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FORECAST OF DEVELOPMENT OF THE GLOBAL E-COMMERCE MARKET

Abstract. Theoretical analysis of the concept of "e-commerce" was carried out. Based on the adaptive brown models of the first and second orders, the Holt linear exponential smoothing model, and the Box-Jenkins model, the forecast of the world e-commerce market volumes for 2020-2022 was constructed. The reliability and adequacy of the forecast models were evaluated. The basic, optimistic and pessimistic scenarios for the development of the global e-commerce market for 2020-2022 are highlighted and described. According to the basic development scenario, the market is expected to continue its active growth at the level of 18.4 ± 3.5% per year until 2022. At the same time, there is a tendency to decrease the growth rate from 19.61% in 2020 to 17.21% in 2022, due to the geographical change in the growth trend of Internet penetration from developed countries to low-income countries in Africa. The analytical dependence of the e-commerce influence on the growth of the world economy is constructed, which shows, that the increase in the volume of the world e-commerce market by $ 1 billion increases global GDP by $ 4.99 billion. Based on the constructed model of the relationship between global GDP and the volume of the global e-commerce market, the forecast of global GDP growth in 2020-2022 by 4.0 ± 1.0% annually is constructed. The increase in the share of the e-commerce market in global GDP in 2022 compared to 2019 is projected at 47.5%.

Key words: e-commerce, forecast, adaptive models, regression analysis, global gross domestic product, regions, forecast models, world market volume, household income, retail trade volumes.

The relevance of the topic. Modern reality is characterized by the rapid development of the information and communication technologies, which, while actively developing, generate the appearance of a huge number of socio-economic processes in all spheres of human activity. For the economic sphere, e-Commerce is such a phenomenon. The rapid development of information and communication technologies, including the Internet, creates fundamentally new conditions for the business development: the formation of new markets, the emergence of fundamentally new offers, the expansion of demand for goods and services, etc. Widespread use of information technologies, along with globalization, is the factor that determines the nature of the development of the modern economy, as well as the problems, that need to be investigated in the new conditions [1, P.65]. These new development includes the development of e-business, in particular, e-commerce. At the moment, there are few studies in the economic literature, that study the theoretical foundations of e-commerce and its impact on the development of the world economy, and there is no clear and generally accepted definition of the concept of "e-commerce". Predictive estimates of e-commerce development consider only one development scenario [2, p.15].

Materials and methods of research. Among the most common forecasting methods, there are trend methods, based on growth curves and adaptive methods. Both groups of methods have their own characteristics. Trend models are used only for a long time series, containing more than 10 observations, so they do not fit the nature of the original data (table 1).

Table 1 – Dynamics of retail trade volume in the e-commerce market [3]

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Volume of Global Commerce, billion US dollars, USA	–	1 060	1 250	1 336	1 548	1 845	2 382	2 928	3 535

The most well-known adaptive methods include: the random walk model, the moving average model, the brown exponential smoothing model (zero, first, and second orders), the Holt linear exponential smoothing model, the winters model, and the Box-Jenkins model.

Research results. Theoretical analysis of the diversity of the concept of "e -commerce, presented in the works [3, p.21], it allowed to use the Euler-Venn diagrams in order to formulate the concept of "e-commerce" "E-commerce is a type of commercial activity, carried out entirely or partially in a virtual electronic environment, in which information and transactional interactions are carried out on the basis of the use of information and communication technologies in order to ensure higher economic efficiency compared to traditional types of commercial activities" [4]. Based on the formulated concept of e-commerce, the time series of the world e-commerce market was determined (table 1) and built a forecast for 2020-2022 using adaptive brown models of the first and second orders, the Holt linear exponential smoothing model and the Box-Jenkins model. Expert analysis of the built adaptive predictive models of e-commerce market volumes showed that the condition for the ratio of predicted values relative to the last values of the time series level is fulfilled in the case of three models: Brown's Linear Exponential Smoothing and Brown's Quadratic Exponential Smoothing, and the Box-Jenkins autoregressive model (Arima Model).

The forecast accuracy for this model is 96.6 %. Second in adequacy is the second-order brown model. The forecast accuracy for this model is 94 %. The third most adequate model is the first - order brown model with a forecast accuracy of 91 % (figure 1).

