

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ЭКОНОМЕТРИЧЕСКИЙ АНАЛИЗ ПОКАЗАТЕЛЕЙ РАЗВИТИЯ ФИНАНСОВОГО И РЕАЛЬНОГО СЕКТОРОВ ЭКОНОМИКИ

Аннотация. В статье проведена систематизация представления о месте реального и финансового секторов экономики в общей экономической системе государства, выявлены основные показатели (KPI - key performance indicator), которые характеризуют развитие исследуемых секторов экономики. Эконометрическое исследование проведено на основе реальных (фактических) значений, скорректированные на инфляцию и представлены в классической теоретической модели Хикса-Хансена взаимного равновесия на товарном и денежном рынках (IS-LM). Обнаружена высокая статистическая зависимость между реальной учетной ставкой НБУ и средневзвешенной ставкой по всем инструментам, которая показала действенность основного инструмента реализации дискретной монетарной политики макроэкономического регулирования.

Ключевые слова: эконометрический анализ; финансовый и реальный сектор экономики; валовой внутренний продукт; денежная масса; денежная база; национальная экономическая модель Украины.

Формул: 0; рис.: 4; табл.: 2; библи.: 15.

Relevance. The dialectical approach to studying the problems of interaction and development of the real and financial sectors of the economy involves a retrospective analysis of existing scientific concepts and hypotheses. Scientific ideas, hypotheses and achievements of predecessors serve as a starting point for critical reflection and the development of their own proposals within the scope of the subject.

Economic transformations in the domestic economy make it urgent to study the problems of interaction and mutual influence of the real and financial sectors of the economy in the conditions of changing the socio-economic environment of the functioning and development of new forms of organization of market relations taking into account modern trends of digitalization and globalization of economic processes. A particular problem is picked up in the conditions of instability of the domestic economy and significant influence of external factors. This influence leads to the deviation of the basic macroeconomic indicators from the normative equilibrium values. This requires the development of a qualitatively new approach to the analysis of the main macroeconomic indicators of the development of the economy sectors.

Analysis of recent research and publications. The fundamental foundations of the relationship between the financial and real sectors of the economy had been researched by prominent scholars of the world: from the point of view of the financial sector's impact on economic growth and its structure, Goldsmith, R. (1959) [1], the relationship between domestic financial development and economic growth McKinnon, R. (1973) [2], General Theory of Economic Development of the Economic Sectors Schumpeter, JA (1934) [3]. In total these works had revealed the fundamental signs of the interconnection and the existence of a close correlation between the size of the financial sector and economic growth.

The implications of financialization economy had been discussed in Krippner, G. (2005) [4]. evidence supporting the negative effect of financialization of accumulation is found at Stockhammer, E. (2004) [5]. The spatial structure of the global financial industry and its impact on the real economy had been researched by Clark, G. and O'Connor, K. (1997) [6]. The influence of the functioning of stock markets and banks on economic growth had been presented in the writings of Levine, R. and Zervos S. (1998) [7], The causal link between changes in financial sector development and economic growth had been studied by Liang Hshin-Yu and Reichert A. (2006) [8].

The laws and mechanisms of interaction between the real and financial sectors of the economy in the field of domestic science had been researched by the Ukrainian scientists. The fundamental researches on the functioning and definition of the scale and prospects of the financial and real sectors of the economy had been considered by O. Baranovskyi (2017) [9], conducted an assessment of the interconnections and determinants of the development of the banking and real sectors of the Ukrainian economy by M. Zveryakov and L. Zherdets'ka (2017) [10], issues of the Economic Development Strategy of the Ukrainian Economy Sectors by A. Gal'chyns'kyi and V. Heyets (2004) [11], theoretical and methodological aspects of the interaction of the financial and real sectors of the economy by B. Pshyk (2013) [12], M. Rudenko (2017) [13] etc. However, the role of the financial sector has increased significantly under the current conditions of accelerated development and globalization of economic processes, therefore, in our opinion, there is an urgent need to review and analyze the main indicators of interaction and development of the real and financial sectors.

