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Digital of Financial Assets: Current State and Forecast of Development at the Global Level on the Example of Cryptocurrencies

Цифровые финансовые активы: текущее состояние и прогноз развития на мировом уровне на примере криптовалют

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The article is devoted to the development of theoretical aspects, the study of world experience and the development of methodological provisions for predicting the development of digital financial assets (hereinafter — DFA) the use of which is one of the key factors in the digital transformation of payment systems, the banking sector and the financial market as important components of the digital economy.

The purpose of the study is to assess the dynamics and forecast the development of digital financial assets in foreign countries.

Methodology: description, analysis, synthesis, systematization, statistical, graphical, regression, modeling.

To achieve this goal the author definition of "digital financial assets" was proposed, the dynamics of DFA development at the global level through the analysis of information and analytical publications and international reports were investigated, the theoretical basis for predicting the development of DFA was considered, a regression analysis based on statistical data on the volume of transactions with cryptocurrency and GDP in 2010-2019 was performed the results of which made it possible to make a forecast of the development of digital financial assets in foreign countries.

Results: the author's definition of the concept under study is proposed, trends in the development of the global market of digital financial assets are identified on the example of cryptocurrencies and a forecast of their development is made.

The scope of application of the results is in the sphere of state policy on the choice of DFA development directions.

Limitations and directions of future research: in this work the analysis of digital financial assets is based on the use of global data and therefore the authors' current direction of further research is to improve the forecasting methodology and obtain a model that will take into account the peculiarities of socio-economic development of various countries and will allow developing appropriate recommendations for the development of the DFA.

Conclusions. DFA, in particular cryptocurrencies, has a great potential for growth and development, and the results of this study can become the basis for further scientific research in the direction of studying various issues related to the theoretical and practical aspects of the functioning and development of the financial and economic mechanism for using digital financial assets.

Keywords*: digital financial assets, cryptocurrency, transaction, crypto market, regression analysis, development forecast.*

Статья посвящена развитию теоретических аспектов, изучению мирового опыта и разработке методических положений прогнозирования развития цифровых финансовых активов (далее – ЦФА), исполь-зование которых является одним из ключевых факторов цифровой трансформации платежных систем, банковского сектора и финансового рынка как важных составляющих цифровой экономики.

Цель исследования – оценка динамики и составление прогноза развития цифровых финансовых активов в зарубежных странах.

Методология – описание, анализ, синтез, систематизация, статистический, графический, регрессия, моделирование.

Для достижения поставленной цели предложено авторское определение дефиниции «цифровые финансовые активы», исследована динамика развития ЦФА на мировом уровне посредством анализа информационно-аналитических публикаций и международных отчетов, рассмотрены теоретические основы прогнозирования

развития ЦФА, выполнен регрессионный анализ на основе статистических данных об объеме транзакций с криптовалютой и ВВП в 2010–2019 гг., результаты которого позволили составить прогноз развития цифровых финансовых активов в зарубежных странах.

Результаты работы – предложена авторская дефиниция исследуемого понятия, выявлены тенденции развития мирового рынка ЦФА на примере криптовалют и составлен прогноз их развития.

Область применения результатов – в сфере государственной политики по выбору направлений развития ЦФА.

Ограничения и направления будущих исследований: в рамках настоящей работы анализ цифровых финансовых активов основан на использовании мировых данных, в связи с чем актуальным направлением дальнейших исследований авторов выступает совершенствование методики прогнозирования и получение модели, которая будет учитывать особенности социально-экономического развития различных стран и позволит разработать соответствующие рекомендации по развитию ЦФА.

Выводы. ЦФА, в частности криптовалюты, имеют большой потенциал роста и развития, а полученные результаты настоящего исследования могут стать основой для дальнейших научных изысканий в направлении исследования разнообразных вопросов, связанных с теоретическими и практическими аспектами функциони-рования и развития финансово-экономического механизма использования цифровых финансовых активов.

