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THE ROLE OF ECONOMIC AGENTS' EXPECTATIONS IN THE FORMATION OF ECONOMIC CYCLE

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Abstract

Introduction. The article analyzes the mechanism of the economic cycle formation under the influence of the economic agents' expectations. It is emphasized that one of the main reasons for the economic growth termination is generation and accumulation of the systemic risk in the economy due to unreasonable expectations.

The purpose of the research is to analyze the process of the economic cycle formation under the influence of the economic agents' expectations in the USA in 1947 – 2016.

Methods. The researchers offer their own methodology to analyze dynamic processes by transformation of the primary data, applying the total sliding expectations method.

Results. Based on the US data analysis, it is concluded that the peaks of economic cycles in gross domestic product (GDP) values accurately reflect the peaks of time series of the total sliding expectations by the GDP values. A definition of economic entropy as synchronization of expectations level coincidence with the actual course of events in the economic system is given.

Conclusion. The proposed conceptual approaches to explaining the economic cycle mechanism are based on the real economic mechanism and can therefore be applied to

its forecasting.

Keywords: Theory of expectations; economic cycle; gross domestic product (GDP);economic entropy.

JEL Classification: E 32 E 37 C 12

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Роль очікувань економічних агентів в процесі формування економічного циклу

Анотація

Аналізуються актуальні проблеми дії механізму економічного циклу с позицій впливу фактору очікувань економічних агентів. Метою дослідження є аналіз процесу формування економічного циклу під впливу очікувань економічних агентів в США у 1947-2016 рр. На підставі аналізу даних по валовому внутрішньому продукту США робиться висновок, що максимуми економічних циклів мають чітке співпадіння з максимумами динамічних рядів сумарних ковзних очікувань. Зроблені концептуальні підходи до пояснення механізму дії економічного циклу ґрунтуються на реальному економічному механізмі і може бути використаний для його прогнозування.

Ключові слова: теорія очікувань; економічний цикл; валовий внутрішній продукт; економічна ентропія.

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Роль ожиданий экономических агентов в процессе формирования экономического цикла

Аннотация

Анализируются актуальные проблемы действия механизма экономического цикла с позиций влияния фактора ожиданий экономических агентов. Целью исследования является анализ процесса формирования экономического цикла под влияния ожиданий экономических агентов в США в 1947-2016 гг. На основании анализа данных по валовому внутреннему продукту США делается вывод, что максимумы экономических циклов имеют четкое совпадение с максимумами динамических рядов суммарных скользящих ожиданий. Сделанные концептуальные подходы к объяснению механизма действия экономического цикла основываются на реальном экономическом механизме и могут быть использован для его прогнозирования.

Ключевые слова: теория ожиданий; экономический цикл; валовой внутренний продукт; экономическая энтропия.

1. Formulation of the problem

In recent decades, the problems of economic growth and the cycle have always been the focus of attention of the economists. The achievements in Europe in 1950-60s, in Japan in 1960-70s, in South Korea in 1970-90s were not stable, one way or another, and included periods of recession and stagnation. However, there always emerged new countries that achieved economic progress. The most rapid economic success patterns changed specifically in the past few decades. Some countries promptly became leaders, while others continue their slow growth or even reduce the gross domestic product. According to A. Galor (Galor, 2005) [1] during the period from 1000 to1820 the average growth rate of income in the world accounted for approximately 0.05%. In 1820-1870, it was already 0.5%, in 1870-1950 – 1.1%, and since 1950 - it has exceeded 2% [2]. As the authors of the PwC's “World in 2050" report predict, the average annual world economic growth will be at 3%, which will enable to double the global GDP by 2037 and triple it by 2050 [3].

2. Review of recent research and publications

As the history proves, the economic growth is not permanent. It is anyway accompanied by crises. In the early twentieth century, a prominent economist M.I. Tugan-Baranowski wrote: "This book is dedicated to the investigation of the most mysterious and inexplicable phenomenon of the economic pattern of our times – a phenomenon that is still not scientifically grounded– i.e. periodic industrial crises. What force directs this amazing change in revival and stagnation of trade, expansion and reduction of production? "[4].

