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CORRELATION AND REGRESSION ANALYSIS OF THE INTERRELATIONSHIP OF THE FEATURES OF THE BITCOIN CRYPTOCURRENCY

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Abstract: The article is devoted to the phenomenon of a money surrogate, introduced in the form of a bitcoin, a popular cryptocurrency. The purpose of the research is to study the influence of the price-per-unit value of the crypto- currency on the indicator of the market capitalization of the bitcoin crypto- currency through correlation-regression analysis. As a result of the re- search, the author becomes the first to prove the direct dependence of the mentioned indicators, namely, a strong relationship between the price per unit of the cryptocurrency and the indicator of the bitcoin cryptocurrency market capitalization.

Keywords: bitcoin, cryptocurrency, market capitalization, correlation-regression analysis.

Аннотация: Проанализирован феномен денежного суррогата, представленного в виде популярной на сегодняшний день криптовалюты биткоин. Целью исследования является изучение уровня влияния показателя цены за единицу криптовалюты на показатель рыночной капитализации криптовалюты биткоин при помощи корреляционно-регрессионного анализа. Впервые в рамках эконометрической теории доказано наличие прямой зависимости между рассматриваемыми показателями, а именно — присутствие связи сильного характера между ценой за единицу крип- товалюты и показателем рыночной капитализации криптовалюты биткоин.

Ключевые слова: биткоин, криптовалюта, рыночная капитализация, корреляционно-регрессионный анализ.

Introduction. At the turn of the century, there is a rethinking of the basic principles of economic analysis, the old research tools are being improved and new ones are being developed, tendencies towards differentiation and specialization of economic science, as well as towards complication and fragmentation of economic

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knowledge are observed. Economic science is conducting a fundamental development of issues of logic and methodology of scientific knowledge, the foundations of organizing scientific knowledge of emerging new world economic systems are postulated, and an appropriate methodological base for solving nonlinear economic problems is being created. Nevertheless, the conducted research cannot, for the most part, offer specific means for the development of narrowly professional disciplines, as a result of which, within the boundaries of each science, including economics, special theoretical and methodological areas of research are developing, implementing an intra-scientific synthesis of specialized knowledge and comprehending interdisciplinary interaction. The new subject field that opens up in this connection allows us to radically reconsider the content of a number of theories that were previously considered to be quite well-established.

At present, there is great interest in the scientific or, at least, systematic understanding of problems that were previously exclusively within the competence of practitioners. This fully applies to the theory of money, money circulation, and credit, which claims to be the main one in modern economic development [16]. Despite the existence of an extensive list of specialized works that examine issues of money and money circulation in sufficient detail, today there is an acute shortage of developments in the theory and practice of the development and functioning of self-developing and self-regulating economic systems. The ease with which some practicing economists would like to transfer classical (and even neoclassical) theories to modern times seems not entirely justified.

Economic doctrines (neoclassical neoliberal theory, structuralism, neo-Keynesian dirigiste theory, functionalism, market-institutional theory, legal concept of integration) and practice highlight the main directions along which the development of the theory and practice of monetary circulation takes place. Nevertheless, the development of globalization based on integration processes (with the help, of course, of new and latest information technologies) often leads to the emergence of directions that are difficult to explain and describe even from the point of view of neoclassicism. It should be noted that nowadays almost all economic concepts put forward at different times find only limited application in connection with the emergence and practical confirmation of multi-level (multi-speed) development, strengthening of the dichotomy of commodity-money exchange, in connection with which it is necessary to distinguish between the theoretically explainable nature of development and specific situational models (when both increasing and decreasing returns from the combination of factors are possible). The past 2017 was remembered by everyone as the time during which the Bitcoin cryptocurrency intervened in the monetary system and further

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strengthened the position of this type of monetary surrogate in the global economy [10].