***Ключевые слова**: цифровые финансовые активы, криптовалюта, транзакция, крипторынок, регрессионный анализ, прогноз развития.*

Introduction

Analysis of works of scientists and experts devoted to the study of the essence of assets, financial assets, digital assets, crypto assets, crypto-currency (B). A. Raisberg [1, p. 14], E.S. Denisenko [2, p. 106], A.Y. Babaev [3, p. 282], V.B. Malitskaya [4, p. 89], R.M. Nuriyev [5, p. 258], I.A. Blank [6, p. 111], J. Conner [7], N. Dosh [8] and others.), as well as the legislation enshrining the concept of FFA, allowed to define a digital financial asset as a digital equivalent of property existing in cash or in the form of various financial instruments, used as a means of payment or for investment purposes [9, p. 57].

The phenomenon of digital financial assets has rapidly become part of the economic reality and can be characterized simultaneously as a factor affecting the macroeconomic stability of countries and as a source of economic growth for national economies. The problems associated with system analysis and comprehensive assessment of the development of digital financial assets have not been sufficiently developed at the present time, which predetermined the relevance, as well as the purpose of this study — to assess the dynamics and forecast the development of digital financial assets in foreign countries.

Development of digital financial assets market on a global scale

It should be noted that the type of digital financial assets such as crypto assets, in particular cryptocurrency, has become particularly important in the digital economy, which made it advisable to study the global experience of the development of the CFA using cryptocurrency as an example. The analysis of information and analytical publications and international reports on the topic of the study [1][2][3][4][5] [10] made it possible to identify the following main trends in the development of the global cryptographic market:

1. The cryptocurrency market has shown rapid growth over the past years. However, in 2018, the total market capitalisation of the cryptocurrency dropped by more than 4.6 times and the trading volume more than doubled. However, in 2019, the sales volume grew 5.5 times in 9 months of 2020 — by 37 %, and market capitalisation almost doubled, which indicates that cryptocurrencies are in demand and that the crypt market is developing (see Chart 1).

[1] Cryptocurrency. *Coinmarketcap.* Available at: https://coinmarketcap.com/ (Accessed 20.09.2020).
[2] BLOCKCHAIN.COM. Available at: https://www.blockchain.com/ (Accessed 20.09.2020).
[3] Coins / CoinGecko. Available at: https://www.coingecko.com/en (Accessed 20.09.2020).
[4] Global cryptocurrency benchmarking report. *University of Cambridge*. 2017. Available at: https://www.jbs.cam.ac.uk/2017-global-cryptocurrency-benchmarking-study.pdf (Accessed 20.09.2020).
[5] State of Cryptocurrency Report 2018: *Global.* Available at: https://www.slideshare.net/PundiXLabs/state-of-cryptocurrency-report-2018-global-86219082 (Accessed 20.09.2020).

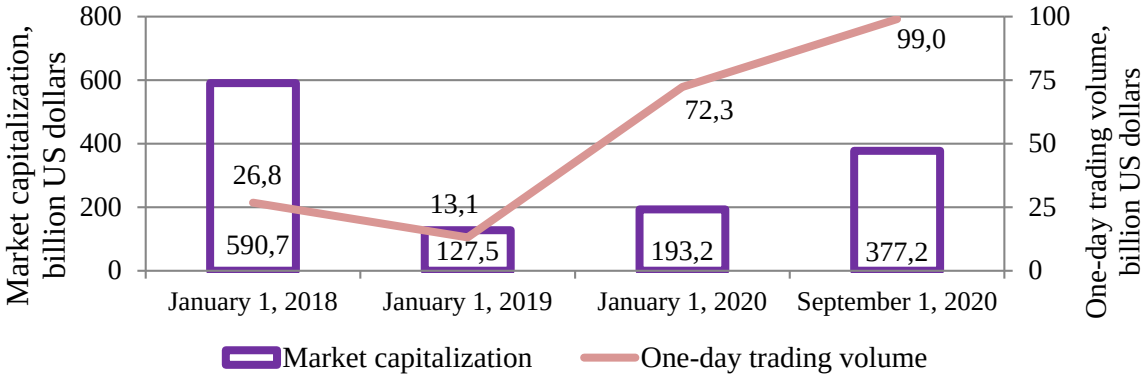

Fig. 1. Total market capitalisation and one-day sales volume, billion USD.