Theories which explain the reasons of the cyclical economic development existence are quite diverse, even within economic schools. In this paper, our aim was not to analyze the approaches and views on this issue. Let us just note that modern economists hardly have any doubts about the inevitability of the next economic cycle. It is important, according to Nobel laureate E. Phelps [Phelps, 2015], that to consider the possibility of collapse in the economy as its drawback is similar to calling a drawback

the tendency to rapid changes in mood – from mania to depression, which frequently occurs among creative people. [5. S. 415].

The desire to predict the future has always been one of the most cherished human dreams. Moreover, predicting events is a human characteristic. Based on the accumulated data and experience, people are able to predict the future. In modern society, it is one of the most important aspects of life. We are daily surrounded by lots of various forecasts regarding the future, including the economic future. Accepting it or not, the society creates expectations for the future, which are then accompanied by specific actions. The latter tends to minimize the negative effects of the events that, as expected, may lead to losses.

However, it is questionable whether it is possible to predict the future in terms of economic events. In the view of J. Keynes it is impossible. He explains it by the lack of coordination in modern business projects. As J. Keynes believed, [Keynes, 1936], "we just do not know" the future, although it would be "best to know it" [6].

A similar view, albeit from a different angle, is supported by Jesús Huerta de Soto [Huerta de Soto 2009]. He believes that an unsolvable logical contradiction occurs when conducting the business analysis: the demand for entrepreneurial resources, based on the expected costs and benefits, involves the belief that some information can be received immediately today (about the possible future value of costs and benefits), and before this information is created by entrepreneurial efforts [7].

After all, the simple practice of human activity shows that in today's society people, including the investors, constantly have to make decisions relying on the potential future income. The companies that intend to invest are to know the sequence of future income from the invested capital. However, in this case the problem of uncertainty and risk evolves. The question is how economic agents form their future expectations. Modern economic theory formulates two approaches to this matter: generally adaptive expectations hypothesis and rational expectations hypothesis.

Koyck [Koyck, 1954] and Cagan [Cagan, 1956] are considered the founders of the theory of adaptive expectations [8.9]. The basis of this theory is a simple principle that people form their future expectations depending on the extent to which their expectations were wrong in the past as related to the present. In this case, a simple principle operates: the events of the past shape the future human economic expectations. For instance, if the inflation rate in the country by years is 3%, 4%, 5%, then we can expect 6% inflation in the next period. At the same time, it can be different than the forecasted inflation rate due to urgent government's or central bank's actions. It is the unpredictable events that can significantly distort the importance of the previous events.

The founders of the rational expectations theory are Muth [Muth, 1961] and Simon [Simon, 1958] [10,11]. They believe that people use more sophisticated methods while forming their expectations, especially when it comes to investing substantial capital. These economists claim that, while forming their expectations about the future economic variables' behavior, both companies, and individuals use all the information available at their disposal, combining it with their own ideas.

The principles of the rational expectations theory widely spread when discussing the impact of expectations' factor on the inflation rate. The impetus for this was the difference between the Keynesian theory and the actual results of governmental policy in the economy of the developed countries in early 70's. The fact is that in 1958 A. Phillips [Phillips, 1958] published his famous article highlighting the relationship between inflation and unemployment [12]. This relationship is called the Phillips' curve and today it is included into all textbooks on macroeconomics. One of its critics, a Nobel laureate (1995) Robert Lucas noted that this theory ignores the optimal behavior of the economic agents, including formation of rational expectations [13]. As the economic agents use obvious accessible information optimally (efficiently) when forming their expectations, their predictions, claims R.-E. Lucas [Lucas, 1976], should be seen as rational ones. In fact, it meant that economic agents made the most precise future predictions and may foresee governmental actions in their plans.

Simultaneously, the economists engaged in analyzing the relationship between economics and psychology prove that, while making objective decisions regarding the received information, several factors caused by human psychological characteristics may occur. [14]. These include believes, social pressure and emotions. Only a limited number of people can overcome all the three obstacles. In our opinion, public pressure, or crowd psychology, has a particularly strong impact on making managerial decisions. Most clearly these trends are demonstrated in the stock markets where the rapid growth in asset values often exceeds the cost-effective limits because of the psychological factors. Also expectations have significant impact during the formation of prices for energy, particularly oil. Ultimately, all these factors lead to formation of real efficacy at the level of specific enterprises [15].