Presenting main material. Based on previous author research on the theoretical aspects of interaction between sectors of the economy [14], it can be argued that modern macroeconomics is a synthesis of neoclassical, Keynesian and monetarist theories, and deals with several types of interconnected markets, among which are: market of goods (commodity market); labor market; money market (money market); capital market. In each of the markets there are considered separate macroeconomic indicators that characterize their state and reflect its equilibrium. Some indicators characterize the quantitative parameters of the market, others - the prices. In the commodity market (the real sector of the economy), the equilibrium is established by the interaction of aggregate demand and aggregate supply, resulting in the formation of an equilibrium level of prices and the equilibrium real volume of national production (real GDP). Under the influence of non-price factors, equilibrium parameters are shifted, while macroeconomic dynamics such as economic growth (or decline) and inflation (or deflation) are observed. Economic growth is due to an increase in real GDP compared to the previous period. Inflation is an increase in the general price level that occurs if the price level of the previous period exceeds the same indicator of the previous one.

Equilibrium in the money market and the capital market, which are components of the financial market, is determined by the interaction of supply and demand for money (or capital), resulting in the formation of an equilibrium interest rate on each of the markets and an equilibrium money supply.

The relationships between the above-described indicators that characterize the equilibrium in each individual market can be described by the following provisions:

1) GDP is one of the non-price factors that determine the demand for money, and affects the equilibrium in the money market, which suggests dependence (and direct) on GDP, money supply and interest rates. The effect of GDP on money supply is based on the Fisher equation: $M * V = P * Y$, which is the basis of a monetarist approach that characterizes the stable relationship between GDP and money supply (M2);

2) money supply is one of the non-price factors of aggregate demand, and it affects the equilibrium in the commodity market, which also allows to assert a direct dependency between money supply, GDP and price levels. Fisher's equation is also considered as a condition for the simultaneous equilibrium in the commodity and money markets;

3) the interest rate (real) directly affects the demand for investment and, consequently, acts on aggregate demand, while changing the parameters of equilibrium in the money market.

In the Keynesian theory, in order to assess the interaction between the real and financial sectors of the economy at the given time, they use the model of simultaneous equilibrium in the commodity and money markets, often referred to as the Hix-Hansen model, or the model IS-LM [15]. The "IS-LM" model is the mainstream macroeconomic model, the use of which can reveal how simultaneous interaction of commodity and money markets will affect real GDP and interest rates. The foregoing serves as the starting point for an econometric analysis of modern interaction and development of sectors of the domestic economy. The econometric analysis of the indicators of the development of the sectors of the economy requires systematizing the representation of the place of the real and financial sectors of the economy in the general economic system of the state, as well as the identification of key performance indicator (KPI) that characterize the development of the studied sectors of the economy.

The econometric study of the main KPI of the financial and real economy sectors should be made on the basis of actual (actual) inflation-adjusted values, so we will perform preliminary calculations and analyze the nominal values of the KPI - macroeconomic indicators characterizing the development of the financial and real sectors of the economy and presented in the classical theoretical Hicks-Hansen model of mutual equilibrium on commodity and money markets (IS-LM). In this case, we use the data of the National Bank of Ukraine regarding the dynamics of the monetary base (B) and monetary aggregates (M0-M3) and the State Statistics Service of Ukraine on GDP (Y) and inflation (SRI), which are presented in Table 1. In order to carry out further calculations, it is necessary to choose the base period, in relation to which the selected indicators will then be listed in real prices. The CPI in Table 1 is presented in a cumulative form in relation to the year 2000. It should be noted that the main indicator of the price on the money market - the interest rate - was investigated in the previous author's research [14], including in real terms.

Table 1

Macroeconomic indicators characterizing the development of the real and financial sectors of the economy in 2001-2017.