Source: compiled by the authors according to Coinmarketcap

2. The number of cryptographic wallets also shows almost double growth over the period under review, with 44.63 million in 2019 compared to 21.45 million in 2017. (Fig. 2), which indicates an increase in demand for cryptocurrency. For 8 months of 2020, the number of cryptowallets has increased by 19 % in comparison with the indicator for the beginning of the year.

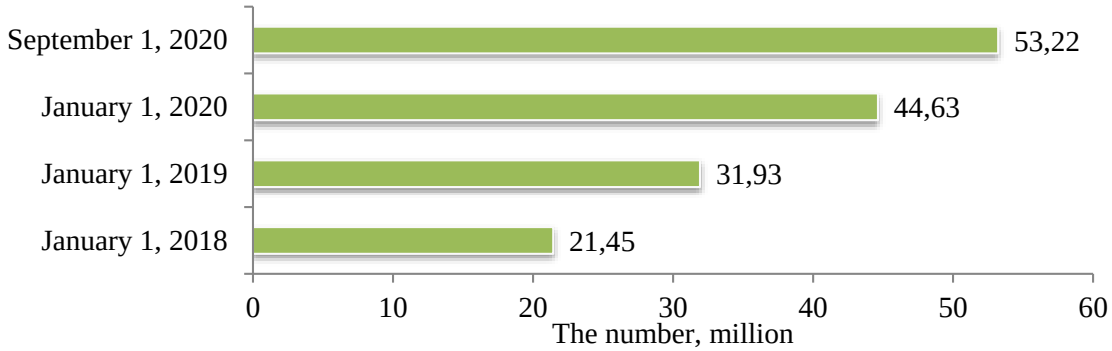

Fig. 2. Number of open cryptowallets in 2017–2020, mln.

Source: compiled by the authors according to BLOCKCHAIN.COM

3. Transaction fees for 2017–2019 were based on the market capitalisation of the cryptocurrencies. As the fee is usually set at a certain percentage of the transaction amount, the higher the market capitalisation of the cryptocurrencies, the greater the demand for them and the higher the transaction amount. Therefore, a record average transaction amount was observed in Q4 2017, when the market capitalisation of the cryptocurrency reached USD 611 billion. At present, the transaction fee averages USD 1.5 (Figure 3).

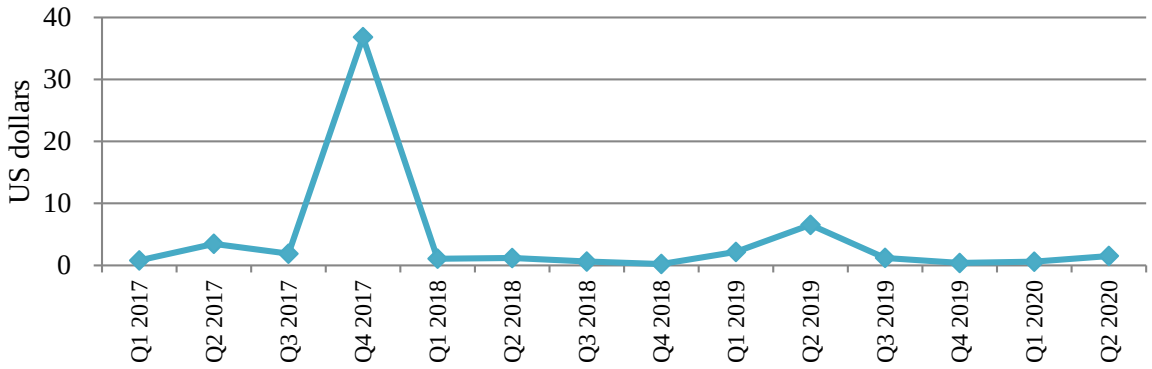

Fig. 3. Dynamics of the average fee for a transaction with the cryptocurrency in 2017-2020, US dollars.