On this occasion Israel Meir Kirzner [Israel Meir Kirzner, 2001] noted that, if a person definitely knows what to expect, his or her plans can be fully explained based on the sound economic activity, optimal resources allocation and their maximizing. In other words, people's plans can be principally viewed as those that accumulate the total knowledge of all the current and future circumstances, related to his or her situation and acting in the world of perfect knowledge. However, the author believes that it is this that makes us to emphasize the importance of vigilance people demonstrate while treating the new information [16].

3. The Purpose of the research is to analyze the process of the economic cycle formation under the influence of the economic agents' expectations in the USA in 1947 – 2016.

4. Results

How may the expectation factor be taken into account to explain the reasons for the economic crisis or collapse? In order to answer this question it is necessary to draw attention to the fact that, according to the theory of rational or adaptive expectations, the economic agents will invest, expand their consumption only when they are confident in their future. In turn, confidence arises as a result of the factors that cause these

expectations. These can be classified as positive in time economic statistics or decisive governmental action program. Anyway, people should receive positive signals, otherwise the economic decisions will not be taken. On the other hand, one of the main reasons for the economic growth termination and, therefore, the early phase of the economic crisis, is that during the recovery period systemic risk is automatically generated and accumulated, and false economic decisions are spread among the entrepreneurs. This is, first of all, a psychological human trait of prolonging expectations for a longer period during the good times. This position is often wrong. Secondly, in this case, the economic agents' expectations match even more. It is possible to claim that the economic entropy level decreases. This creates a kind of social pressure on all the participants of economic relations. People start thinking that rising real estate prices, stock indexes and other assets will continue growing further. Therefore, one should continue investing, applying for loans, buying property. Back in the 20's of the last century A. Aftolion cited a stove as an analogue to this situation. He believed that, guided by a sense of cold and the thermometer value, the room may get overheated; it may take some time before the fuel flares and disperses heat in the room. "The thermometer and feeling cold" are quite misleading and can lead to a serious mistake, because there is a long lag period between the first steps for getting more heat and the moment when finally more heat is received [17, S.158]. At this stage the entrepreneurs who are unable to make proper calculations and predictions about the effectiveness of their business are involved into the economic activity. These are the so-called “second wave” innovators. Their efficiency in terms of economic system is lower, and the risk level in their activity is higher.

All these events lead to the fact that some inconsistencies in the economic system create a rather precarious situation. One minor economic shock is enough to turn the whole system into the opposite direction – the economic crisis. To illustrate, in 2008 the bankruptcy of the Lehman Brothers' investment bank became such a shock. This was a kind of “black swan” that appeared when no one expected. In 1927 A. Pigou [Pigou,

1927] wrote about such impulses as factors pushing the start of the new economic cycles [18].

Getting back to the economic concept of entropy, it should be noted that it was introduced by Clausius [Clausius] in 1865 [19]. According to the second law of thermodynamics, the level of entropy of any system must increase with time. It is characterized by the state of the system components. For example, if one adds milk to coffee, it will gradually distribute on the cup, increasing the overall entropy of the system. The probability that all milk will be distributed by some clear principles, creating a circular or rectangular shape, virtually equals zero. If this happened, it could be assumed that the entropy of the system might decrease.

The economy is also a kind of system that consists of millions of different entities. The majority is represented by consumers, the minority – by investors and entrepreneurs. During the economic growth period, the entropy of the system is gradually decreasing because all the expectations and actions of the system entities are predictable and identical. On the contrary, it is difficult to predict future events during the economic crisis. In fact, most investors minimize their investments, waiting for the good news. Therefore, decisive actions are to be taken by any government in order to overcome the crisis.

Based on this concept, we believe that economic entropy can be regarded as the synchronization level of expectations matching the actual course of events in the economic system. The entropy reaches its pick during the economic system reversal. Under these conditions, business entities' profits are also maximized due to cheap resources and services. The economic growth phase starts. It will last until a certain economic segment or segments accumulate a critical amount of divergence between the expectations and the actual capital efficiency.

Once the level of economic entropy drops below the conventional critical limit, which is defined by the objective conditions, it will actually mean that the crisis is inevitable because of overwhelming economic agents' erroneous actions. At this time,

various resources and investments are actively offered but cannot be demanded by the market for numerous reasons. Also, the prices for a range of goods, primarily, raw materials and real estate, start exceeding their real value.