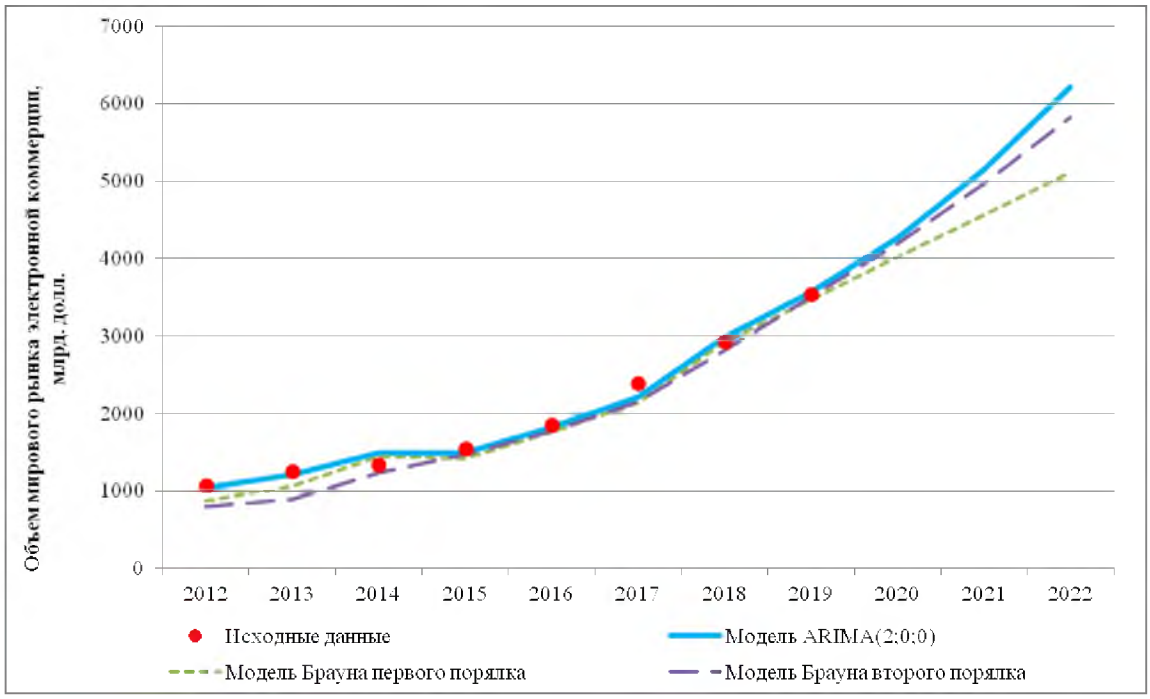

Figure 1 – Results of the global e-commerce market forecast, based on adaptive models

Thus, the analysis shows that the most adequate of the presented models is the Arima model (table 2). In the second place in terms of statistical characteristics is the second-order brown model, and in third place is the first-order brown model. The forecast values for these models are shown in table 2. Each of the statistical models predicts the continued rapid development of the global e-commerce market until 2021.

Table 2 – Forecast values of retail trade volumes in the global e-commerce market by predictive adaptive models

Period	Average forecast values for the model, USD billion.	Average chain growth, %
Arima (p = 2, d = 0, q = 0)		
2020	4265,9 ± 251,4	19,49%
2021	5146,56 ± 541,7	20,64%
2022	6208,07 ± 887,0	20,63%
Brown's Quadratic Exponential Smoothing (a = 0,3945)		
2019	4194,3 ± 271,3	19,61%
2020	4965,35 ± 472,7	18,38%
2021	5819,8 ± 588,5	17,21%
Brown's Linear Exponential Smoothing (a = 0,9999)		
2019	4019,96 ± 283,6	15,72%
2020	4565,94 ± 634,1	13,58%
2021	5111,93 ± 1061,0	11,96%
Forecast e-Marketer		
2019	4206,0	19,0%
2020	4927,0	17,1%
2021	5695,0	15,6%

In order to make a final choice in favor of one of the models, we will analyze the market development, estimates according to the statistical portals Statista (The Statistics Portal) and e-marketer, whose data were used in the formation of the analyzed time series of retail volumes in the global e-commerce market [5].