Years / Indicator	B	M0	M1	M2	M3	Y	CPI, 2000=100%
2001	23,1	19,5	29,8	45,2	45,8	211,2	106,1
2002	30,8	26,4	40,3	64,3	64,9	234,1	105,5
2003	40,1	33,1	51,5	94,9	95,0	277,4	114,1
2004	53,8	42,3	67,1	125,5	125,5	357,5	128,1
2005	82,8	60,2	98,6	193,1	194,1	457,3	141,3
2006	97,2	75,0	123,3	259,4	261,1	565,0	157,7
2007	141,9	111,1	181,7	391,3	396,2	751,1	183,9
2008	186,7	154,8	225,1	512,5	515,7	990,8	224,9

2009	195,0	157,0	233,7	484,8	487,3	947,0	252,6
2010	225,7	183,0	289,9	596,8	597,9	1120,6	275,6
2011	239,9	192,7	311,0	681,8	685,5	1349,2	288,3
2012	255,3	203,2	323,2	771,1	773,2	1459,1	287,7
2013	307,1	237,8	383,8	906,2	909,0	1522,7	289,1
2014	333,2	282,9	435,5	955,3	956,7	1586,9	361,1
2015	336,0	282,7	472,2	993,8	994,1	1988,5	517,5
2016	381,6	314,4	529,9	1102,4	1102,7	2385,4	581,7
2017	399,1	332,5	601,6	1208,6	1208,9	2982,9	661,4

Source: compiled by authors on the basis of own calculations, data of the National Bank of Ukraine and the State Statistical Service of Ukraine www.ukrstat.gov.ua; www.bank.gov.ua

The data contained in Table 1 are nominal and growing, including by increasing the cumulative price level. Therefore, for objective statistical and econometric analysis, we adjust the available data to the cumulative level calculated in relation to the base year 2000. We will also calculate and track the dynamics of important macroeconomic ratios characterizing the internal proportions of the development of the financial and real sectors of the economy, namely: 1) the money multiplier (the ratio of money supply to the monetary base); 2) the coefficient of GDP monetization (the ratio of money supply (at the end of the year) to GDP). In this case, as a money supply, we use the monetary aggregate M3 (Fig. 1).

Analyzing the information in Figure 1, the following intermediate conclusions can be drawn:

- during the analyzed period, there is a tendency towards a gradual increase in the money multiplier from 1.98 in 2001 to 3.03 in 2014, and in 2012, this figure has become the corresponding maximum, and then declined;

- it is worth noting the cyclical character of the dynamics of the money multiplier, when local maxima were reached respectively in 2003, 2007, and 2012, after which there was a decrease in waves with local minimum, respectively, in 2005, 2009 and 2014;

- the coefficient of GDP monetization during the period also tended to increase, increasing from 21.7% in 2001 to 60.3% in 2014 almost three times; but from 2015 until now there is a downward trend, although, given the renewal of the growth of the money multiplier, all the necessary conditions for the reversal of the trend and the gradual increase of GDP monetization have developed;