Source: compiled by the authors according to BLOCKCHAIN.COM

4. According to CoinGecko's rating, the top five cryptocurrencies are Bitcoin, Etherium, Thatcher and Ripley Polcadott (Table 1).

Table 1

CoinGecko cryptology rating as of 20.09.2020.

№ n/n	*Cryptocurrency*	*Price, USD*	*Liquidity, million USD*	*Market capitalisation, billion USD*
1	Bitcoin	10 892,12	19 075,76	201,55
2	Elthereum	372,13	10 808,34	41,96
3	Tether	1,00	32 997,41	15,22
4	Ripple	0,25	1 567,85	11,11
5	Polkadot	4,69	263,79	4,29
6	Bitcoin Cash	225,57	2 052,63	4,18
7	Chainlink	9,97	636,41	3,86
8	Binance Coin	26,20	295,06	3,86
9	Crypto.com Coin	0,16	71,93	3,16
10	Litecoin	47,05	1 571,59	3,08

Note: liquidity — trading activity for this crypt currency on all major stock exchanges; market capitalisation — rate multiplied by available volume.

Source: compiled by the authors according to CoinGecko

5. Almost half of all cryptowallet providers are located in the US and UK. When we consider the origin of cryptographic wallets by region of the world, Europe (42 %), North America (39 %) and Asia Pacific (19 %) are the leaders.

6. According to a social survey conducted as part of an international survey, the majority of respondents use the cryptocurrency for investing, trading, shopping, as a means of saving and paying bills.

7. According to the international report "Report on international bitcoin flows" [10], there were 304 crypto exchanges worldwide in 2019. The largest numbers were in the UK, USA, Hong Kong and Singapore. The smallest number of exchanges are registered in Argentina, India, Mexico, Russia and Indonesia. Almost 10% of all exchanges do not have countries of registration. However, in 2019 the USA, UK, Hong Kong and Singapore were the countries with the largest number of international bitcoin transfers.

8. According to the rating, the Coinmarketcap crypto exchanges on the spot market are Binance, CoinbasePro, HuobiGlobal, Kgakepi FTX and on the derivatives market are Binance, OKEx, BitMEX and VuViti FTX. The leaders in terms of the number of traded crypto currencies are such crypto exchanges as Notit (1034), HitBTC (820), Binance (798), HuobiGlobal (740), ProBitExchange (690), HuobiKorea (575), Gate.io (532), OKEx (526), Bittrex (506) and MXC (MoCha) (490).

Thus, cryptocurrency is a promising means of settlement, which makes it possible to significantly simplify the process of making payments for goods and services and an investment instrument whose rapid development is caused by the following factors [11, pp. 419-420]:

- the widespread use of the internet and the emergence of virtual communities, which in turn contributes to the growth of e-commerce and makes it necessary to make anonymous and cheap electronic payments within the network space;
- significant achievements in the field of cryptography, as well as the rapid growth of computer computing power and its cheapening, and the variety of mobile telecommunication devices and means of access, which facilitates the introduction and use of new payment instruments.

Since the development of the CFA is a factor in the digital transformation of payment systems, the banking sector and the financial market as important components of the digital economy, a forecast of their development was made.

Forecasting theory and methodology

A study of the methodological basis for the development of digital financial assets made it possible to identify scientific and methodological tools for the forecasting process, a summary of which is presented in Table 2.

Table 2

Scientific and methodological tools for forecasting the development of digital financial assets

Component of scientific and methodological tools	Forecasting of CFA development
Objective	Obtaining scientifically substantiated options for the development trends of the object under research
Functions	Retrospective analysis of processes and trends, assessment of future performance of these trends, identification of key problems and possible development alternatives, selection of the best alternative
Principles	Unity of politics and economics, consistency of forecasting, scientific validity, adequacy of forecasts to objective development patterns, alternativeness
Methods	Heuristic ("interview" method, analytical method, scriptwriting method, commission method, "Delphi" method, "brainstorming" method, controlled idea generation method); Formalised forecasting methods (moving averages method, exponential smoothing, trend extrapolation, autoregression, regression models, simulation method, econometric models); Combined (morphological, system analysis, matrix models)

Source: compiled by the authors according to [12-14].