From the point of view of e-marketer portal experts, the volume of retail sales in the e-commerce market for 2020 will be $ 4,206 billion. $ 4,927 billion in 2021. $ 5695 billion for 2022, for 2023-6542 billion dollars [6]. Statista data shows that they are used by such portals as Shopify Plus [7], Monetha [8], The Next Scoop and others.

Knowing that according to the forecast data of the Statistics Portal, on average over three years (2020-2022), the growth of retail sales in the global e-commerce market will be about 18.1 %, we will make the final choice in favor of the second-order brown model. From table 2, you can see that the forecast values provided by the e-marketer portal have the closest similarity with the forecast values of the market volume obtained using the second-order brown model. The predictive polynomial for this model was determined by the authors based on the discounted brown least squares method:

$$y(t) = 3488,9 + 638,3*t + 38,4*t^2.$$

The results obtained using the Arima model and the first-order Brown model are almost equally distant from the data, provided by the e-marketer portal.

The forecast values obtained from the first-order Brown model have a negative relative deviation with e-marketer data and show the lowest growth of the e-commerce market, compared to the other two statistical models were analyzed. Accordingly, the forecast results obtained using the first-order Brown model with the parameter a = 0.9999 should be considered a pessimistic (conservative) scenario for the development of the world e-commerce market until 2022.

According to the optimistic scenario, the rapid growth of retail trade in the global e-commerce market is expected to continue, on average, by 20-25 % per year. Therefore, the second condition for the optimistic scenario is the speeding up of reducing the cost of mobile data traffic, the third - the increase in geographical accessibility of mobile Internet and free access points Wi-Fi, the fourth is the emergence of new technologies for mobile devices that enhance the ease of use, as well as contributing to increasing the availability of existing models of phones with the release of a growing number of tech leaders. However, it should be noted that the scenario does not require simultaneous fulfillment of all its conditions.

Also, the conditions that incline the global e-commerce market to develop according to an optimistic scenario include: the emergence of new more effective delivery methods, the creation of interstate measures to support activities in the field of e-commerce, etc. According to the pessimistic development scenario, the growth of retail trade in the global e-commerce market is projected to decrease from 19,0 % in 2020 to 15,6 % in 2022 (table 2). By analogy with the formation of a description for an optimistic forecast of the development of the e-commerce market, the main conditions for the implementation of a pessimistic (conservative) scenario will be:

- slowing current trends of the global spread of broadband access to the Internet;
- no reduction or increase in the cost of mobile traffic for any reason (for example, legislation).

The baseline scenario is based on the continuation of current trends in the development of the global e-commerce market and is the most likely scenario. According to this scenario, retail trade volumes in the global e-commerce market are expected to grow by an average of 18,4 % per year by 2022 (figure 2). In 2022, the volume of the global e-commerce market will exceed 5 trillion dollars for the first time, which will surpass the same indicator in 2019 by 64,6 %, and the growth compared to 2012 will be 5.5 times.