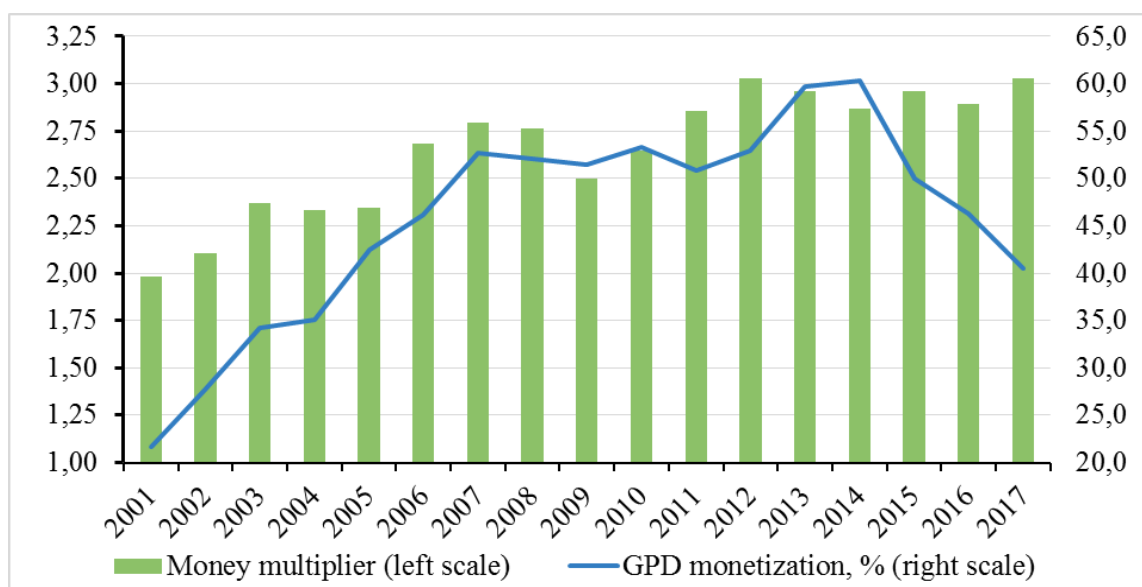


Fig. 1. Dynamics of money multiplier and GDP monetization in 2001-2017

Source: calculated by authors on the basis of Table 1 data

- we note a certain stabilization of the indicator of monetization of GDP in 2007-2012 at the level of 51-53%.

Further research will concentrate on the analysis of the dynamics of indicators of the monetary base, money supply and GDP relative to the previous year (Fig. 2).

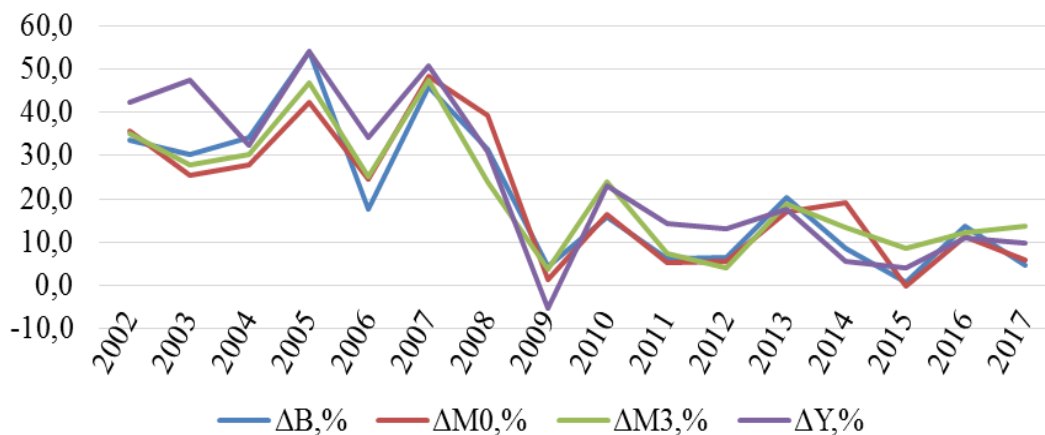


Fig. 2. Dynamics of monetary base, money supply and GDP in 2001-2017 (% to the previous year)

Source: calculated by authors on the basis of Table 1 data

Analyzing the data in Figure 2, one important feature should be noted: all the indicators under study have almost identical dynamics, which is proof of the strong interaction of money and commodity markets. In addition, it is worth noting the existence of two time periods, in which the dynamics of the four indicators shown in the picture significantly differed, namely: 1) 2002-2008 - a period of rather rapid growth, which occurred at about 40% of the limit, and in 2005 and 2007 even exceeded 50%; 2) 2009-2017 - a significant deceleration of the growth rates of nominal values, where the average limit is already 10%. Note that just after the global financial crisis, the dynamics of indicators slowed down significantly.

Next, let's proceed directly to an econometric study, but we will note this on some theoretical points. The real interest rate (R (real)) along with real GDP (Y (real)) is one of the main indicators of the simultaneous development of commodity and money markets within the framework of the IS-LM macroeconomic equilibrium model, which simultaneously affects the level of investment, and then on equilibrium GDP through the classical macroeconomic equation $Y = C + I + G + X_n$, and on the level of money supply, and hence on the real equilibrium money supply (M (real)). Previously, the study [14] graphically showed the dependence of the real average weighted rate on the real discount rate of the NBU (R_k (real)). The calculations showed that the correlation coefficient between them in 2001-2017 was 0.95, indicating that there was a high correlation dependence. This confirms the classic fact that the key rate (the NBU discount rate) is the main instrument of influence on the level of interest rates.