The economic system has a relatively fixed margin for the erroneous decisions taken by its entities. However, if the number and the cost of errors exceed a certain limit, it pushes the system out of stability. These errors primarily occur when making investment decisions, both by businesses and consumers.

For the sake of testing our theoretical assumptions, a corresponding methodical approach has been developed. It is based on our method of calculating the total sliding expectations [20]. The essence of this method is briefly as follows. The first stage is defining an interval of time series, according to which alignment should be performed. This trend line differs depending on the situations.

In the second stage, according to the obtained equation, the value is predicted one period ahead. The third stage is associated with comparison between the predictive value ($X^{/}$) with the actual value (X) by finding the difference between them $\Delta X = X - X^{/}$. The purpose of this comparison is that, if the trend has changed, the difference is quite substantial. Conversely, if the trend is preserved, the value ΔX cannot significantly vary X. A mathematical sign is vital here ΔX. If the sign is negative it means that the predictive value exceeded the factual, and therefore, the real growth rate was lower than the expected one, based on the previous data. If the difference is positive, the conclusion is opposite. In the fourth stage, the entire described process is shifted one period forward and repeated. As a result, the original time series is converted into a series showing the deviation between the actual and the forecasted data.

In the fifth stage, all values ΔX for a certain time period are summed up (the period may be equal to 5-10 periods, or some other value). Subsequently, the resulting value can have either a “+” or a “-” sign. If the value is positive, it would indicate that, during the selected time period the actual values prevailed over the expectations, and, therefore, the economic situation was slightly better than the expected one, based on the

previous events. If the value is negative, the conclusion should be the opposite. It has been decided to name the resulting value “the total sliding expectation”.

In terms of the expectations' level, these calculations are also important because the economy is difficult to predict in uncertain times. The total value of the sliding mode (ΔX) will significantly differ from 0, or at least from the average. It will give grounds to speak about the increasing risk and economic agents' uncertainty. Therefore, according to our concept, when the critical level is reached, mass panic in the relevant markets will start, as well as the removal and the transfer of assets into the liquid form.

It was decided to conduct the validation of the proposed conceptual approach to the explanation of the economic cycle based on the US data. This country has been chosen because it represents one of the world's largest economies, and actually generates the current economic trends in the world. In addition, the National Bureau of Economic Research has considerable experience related to formal definition of the beginning and the end of the economic crisis.

Online Bureau of Economic Analysis website of this country provides a great number of data on the gross domestic product since 1929 [21]. However, GDP data sorted by quarters is available since 1947. For the proposed method, this fact is important because a one-year period is not optimal when assessing the changes in expectations. The purpose is best achieved when the quarterly or even monthly data are analyzed. It has been decided to take the quarterly data on changes in real gross domestic product (in 2009 US dollars) for 1947-2016. The width of the sliding window in determining the sliding expectations equals ten periods (quarters), in order to eliminate the influence of random fluctuations. The sliding window when summing the expectations equals five periods. In this case, it is important to consider the current fluctuations, simultaneously eliminating the influence of random variation.

Furthermore, it has also been decided to compare the obtained results with the officially established economic cycle minimum values. The National Bureau of Economic Research publishes the latest values on its website. [22] For the period

chosen, the maximum values of economic cycles occurred in the fourth quarter of 1948, the second quarter of 1953, the third quarter of 1957, the second quarter of 1960, the fourth quarter of 1969, the fourth quarter of 1973, the first quarter of 1980, the first quarter of 1981, the third quarter of 1990, the first quarter of 2001, and the fourth quarter of 2007.