For the purpose of this study, a formalised forecasting method was used — the construction of a regression model, where the effective factor (y) is the volume of transactions with the cryptocurrency and the independent factor (x) is the world gross domestic product (GDP).

The information base for the regression analysis was provided by the World Bank statistics[1] and the analytical website BLOCKCHAIN.COM[1] (Table 3).

Table 3

Dynamics of the volume of transactions with the cryptocurrency and GDP in 2010-2019.

Year	*Volume of transactions with cryptocurrency, thousand.*	*World GDP, trillion dollars USD*
1	*2*	*3*
2010	216,00	66,05
2011	2 125,00	73,39
2012	10 498,00	75,09
2013	30 168,00	77,24
2014	55 234,00	79,33
2015	100 305,00	75,05
2016	183 245,00	76,17
2017	287 555,00	80,95
2018	361 286,00	85,91
2019	487 508,00	87,97

Source: compiled by the authors according to the World Bank and the analytical website BLOCKCHAIN.COM

To find an equation describing the type of relationship between the analysed indicators, the analytical capabilities of the "Data Analysis" package in MS Excel were used. However, since the built-in "Regression" command uses an algorithm to find parameters of a linear equation only, the types of nonlinear equations are preliminarily linear.

As a result of the linearisation of the nonlinear equations and the use of the "Regression" command, the regression equations presented in Table 4 have been obtained.

[1] GDP (current US$) [Electronic resource]. *World Bank Open Data*. Available at: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD (Accessed 20.09.2020).

Table 4

Regression equations describing the relationship between the volume of transactions in the cryptocurrency and global GDP

№ n/n	*Regression equation*	*Equation number*
1	Linear: y = −1 672 611,47 + 23 476 × x, R^2 = 0,7334 $t_{ст}$ (−4,29) (4,69) F = 22,01	(1)
2	Logarithmic: y = −7 547 434,4 + 1 769 918,6 × lnx, R^2 = 0,7008 $t_{ст}$ (−4,24) (4,33) F = 18,74	(2)
3	Polynomial 2 degrees: y = 5 656 904,97 — 166 413,2× x + 1 222,6× x^2, R^2 = 0,8556 $t_{ст}$ (1,87) (−2,13) (2,43) F = 20,74	(3)
4	Degree: lny = −106,84 + 26,99 × lnx, R^2 = 0,7803 $t_{ст}$ (−4,85) (5,33) F = 28,42	(4)
5	Exponential: lny = −16,23 + 0,35 × x, R^2 = 0,7575 $t_{ст}$ (−3,02) (5) F = 25	(5)

Source: compiled by the authors.

The linear regression equation is statistically significant, adequate and suitable for forecasting, since the calculated value of the F-criterion (F-criterion = 22.01) is greater than the table value (Ftable = 5.32) and also has statistically significant regression coefficients and a free term of the equation, since the calculated values of the Student t-criterion (-4.29 and 4.69) exceed the critical value (tcr = 2.31). The value of the determination coefficient (R^2 = 0.7334) indicates a sufficiently high quality of the resulting equation, but is inferior in quality to the exponential, step and polynomial equation of the 2nd degree.

The logarithmic equation is also statistically significant, adequate and suitable for forecasting, since the calculated value of the F-criterion (F-criterion = 18.74) is greater than the tabular value (Ftable = 5.32), and also has statistically significant regression coefficients and a free term of the equation, since the calculated values of the Student's t-criterion (-4.24 and 4.33) exceed the critical value (tcr = 2.31). However, the value of the determination coefficient (R^2 = 0.7008) is the lowest of all the obtained regression equations.