Figure 3 shows the statistical dependence between R (real) and R_k (real) in Ukraine, provides a one-factor linear regression equation and a coefficient of reliability of approximation.

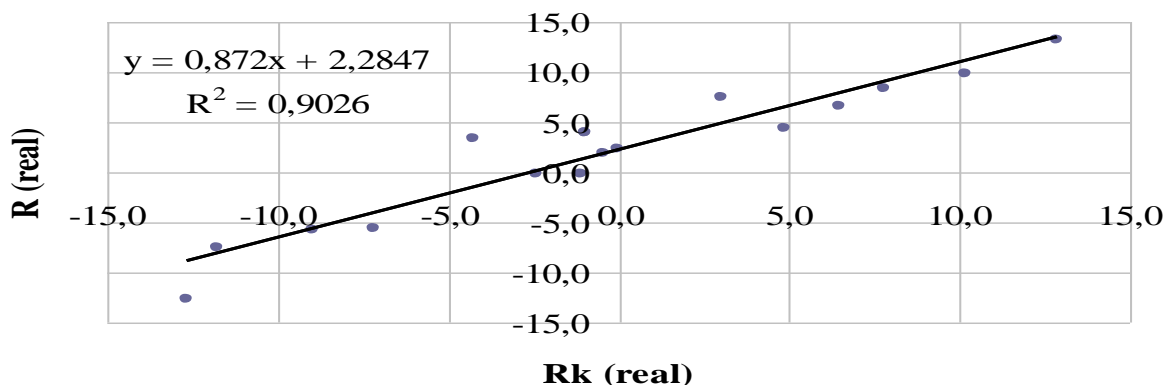


Fig. 3. Dependence of the real weighted average rate on the NBU discount rate in 2001-2017
Source: calculated by the authors on the basis of Table 1 and [14]

A change in the real discount rate by 90% explains the change in the real average weighted interest rate (Figure 3), which is indeed the main factor in its change. Thus, it is the NBU discount rate that determined the movement of the weighted average interest rate in the long-term retrospective. Next, let's see how the real key rate influenced the change in the real money supply in Ukraine (Fig. 4).

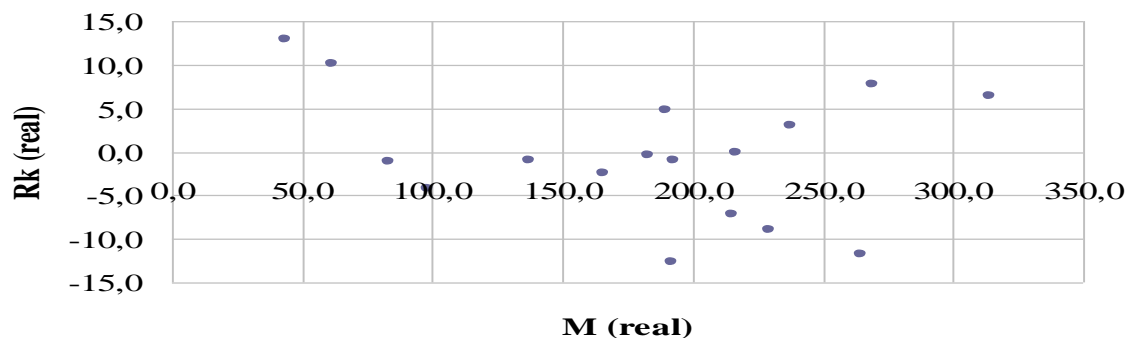


Fig. 4. Real money supply (M (real)) and real NBU discount rate (Rk (real)) in 2001-2017

Source: calculated by the authors on the basis of Table 1 and [14]

The superficial analysis of the data presented in Figure 4 can not provide arguments for the existence of a stable statistical dependence between them, but it is necessary to take into account the fact that the real key rate only affects the short and medium term real money supply due to direct influence on the supply of money. The demand for money in the long run is largely determined by real GDP. Therefore, it would be appropriate to investigate the dependence of real money supply in Ukraine on real GDP and interest rates. The simultaneous equilibrium in the money and commodity markets involves the formation of a set of equilibrium states in the plane “real interest rate - economic growth”. Given that under the influence of many independent factors in the formation of equilibrium, separately in the commodity and money markets, and simultaneous macroeconomic equilibrium in both markets, there should not be a pronounced statistical dependence between the indicated indicators.