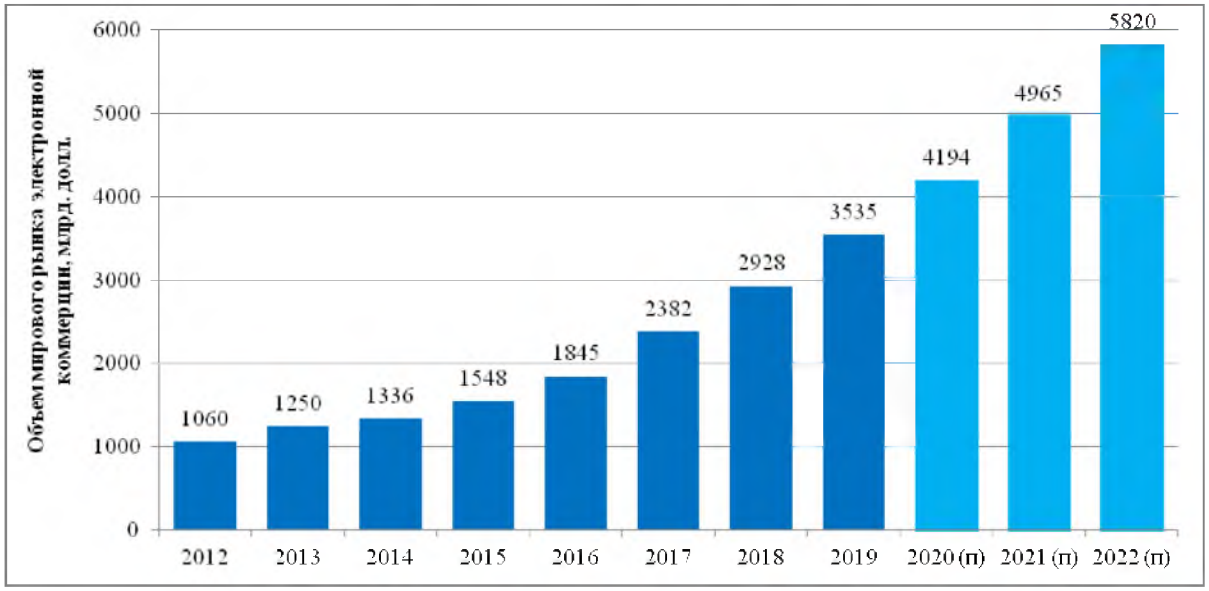

Figure 2 – Global e-commerce market volume Forecast: baseline scenario (in USD billion)

But at the same time, there is a tendency to decrease the growth rate from 19,6% in 2020 to 17,2% in 2022. This can be explained by the geographical change in the trend of increasing Internet penetration from developed countries (with a relatively high level of saturation) to the countries with less developed economies, where the Internet is not yet sufficiently developed. So, for 2018 the number of Internet users in Western Sahara (a territory in North Africa) increased by 364 %, in the Republic of Djibouti (a state in East Africa) - by 203 %, in Tanzania (East Africa) - 173 %, in the Republic of Niger (West Africa) - 146% in Afghanistan (Central Asia) - 142 % in the Republic of Côte D'Ivoire (West Africa) - 69 % [9, p.145], etc. However, the vast majority of them are low income countries in Africa. The total monetary volume of transactions made by such countries using the Internet makes a small contribution to the volume of the global e-commerce market.

The largest contribution to the pace of development of the global e-commerce market will be made by the most technologically advanced regions, such as the countries of Europe, North America, as well as Japan and China. In turn, the e-commerce market of each of these countries will develop in its own way depending on local national, demographic and other factors [9, p.146].

The development of the global e-commerce market directly affects the growth of the world economy. Analysis of the correlation between the global gross domestic product (GDP) and the volume of the world e-commerce market shows a high value of the pair correlation coefficient - 0.9138 with a coefficient of determination equal to 0.835 and a sample-adjusted coefficient of determination equal to 0.807 (table 3, figure 3).

Table 3 – Dynamics of Global GDP and Volume of the Global E-Commerce Market

Year	2012	2013	2014	2015	2016	2017	2018	2019
Retail trade volume in the global e-commerce market, USD billion	1 060	1 250	1 336	1 548	1 845	2 304	2 842	3 535
World GDP at current prices [26], in billions of dollars	74 619	76 750	78 832	74 602	75 653	80 051	84 740	87 265