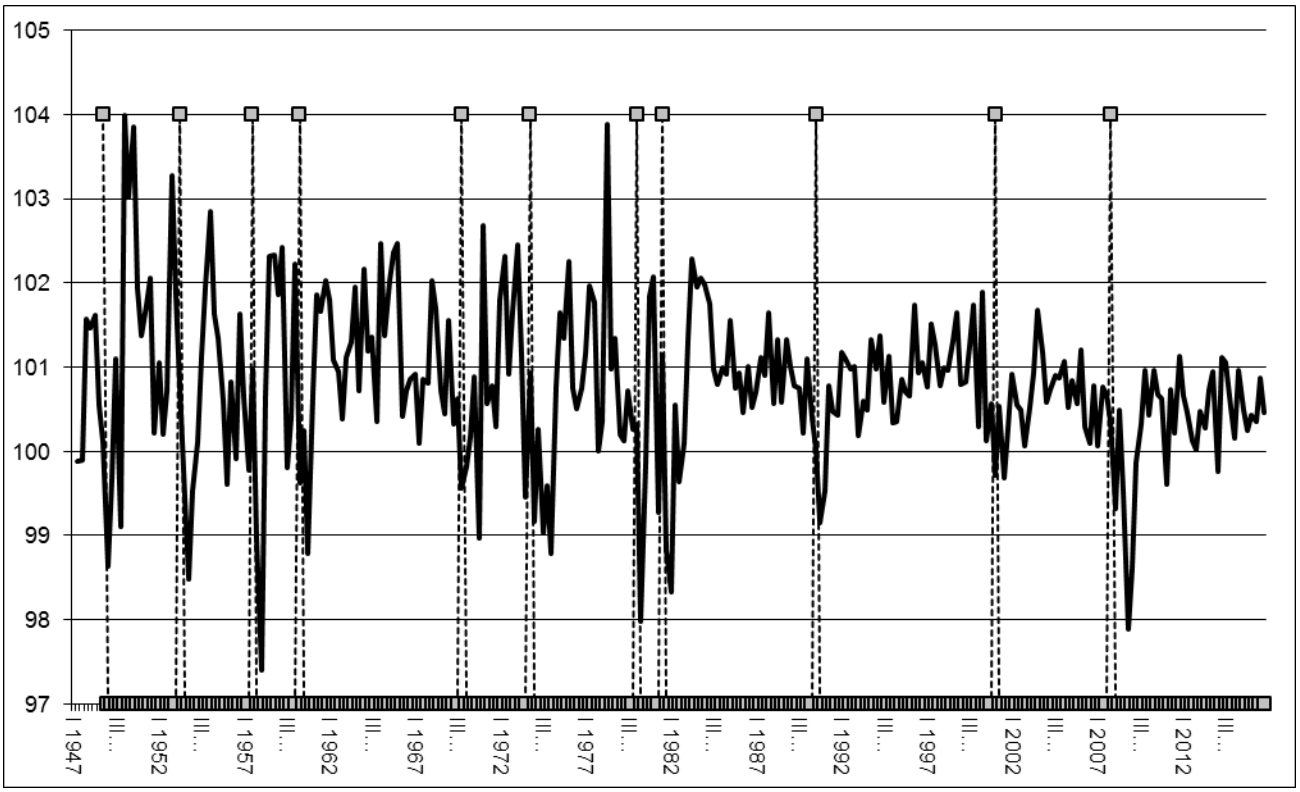

Fig. 1. The dynamics of the real US GDP changing rate in 1947-2016 (%)

Source: Calculated by the author [21, 22]

Fig. 1 shows the dynamics of the real US GDP changing rate in 1947-2016 in terms of quarterly data. The vertical lines show the economic cycles' maximum values according to the National Bureau of Economic Research. This time series is characterized by fairly substantial variations and fluctuations that makes data analysis far more complicated.

The results of processing data by applying the total sliding expectations method is shown in Fig. 2. The width of the sliding window in determining the sliding expectations equals ten periods (quarters), in order to eliminate the influence of random fluctuations.

The sliding window when summing the expectations equals to five periods. Such transformation of the initial data allowed us to present the hidden patterns in gross domestic