The visual analysis of the statistical dependence between the indicators presented in Figure 6 is enough to assert the absence of a pronounced high correlation between them, as evidenced by the rather low correlation coefficient of “-0.24”.

At the end of the study, we will conduct an econometric analysis of the effect the real discount rate, real GDP and the real money base for the real money supply. The following remarks should be made:

- 1) the first factor (regressor) is, in essence, an instrument of the NBU's discrete monetary policy and directly affects the supply of money, reducing it by raising the rate, and vice versa; in the Keynesian interpretation of the demand function for money, it indirectly affects the real interest rate and is characterized by an inverse dependence on the money supply (including it can create a liquidity trap);
- 2) the second regressor is a classic component of demand function for money, from monetarists to Keynesians; a large number of scientists, starting with Milton Friedman, showed a direct statistical relationship between real GDP and money supply;
- 3) the real monetary base influences the supply of money in a direct way at the expense of the money multiplier; however, in the presence of high regression between real GDP and the monetary base, this can create the effect of multicollinearity and distort the influence of factors (regressors) on the resultant indicator when applying correlation-regression analysis.

Taking into account the above observations, the real money supply should be directly dependent on GDP and money base and inversed from the real discount rate. Let's see how this happens in Ukraine. A preliminary analysis of the dynamics of nominal and real indicators of the monetary base, money supply and GDP allows us to assume that there is multicollinearity between real GDP and the real monetary base, as well as the absence of a clearly defined graphical long-term relationship between the real money supply and the real weighted average rate. Taking into account that the correlation coefficient between the real average weighted rate and the NBU discount rate in

2001-2017 was 0.95, namely the second indicator is the main instrument of the implementation of discrete monetary policy, we note that the NBU discount rate is indeed an important factor in changing market rates.

The basic hypotheses of the study are as follows: 1) the real money supply (M (real)) is characterized by the dependence on the real GDP (Y (real)), the monetary base (B (real)) and the real discount rate of the NBU (Rk (real)); 2) there is a direct statistical relationship between M (real) and Y (real) and the inverse between M (real) and Rk (real).

For verifying the first hypothesis, one and multi-factor correlation coefficients will be calculated, a multi-factor regression equation is constructed and its verification is checked for statistical adequacy. For testing the second hypothesis, correlation coefficients and regressor coefficients will be analyzed. The results of the correlation analysis are presented in Table 2.

Table 2

Coefficients of correlation between the main indicators under study

Indicator	R (real)	Rk (real)	B (real)	M (real)	Y (real)
R (real)	1,00	0,95	-0,30	-0,31	-0,24
Rk (real)	0,95	1,00	-0,30	-0,28	-0,21
B (real)	-0,30	-0,30	1,00	0,99	0,94
M (real)	-0,31	-0,28	0,99	1,00	0,97
Y (real)	-0,24	-0,21	0,94	0,97	1,00

Source: calculated by the authors on the basis of Table 1 and [14]

The calculated correlation coefficients allow us to conclude that there is a very strong correlation between M (real), B (real), and Y (real), which fully confirms hypothesis number 1. But in the future, in order to eliminate the multicollinearity between variables of a regression model and obtain unmatched estimates of regression coefficients as a regressor will only consider real GDP.

Both interest rates are characterized by the existence of an inverse dependence with the other three indicators, and this confirms the hypothesis number 2. The fact that the calculated correlation coefficients are characterized by low values (by module) due to the fact that the change in interest rates affects the selected indicators in the short and medium term, because, unlike the latter, they are not under the influence of long-term trends that was shown in paragraph two. Consequently, the effect of indicators that are not characterized by persistence or antipersistence, on those developing under the influence of trends, weakens with the extension of the time interval.