The polynomial equation of degree 2 is statistically significant, adequate and suitable for forecasting, since the calculated value of the F-criterion (F-criterion = 20.74) is greater than the table value (Ftable = 4.74) and also has the highest determination coefficient (R^2 = 0.8556). The regression coefficient at x2 is statistically significant because the calculated value of the Student's t-criterion (2.43) is modulo higher than the critical value (tcr = 2.36). However, the free term and the regression coefficient at x are statistically unimportant because the calculated Student t-criterion (1.87 and -2.13) for module does not exceed the critical value (tc = 2.36).

The regression degree equation is the second most important determinant coefficient (R^2 = 0.7803), which is statistically significant as it is. The calculated values of the Student's t-criterion (-4.85 and 5.33) are modulo higher than the critical value (tcr = 2.31), and the equation is statistically significant, adequate and suitable for forecasting, since the calculated value of the F-criterion (F-criterion = 28.42) is greater than the tabular value (Ftable = 5.32).

The exponential regression equation has the third highest determinacy coefficient value (R^2 = 0.7575), which is statistically significant as the calculated values of the Student's t-criterion (-3.02 and 5) are modulo higher than the critical value (tcr = 2.31), and the equation is statistically significant, adequate and suitable for forecasting, since the calculated value of the F-criterion (F-criterion = 25) is greater than the tabular value (Ftable = 5.32).

Survey results and discussion of the findings

The best equation that describes the relationship between the volume of transactions in the cryptocurrency and global GDP is the polynomial 2nd degree equation.

The scatter plot shown in Figure 4 is also constructed to confirm the result.

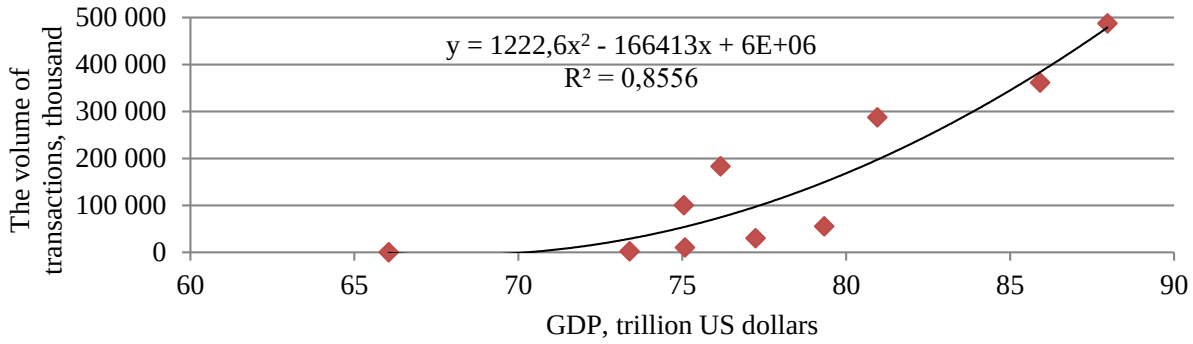

Fig. 4. Dependence of the volume of transactions with cryptocurrency on global GDP.

Source: compiled by the authors

The relationship between the two factors can be described in polynomial equation 2 degree (6):

$$y = 1\,222{,}6 \times x^2 — 166\,413 \times x + 5\,656\,904{,}97, \quad (6)$$

Where y — the volume of transactions with the cryptocurrency, thousand;
x — world GDP, trillion USD.

Based on the resulting regression equation, a forecast of the volume of transactions with the cryptocurrency was made.

The value of the determination coefficient ($R^2 = 0.8556$) of equation (6) indicates that a variation of 85.56 % of the value of the volume of transactions with the cryptocurrency depended on a variation of the values of world GDP, while the remaining value of 14.44 (100 % — 85.56 %) depended on a variation of other factors not involved in the analysis. This equation therefore well describes the current trend of the given indicator and can be used for forecasting.

In order to forecast the volume of transactions with the cryptocurrency for 2020 and 2021, the forecast values of the world GDP of the World Bank and the International Monetary Fund were used (Table 5).

Table 5

World Bank and International Monetary Fund projections of global GDP

	World Bank		*International Monetary Fund*	
	Changing, %	*Forecasted value of GDP, trillion USD*	*Changing, %*	*Forecasted value of GDP, trillion USD*
2020	2,5	90,17	–3,0	85,75
2021	2,6	92,52	5,8	90,72

Source: compiled from [15-17].