Main part. This situation is due to increased demand from economic entities for a monetary surrogate, presented in the form of the cryptocurrency Bitcoin, due to such indicators as: the price per unit of cryptocurrency and the level of market capitalization [15]. A comparative analysis of popular cryptocurrencies according to the above-mentioned characteristics as of May , 2024 is presented in Table 1.

Table 1

Top 10 cryptocurrencies as of May , 2024 [13]

Cryptocurrency name	Number of coins	Total Price per unit of cryptocurrency, US dollar	Capitalization level, US dollar
Bitcoin	21 000 000	1537,59	25 078 957 026
Ethereum	~90 000 000	90,99	8 308 875 192
Ripple	100 000 000 000	0,07	2 819 940 123
Litecoin	84 000 000	23,67	1 205 847 817
Dash	22 000 000	93,04	676 402 030
Ethereum Classic	~90 000 000	7,20	657 782 367
NEM	8 999 999 999	0,06	542 706 300
Monero	18 446 744	25,97	374 095 905
Golem	—	0,25	207 633 020
Augur	—	17,31	190 395 700

Thus, based on the data presented in Table 1, the most recognized cryptocurrency in May 2017 is headed by the Bitcoin cryptocurrency, the most stable of them [2]. As of May 4, 2017, the capitalization of Bitcoin coins reached $ 25 billion, which is 4 times more than the same indicator for the Ethereum cryptocurrency, which occupies an honorable 2nd place, and 8 times higher than that of the Ripple cryptocurrency, which completes the top three in terms of cryptocurrencies [13]. In terms of the price per unit of currency, the Bitcoin cryptocurrency is the most expensive among all existing digital currencies. Thus, on May 4, 2017, the price for one Bitcoin coin was $ 1,537.59, which is almost 16 times more expensive compared to the price per unit of the Ethereum currency, which was $ 90.99 on May 4, 2017. Thus, the Bitcoin cryptocurrency is in the lead compared to its competitors (primarily compared to such types of cryptocurrencies as Ethereum, Ripple and Litecoin) in almost all respects: by the level of market capitalization, by the price per unit of currency and by the prospects for further use. Bitcoin (from English “bit” - the minimum unit of information and “coin” - coin) is a money surrogate presented in the form of cryptocurrency; it is a

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payment instrument of a new generation. With the help of the Bitcoin currency, it is possible to conduct transactions online [1]. The Bitcoin unit of payment itself is nothing more than a unique cryptographic code that cannot be used more than once [12]. Like the generally recognized currencies euro and dollar [14], the cryptocurrency bitcoin has its own rate on a certain date. Given the growing interest of scientists in the phenomenon of a monetary surrogate, presented in the form of the cryptocurrency bitcoin, we will trace the level of influence of the price per unit of cryptocurrency on the market capitalization of the cryptocurrency bitcoin using correlation and regression analysis [6, pp. 31-33]. The use of such a method of statistical analysis will help to establish the nature and quantitative expression of the relationship between the above indicators of the analyzed cryptocurrency.

The initial and calculated data for creating a statistical model based on correlation and regression analysis are the price per unit of the bitcoin cryptocurrency and the capitalization level of the analyzed monetary surrogate for the period from January 2014 to January 2018 (Table 2).

Table 2

Initial data for conducting correlation-regression analysis

Date	Indicator	
	Price for 1 Bitcoin, US Dollar (x)	Bitcoin Market Cap, USD (y)
02.01.2014 г.	771,15	9 400 260 663,00
02.01.2015 г.	313,64	4 289 287 759,00
01.01.2016 г.	434,22	6 527 492 315,00
01.01.2017 г.	972,95	156 441 622 845,00
01.01.2018 г.	13 791,60	231 350 986 890,00

Having analyzed the system of indicators presented in Table 2, we can assume that in the conditions of the modern economy, with the growth of the price per unit of the Bitcoin cryptocurrency, the market capitalization indicator of virtual currencies (in our case, the Bitcoin cryptocurrency) increases.