The obtained regression equation has the following form:

$$M (\text{real}) = - 101,6 + 0,7452 * Y (\text{real}) - 0,8124 * Rk (\text{real}).$$

In this case, the index of the multiple correlation is 0.971, which exceeds the corresponding value of the correlation coefficient between real GDP and money supply (0.968). The determination coefficient is 0.943, which means that the variables included in the model are 94.3% explaining the change in the resulting figure. The adjusted determination coefficient when included in the model of the real discount rate of the NBU exceeds the corresponding index of the one-factor model, which means that the obtained two-factor regression model can be used to predict the dynamics of the real money supply.

The verification of the statistical significance of the regression model by Fischer's criterion showed that the calculated F-statistic value of 114.97 far exceeds the tabular criterion, which for two variables at fourteen degrees of freedom is: $F (2; 14) = 3.74$.

It should be noted that by abandoning the real monetary base as a variable of regression model, the lack of multicollinearity between variables was achieved. For a final conclusion on the statistical significance of the model we also test for the absence of auto-correlation of residues and heteroscedasticity.

To assess heteroscedasticity we use Student's criterion. Since the calculated value of the Student's rank correlation, which is 0.31, is less than the Student's tabulation criterion (0.52), one can conclude that there is no heteroscedasticity. The calculated value of the coefficient of auto-correlation was 0.259. Since it is lower than 0.52, we conclude that there is no auto-correlation of

residues and the statistical significance of the regression model. The obtained regression coefficients, which characterize the effect on real money supply, respectively, of real GDP (0.7452) and discount rate (-0.8124), confirm the first and second hypotheses.

Conclusions. According to the results of the econometric analysis of the indicators of the development of the sectors of the economy, we can draw conclusions that are contained in the following provisions.

1. The study showed a significant correlation between the nominal and real GDP, money supply and monetary base, which changed almost simultaneously during 2001-2017. The strong correlation between the actual values of these indicators is confirmed by very high correlation values ranging from 0.94 to 0.99. Almost functional dependence of the money supply on the monetary base is explained by the availability of the existing mechanism of monetary animation, and the money market multiplier tends to increase. The coefficient of GDP monetization by 2014 was characterized by a long-term tendency to increase, but as a result of a significant number of problems, including the necessary “purge” of the banking system for the third consecutive year, there was a significant decrease.

2. The high statistical dependence between the real NBU discount rate and the weighted average interest rate on all instruments was demonstrated by the effectiveness of the main instrument for implementing the discrete monetary policy of macroeconomic regulation. The negative significance of the correlation coefficients between the interest rates and the quantitative indicators of the real and financial sectors of the economy has shown that the traditional theoretical compromise in choosing the main problems to be solved in the economy to ensure macroeconomic stability is also typical for Ukraine. The application of the policy of “expensive money” to combat high inflation negatively affects the real money supply, and taking into account the very high dependence between it and GDP, slows down the growth of the real sector of the economy, and vice versa.

3. The obtained equation of two-factor regression with very high reliability is explained by the retrospective changes of real money supply. The most important factor for it is real GDP, which confirms the strong interconnection between the real and financial sectors of the economy in the process of developing the economic system. The quantitative indicators of the development of both sectors are under the influence of long-term trends that have their own nature and often depend on trends in the development of the world economy and finance, as well as internal problems that are often predictable. At the same time, the synchronous long-term dynamics of real GDP, money supply and money base and the statistical relationship between them, firstly, signal that in Ukraine the rules of a market economy have already been formed and effective methods and instruments in such conditions can be applied. macroeconomic regulation, and secondly, processes occurring in one of the specified sectors of the economy will necessarily reflect on the other. Therefore, solving macroeconomic problems requires a balanced and integrated approach taking into account the nature and strength of the relationship between different processes and phenomena.

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Стаття рекомендована до друку 21.10.2019

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The article is recommended for printing 21.10.2019

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