By substitution of the forecast values of world GDP with the resulting regression equation, a forecast of the volume of transactions with the cryptocurrency was obtained (Figure 5):

Based on World Bank data (formulae (7) and (8)):

$$y_{2020} = 1\,222{,}6 \times (90{,}17)2 — 166\,413 \times 90{,}17 + 5\,656\,904{,}97 = 591\,951{,}7, \quad (7)$$

$$y_{2021} = 1\,222{,}6 \times (92{,}52)2 — 166\,413 \times 92{,}52 + 5\,656\,904{,}97 = 725\,769{,}6, \quad (8)$$

Based on International Monetary Fund data (formulae (9) and (10)):

$$y_{2020} = 1\,222{,}6 \times (85{,}75)2 — 166\,413 \times 85{,}75 + 5\,656\,904{,}97 = 376\,844{,}4, \quad (9)$$

$$y2_{021} = 1\,222{,}6 \times (90{,}72)2 — 166\,413 \times 90{,}72 + 5\,656\,904{,}97 = 622\,060{,}4, \quad (10)$$

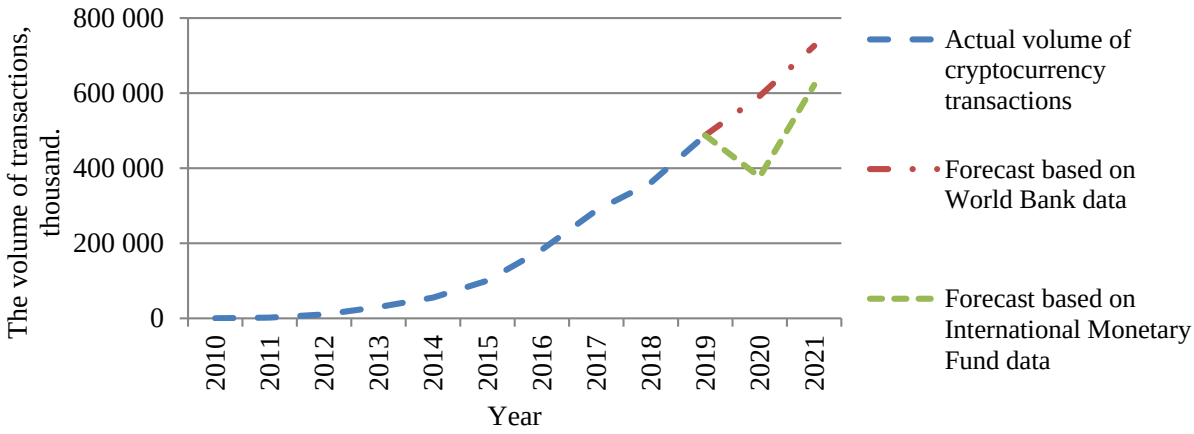

Fig. 5. Forecast of the transactions volume with the cryptocurrency.

Source: compiled by the authors

Conclusion

Thus, the results of the survey have made it possible:

- identify trends in the development of the global cryptographic market, which indicate that in developed countries the cryptographic currency as a means of payment is reaching a new level of development: the range of services and additional opportunities provided by payment systems to their users is expanding, and new services are being created to further simplify procedures for transactions and expand the geography of their provision;

- make a forecast of the volume of transactions in the cryptocurrency on the basis of forecast data from the World Bank, which corresponds to the optimistic scenario where the forecast for 2021-2022 will show an increase of almost twofold (in relative terms — by 49%, in absolute terms — by 238 million). In turn, the forecast of the volume of transactions with the cryptocurrency based on the forecast data of the International Monetary Fund corresponds to the conservative version, where in 2021 a 3% reduction in world GDP will lead to a 23% reduction in transactions volume (in absolute terms — by 111 million), and in 2022 the growth of world GDP will lead to an increase in transactions volume to 622 million, which is a quarter of the current level of this indicator.

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