A graphical representation of the price per unit of the Bitcoin cryptocurrency is shown in Figure 2, and the market capitalization indicator of the Bitcoin cryptocurrency is shown in Figure 3. In order to determine the dynamics of the development of the analyzed indicators, trend lines have been added to the graphs.

Conventionally, the path of development of the price per unit of the Bitcoin cryptocurrency can be divided into three stages:

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1) a systematic decline - over the course of one year (from January 2014 to January 2015), the indicator decreases from $771.15 to $313.64;

2) steady growth — the period from 01/02/2015 to 01/01/2017 is characterized by a smooth and insignificant increase in the price per unit of the bitcoin cryptocurrency against the background of the overall dynamics of the indicator;

3) abrupt rise — the last analyzed period (from 01/01/2017 to 01/01/2018) clearly demonstrates an abrupt change in the price per unit of the bitcoin cryptocurrency. Thus, the indicator in question increased almost 14 times in the period from January 2017 to January 2018, which indicates the volatile nature of the bitcoin cryptocurrency.

The existence of this hypothesis is due to the fact that the dynamics of the analyzed indicator of the market capitalization of the Bitcoin cryptocurrency can also be conditionally divided into 3 periods:

1) decline - from 01/02/2014 to 01/02/2015, there is a drop in the considered indicator by almost 2 times - from the mark of 9,400,260,663.00 US dollars to the mark of 4,289,287,759.00 US dollars;

2) smooth growth - from 01/02/2015 to 01/01/2016 there is an insignificant increase in the market capitalization indicator of the Bitcoin cryptocurrency: so from the mark of 4,289,287,759.00 US dollars, the indicator rose to the level of 6,527,492,315.00 US dollars;

3) a jumpy rise - an uneven growth of the indicator according to the data in Figure 4 can be observed from 01.01.2016 to 01.01. 2018 inclusive.

It should be noted that the unevenness characterizing the rises and falls of the studied indicators of the price per unit of the bitcoin cryptocurrency and the market capitalization of the bitcoin cryptocurrency is due, according to the authors, to a sharp increase in interest from economic entities in bitcoin and, as a result, an annually increasing demand for this cryptocurrency [3].

The interdependence of the indicators of the price per unit of the bitcoin cryptocurrency and the market capitalization of the bitcoin cryptocurrency can be described by the mathematical equation of simple linear regression (formula 1):

$$U_n = a_0 + a_1 x_1 + \ldots + a_n x_n ,$$

where a is the regression coefficients; x is the influencing factor (the price per unit of the bitcoin cryptocurrency, dollars); n is the number of years analyzed; Y is the market capitalization indicator of the bitcoin cryptocurrency, dollars [9].

In order to determine the relationship between the price per 1 bitcoin and the level of market capitalization of the bitcoin cryptocurrency, we will supplement the original table (Table 2) with data for calculating the parameters of the regression equation.

In order to determine the parameters of the mathematical equation of the straight line:

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$$y_X = a + bx,$$

the system of equations must be solved:

$$\begin{cases} na + b\Sigma x = \Sigma y; \\ a\Sigma x + b\Sigma x^2 = \Sigma xy. \end{cases}$$

By substituting the available values into formula (3), we obtain an equation of the following type:

b = 14571849,03;
a = 34145643635,08.

Thus, the regression coefficient b =14571849.03.
Since, there is a direct relationship between the parameters x and y.
The linear relationship equation is:
y = 3414564363,08 + 14571849,03x

In order to determine the level of relationship between the analyzed features, it is necessary to find the value of the correlation coefficient [5p. 18-20] using formula (5):

Conclusions and suggestions. Let's check the obtained value of the correlation coefficient using the Chaddock table [8 p. 26]. Since the obtained value of the indicator is in the range from 0.7 to 1.0, this indicates the presence of a strong direct correlation relationship between the price per unit of bitcoin and the market capitalization of the cryptocurrency under study. In other words, as the price per 1 bitcoin increases, the market capitalization of the bitcoin coin will increase and vice versa.

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