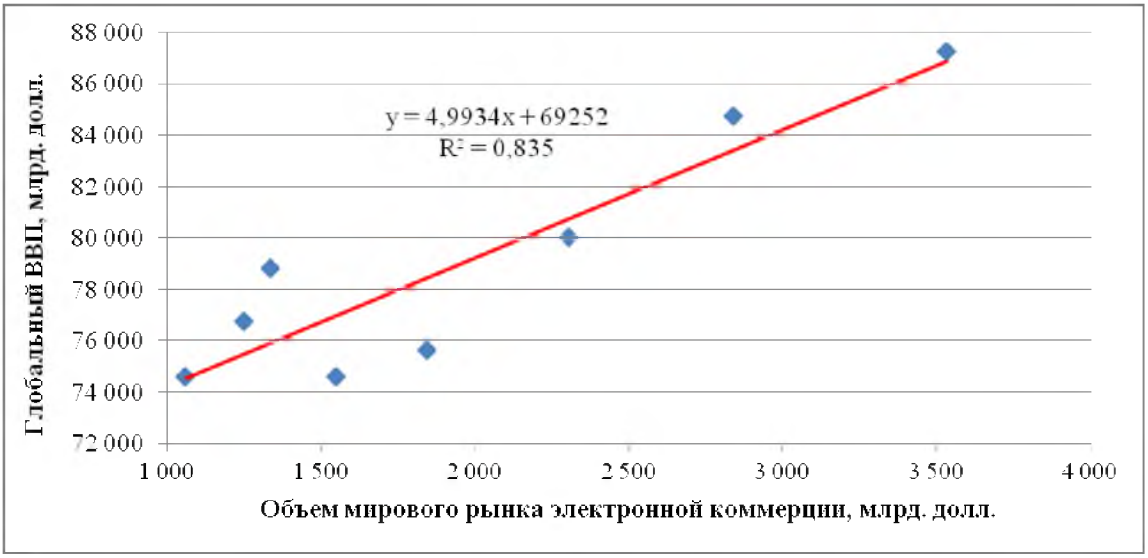

Figure 3 – Regression model of the dependence of global GDP and the volume of the world e-commerce market

The adjusted coefficient of determination, which shows the share of GDP variation, explained by the impact of the growth of the global e-commerce market, in our case is 0,807, which means that the variation of world GDP by 80,7% is due to the influence of the world e-commerce market, by 19,3% - a variety of other factors [10]. The regression model of the impact of the development of the world e-commerce market on global GDP is shown in figure 3. It is significant with a confidence probability of 99.85%:

$$y = 4,9934*x + 69\ 251,88$$

where y is global GDP and x is the volume of the global e-commerce market.

Consequently, an increase in the global e-commerce market for every billion US dollars leads to an increase in global GDP of $ 4,99 billion. Substituting the initial data in the model of the dependence of world GDP on retail trade volumes in the world e-Commerce market, we get the following forecast values of world GDP for 2020-2022 (table 4):

Table 4 – Forecast values of world GDP based on the basic scenario for the development of the world e-commerce market (in billions of dollars USA)

Year	Lower bound of the forecast	Average	Upper bound of the forecast
2020 (п)	88 342,67	90 195,89	92 049,06
2021 (п)	91 685,53	94 046,08	96 406,64
2022 (п)	95 373,89	98 312,73	101 251,6

Thus, the volume of world GDP under the basic scenario for the development of the world e-commerce market in 2020 will be 90,195. 89 ± 1,853. 2 billion dollars, in 2021 - 94,046, 1 ± 2,360, 6 billion dollars, in 2022 - 98,312. 73 ± 2,938. 8 billion dollars.

Based on the available data, you can get the following values for the share of e-commerce in global GDP (table 2 and 4): according to the basic development scenario, the contribution of e-commerce to the world economy is projected to grow from 4 % in 2019 to 5,9 % in 2022.

It should be noted, that many international organizations (APEC, BRICS, OECD) recognize the high growth potential of the world economy due to the development of e-commerce. At the same time, the governments of many countries (the United States, China, South Korea, the European Union, etc.) create and implement special programs to stimulate e-commerce in their countries. For example, the Chinese government supports its key electronic platforms (Alibaba, WeChat, etc.), optimizes customs procedures, introduces tax incentives for retail exports, encourages the operation of electronic payment systems, introduces innovations in various fields (production, trade, logistics), and optimizes existing legislation for e-commerce (for example, updating the law on consumer protection) [10, p.398].

Conclusion. Adaptive models are used to forecast the development of the global e-commerce market. Three scenarios for the development of the global e-commerce market up to 2022 are identified and described, with the definition of a forecast polynomial for the basic (most likely) development scenario. According to this scenario, the market is expected to continue its active growth at the level of 18.4 ± 3.5% per year until 2022. At the same time, there is a tendency to decrease the growth rate from 19.61% in 2020 up to 17.21 % in 2022, due to the geographical shift in the growth trend of Internet penetration from developed countries to low-income African countries. As a result of the correlation and regression analysis, it is proved that the development of e-commerce has a significant impact on the growth of the world economy. Based on the built model of the relationship between global GDP and the volume of the world e-commerce market, the forecast of global GDP is constructed, which shows that the average annual growth of global GDP in 2020-2022 will be 4.0 ± 1.0% (table 4), and the e-commerce market share in global GDP will increase by 47.5% in 2022 compared to 2019.