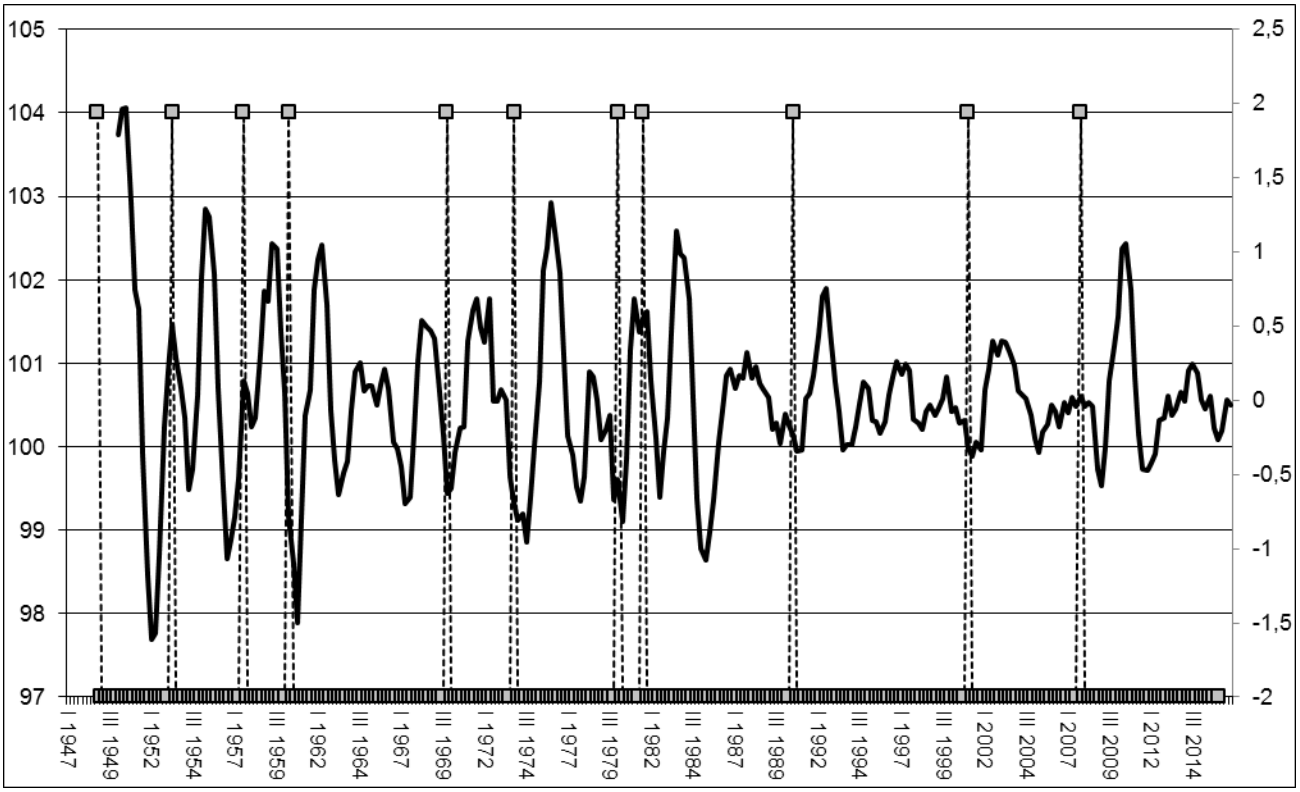

Fig.2. The dynamics of the real US GDP total sliding expectations in 1947-2016 (%)

Source: Calculated by the author [21, 22].

product changes, specifically in the light of expectations. It should be noted that almost every peak period of sliding expectations time series is preceded by the economic cycle maximum value. Although, there were some periods when the maximum of dynamic sliding expectations time series occured without reaching the maximum gross domestic product.

Let us summarize the results for the periods presented in Tab. 1. The difference between the actual and the maximum total sliding expectations values averaged 65 quarters. Although, it was the largest in the last cycle and equaled 22 quarters. We will not go deeper into explaining the reasons for this discrepancy. This is a complex issue,

which requires independent research. The main result is the establishment of the pattern.

Our aim was also to answer the question to what extent the total sliding expectations values correlate with the actual economic cycle values. In order to answer

Tab. 1: The dates of the US GDP economic cycle maximum values and the sliding expectations time series maximum values in 1952–2016

The economic cycle maximum values	The sliding expectations time series maximum values
1953 – II	1952 – III
1957 – III	1955 – II
1960 – II	1959 – III
1969 – IV	1968 – III
1973 – IV	1972 – II
1980 – I	1978 –II
1981 – I	1981 – I
1990 – III	1987 – IV
2001 – I	1999 – IV
2009 – IV	2003 – II

Source: Calculated by the author [21, 22].