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ӘЛЕМДІК ЭЛЕКТРОНДЫҚ КОММЕРЦИЯ НАРЫҒЫНЫҢ ДАМУ БОЛЖАМЫ

Аннотация. «Электрондық коммерция» ұғымына теориялық талдау жүргізілді. Эйлер-Венн диаграммасының көмегімен «электрондық коммерция» ұғымының алуан түрлілігін талдау негізінде «электрондық коммерция» ұғымы (ағылш. e-commerce) деген біз – виртуалды электрондық ортада толық немесе ішінара жүзеге асырылатын коммерциялық қызмет түрі, онда ақпараттық және транзакциялық өзара қатынастағы коммерциялық қызметтің дәстүрлі түрлерімен салыстырғанда жоғары экономикалық тиімділікті қамтамасыз ету мақсатында ақпараттық-коммуникациялық технологияларды қолдану негізінде жүзеге асырылады». Әлемдік электрондық коммерция (2012-2019 жылдар) нарығы көлемінің уақытша қатарына бірінші және екінші тәртіптегі Брауның бейімделу моделі, Хольтты сызықтық экспоненциалды тегістеу моделі және Бокс-Дженкинс моделі негізінде 2020-2022 жылдарға арналған электрондық коммерцияның өсу болжамы құрылды. Болжамдық модельдердің дұрыстығы мен барабарлығы бағаланды. 2020-2022 жылдарға арналған әлемдік электрондық коммерция нарығын дамытудың базалық, оптимистік және пессимистік сценарийлері бөлініп сипатталған. Базалық сценарий электрондық коммерцияның әлемдік нарығын дамытудың ағымдағы үрдістерін жалғастыруға негізделеді және оқиғаларды дамытудың ең ықтимал нұсқасы болып саналады. Осы сценарийге сәйкес 2022 жылға дейін электрондық коммерцияның әлемдік нарығында бөлшек сауда көлемі орташа есеппен жылына 18,4% өседі деп күтілуде. 2022 жылы әлемдік электрондық коммерция нарығының көлемі алғаш рет 5 триллион доллардан асады, бұл 2019 жылдың ұқсас көрсеткіштен 64,6%-ға асып түседі, ал 2012 жылмен салыстырғанда өсім 5,5 есені құрайды. Сонымен қатар өсу жылдамдығы 2020 жылғы 19,6%-дан 2022 жылы 17,2%-ға дейін төмендеген. Мұны дамыған елдерден экономикасы төмен, яғни ғаламтор да әлі жеткілікті дамымаған елдермен салыстырмалы түрде алғанда жоғары қанықтылығы бар интернеттің ену динамикасының географиялық өзгерісі арқылы түсіндіруге болады. Бұл ретте олардың басым көпшілігі – халық табысының төмен деңгейі негізінде сипатталатын Африка елдері. Мұндай елдер Интернет желісін пайдалана отырып жасайтын мәмілелердің жиынтық ақшалай көлемі электрондық коммерцияның әлемдік нарығының көлеміне елеусіз үлес береді. Электрондық коммерцияның әлемдік нарығының даму қарқынына технологиялық тұрғыдан дамыған Еуропа, Солтүстік Америка елдері, сондай-ақ Жапония мен Қытай сияқты өңірлер ірі көлемде үлес қосады. Өз кезегінде, осы елдердің әрқайсысының электрондық коммерция нарығы жергілікті ұлттық, демографиялық және өзге де факторларға байланысты өз

жолымен дамитын болады. Жүргізілген корреляциялық-регрессиялық талдау нәтижесінде электрондық коммерцияның дамуы әлемдік экономиканың өсуіне елеулі әсер ететіні дәлелденді. Электронды сауданың әлемдік экономиканың өсуіне әсер ететін аналитикалық тәуелділігі әлемдік электрондық сауда нарығының 1 млрд. долларға артуы әлемдік ЖІӨ-нің 4,99 млрд. жоғарылатады. Жаһандық ЖІӨ мен электрондық коммерцияның әлемдік нарығының көлемі арасындағы тәуелділік моделі негізінде 2020-2022 жылдары жыл сайын 4,0 ± 1,0%-ға жаһандық ЖІӨ өсімі болжамы салынды. 2019 жылмен салыстырғанда 2022 жылы жаһандық ЖІӨ-дегі электрондық коммерция нарығының үлесін арттыру 47,5% деп болжануда.

Түйін сөздер: электрондық коммерция, болжам, бейімделу модельдері, регрессиялық талдау, жаһандық жалпы ішкі өнім, өңірлер, болжамды модельдер, әлемдік нарық көлемі, халық табысы, бөлшек сауда көлемі.

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ПРОГНОЗ РАЗВИТИЯ МИРОВОГО РЫНКА ЭЛЕКТРОННОЙ КОММЕРЦИИ

Аннотация. Проведён теоретический анализ понятия «электронная коммерция». На основе анализа многообразия понятия «электронная коммерция» с помощью диаграмм Эйлера-Венна сформулировано понятие «электронная коммерция» (от англ. e-commerce): «электронная коммерция – это вид коммерческой деятельности, осуществляемый полностью или частично в виртуальной электронной среде, при которой информационные и транзакционные взаимодействия осуществляются на основе применения информационно-коммуникационных технологий с целью обеспечения более высокой экономической эффективности по сравнению с традиционными видами коммерческой деятельности». На основе временного ряда объемов мирового рынка электронной коммерции (2012-2019 годы) построен прогноз роста электронной коммерции на 2020-2022 годы на основе адаптивных моделей Брауна первого и второго порядков, модели линейного экспоненциального сглаживания Хольта и модели Бокса-Дженкинса. Оценены достоверность и адекватность прогнозных моделей. Выделены и описаны базовый, оптимистический и пессимистический сценарии развития мирового рынка электронной коммерции на 2020-2022 годы. Базовый сценарий основывается на продолжении текущих тенденций развития мирового рынка электронной коммерции и является наиболее вероятным вариантом развития событий. Согласно данному сценарию до 2022 года ожидается активный прирост объемов розничной торговли на мировом рынке электронной коммерции, в среднем, на 18,4 % в год. В 2022 году объем мирового рынка электронной коммерции впервые превысит 5 триллионов долларов, что превзойдет аналогичный показатель 2019 года на 64,6 %, а рост по сравнению с 2012 годом составит 5,5 раза. В то же время наблюдается тенденция снижения скорости прироста с 19,6 % в 2020 году до 17,2 % в 2022 году. Это можно объяснить географической сменой тенденции роста проникновения Интернета из развитых стран с относительно высоким уровнем насыщения в страны с менее развитой экономикой, где Интернет еще недостаточно развит. При этом подавляющее большинство из них – страны Африки, характеризующиеся низким уровнем дохода населения. Совокупный денежный объем сделок, совершаемых такими странами с использованием сети Интернет, дает незначительный вклад в объем мирового рынка электронной коммерции. Наибольший вклад в темпы развития мирового рынка электронной коммерции будут вносить самые развитые в технологическом аспекте регионы, каковыми являются страны Европы, Северной Америки, а также Япония и Китай. В свою очередь, рынок электронной коммерции каждой из этих стран будет развиваться своим путем в зависимости от местных национальных, демографических и иных факторов

В результате проведенного корреляционно-регрессионного анализа доказано, что развитие электронной коммерции оказывает значимое влияние на рост мировой экономики. Построенная аналитическая зависимость влияния электронной коммерции на рост мировой экономики показывает, что увеличение объемов мирового рынка электронной коммерции на 1 млрд. долл. увеличивает глобальный ВВП на 4,99 млрд. долл. На основе построенной модели зависимости между глобальным ВВП и объемом мирового рынка электронной коммерции построен прогноз прироста глобального ВВП в 2020-2022 гг. на 4,0 ± 1,0% ежегодно. Увеличение доли рынка электронной коммерции в глобальном ВВП в 2022 году по сравнению с 2019 годом прогнозируется на 47,5%.

Ключевые слова: электронная коммерция, прогноз, адаптивные модели, регрессионный анализ, глобальный валовой внутренний продукт, регионы, прогнозные модели, объем мирового рынка, доход населения, объемы розничной торговли.

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