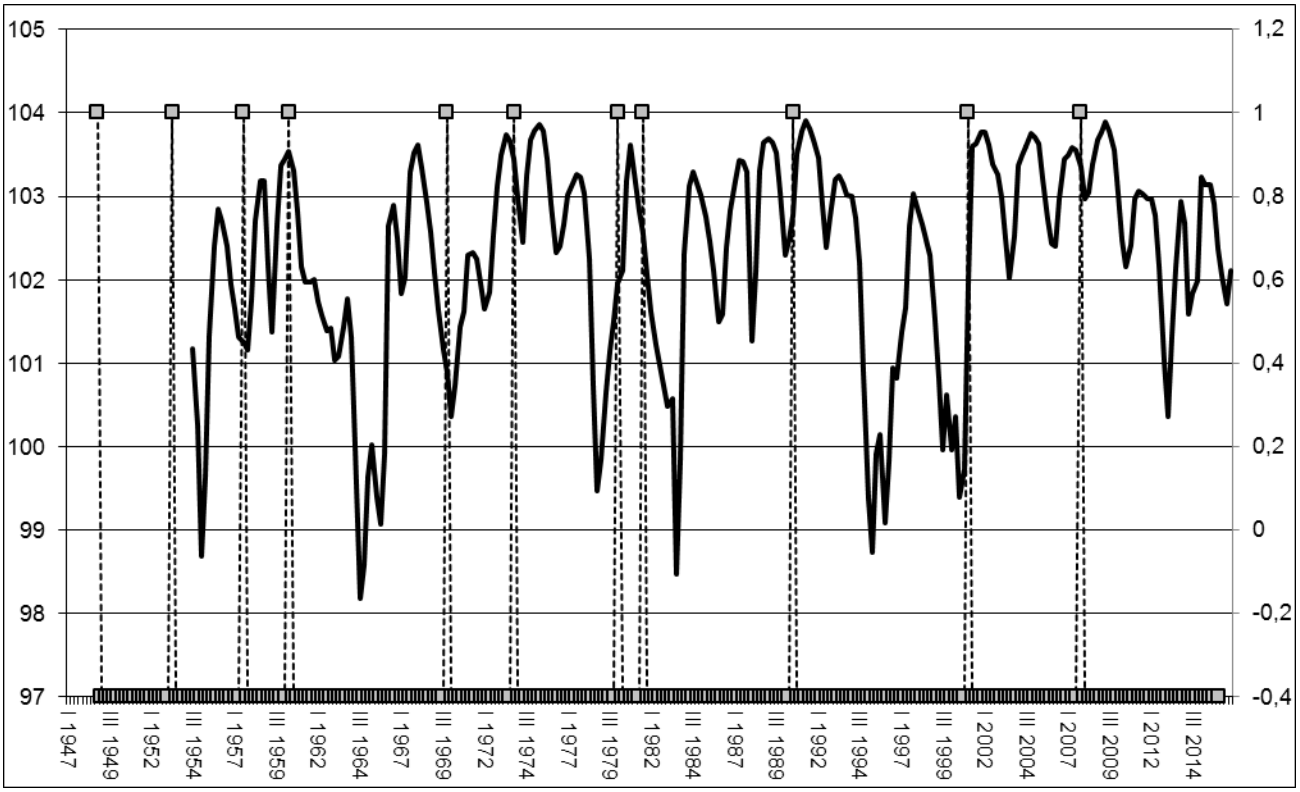

Fig. 3. The dynamics of the correlation coefficients between the model and the real US GDP sliding expectations in 1947-2016 (%)

Source: Calculated by the author [21, 22].

this question, the following calculations were carried out. In the first phase, according to the linear trend the model values for the last time series value were determined. Next, we applied the method of sliding window to calculate the subsequent data. The last stage was to determine the correlation coefficients between the model and the sliding expectations. The width of the sliding window was equal to ten periods (quarters).

The aim of this calculation was also to test the assumption that the peaks of economic cycles comply with the expectation maxima. This can be proved by the high values of correlation coefficients between the model and the actual sliding expectations values. The resulting data are shown in Fig. 3. It can be inferred from the figure that the economic cycle maximum values coincide quite clearly with the correlation coefficient high values. This confirms our assumption.

5. Conclusions

Thus, the conducted research allowed us to claim that there is a fairly close relationship between the actual dynamics of the US gross domestic product and economic agents' expectations relative to its possible changes. In addition, there is a coincidence of expectations with the economic cycle maxima. The results clearly encourage the possibility to increase the economic dynamics' predictability.

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