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ROLE OF THE BEHAVIORAL CYCLE IN THE ECONOMY

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Abstract. This study introduces and empirically confirms the concept of a behavioral cycle, which reflects the change in the prevalent attitude of economic actors. Monitoring the dynamics of the behavioral cycle enables increasing the accuracy of determining the phase of the economic cycle, considering both the material and behavioral components of the economy. The behavior of actors is taken into account because of their economic expectations coupled with their previous experience in handling crises. The behavior of economic actors is affected by external environmental parameters, which, in turn, determine the individual predisposition of actors to engage in an active, adaptive, or reactive type of behavior. The fractal analysis shows long-term patterns in the dynamics of actors' expectations in Russia. The in-

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Аннотация. Исследование раскрывает и эмпирически подтверждает концепцию поведенческого цикла, отражающего изменение доминирующих настроений экономических субъектов. Мониторинг динамики поведенческого цикла позволяет повысить точность определения фаз экономического цикла, отражающего как материальную, так и поведенческую компоненты экономики. Целью исследования является концептуализация поведенческого цикла и оценка его влияния на экономический цикл.

Поведение субъектов рассматривается как результат накопленных ожиданий, анализа параметров внешней среды, накопленного опыта прохождения кризисов, личностной predispositionности субъектов к активному,

dicators of expectations are a persistent parameter used for identifying the phases of the behavioral cycle. This research singles out the phases of the behavioral cycle, starting from the 4th quarter of 1998, following the approach of D. Harding and A. Pagan and the indicators of expectations demonstrating the presence of long-term patterns. The study shows that seven behavioral cycles have been observed in Russia since 1998. Several peak values for behavior cycles coincided with crisis periods in the economy. The superimposition of the phases of the behavioral cycle on the economic cycle reveals a relationship between the behavioral cycle and the material cycle, forming the general economic cycle.

Keywords: behavioral cycle, crisis, economic behavior, risks, uncertainty, economic cycle, volatility, behavioral supervision, central bank, economic entity

Introduction

This study reveals the concept of a behavioral cycle that analyzes the behavior of economic actors at the macro level. The economy, due to the absolute impossibility of its existence without people's participation, is practically behavioral [Maslennikov, 2000]. All economic processes occur under the influence of factors that can be divided into two interrelated groups, namely objective (material) and subjective (behavioral). The relationship between the phases of the economic cy-

адаптивному или реактивному типам поведения и т. д. С помощью фрактального анализа демонстрируется наличие долгосрочных закономерностей в динамике показателей ожиданий субъектов в России. Показатели ожиданий, являющиеся персистентными, применяются для идентификации фаз поведенческого цикла. С учетом подхода, изложенного в работе Д. Хардинга и А. Пейгана, и показателей ожиданий, демонстрирующих наличие долгосрочных закономерностей, проводится идентификация фаз поведенческого цикла, начиная с четвертого квартала 1998 г.

Исследование демонстрирует, что начиная с 1998 г. в России наблюдалось семь поведенческих циклов, ряд пиковых значений по которым совпали с экономическими кризисами. Наложение фаз поведенческого цикла на экономический цикл демонстрирует наличие взаимосвязи, возникающей благодаря тому, что поведенческий цикл наряду с материальными циклическими процессами формирует наблюдаемый экономический цикл.

Ключевые слова: поведенческий цикл, кризис, экономическое поведение, риски, неопределенность, экономический цикл, волатильность, поведенческий надзор, центральный банк, экономический субъект

cle and the behavior of actors was formulated by Kondratiev, when he described the second empirical rule: “Periods of upward waves of large cycles, as a rule, are much richer in major social upheavals and upheavals in the life of society (revolutions, wars) than periods of downward waves” [Kondratiev, 2002: 767]. This empirical rule is largely related to the behavior of economic actors and their tendency to act aimed at changing the external environment. The empirical rule emphasizes the relationship between the actions of actors and the dynamics of economic fluctuations. Less attention has been paid to explaining the role of behavior in economic dynamics at the macro level than to the material components of the economic cycle controlled by traditional economic indicators, i. e., savings rates, investments, public procurement volume, etc. [Romer, 2014; Klinov, 2015]. This approach is incomplete due to its predominant focus on the economic cycle’s material component.

Numerous studies have shown the cyclical nature of various parameters forming the material component of the economic cycle, e. g., the presence of long-term trends in the dynamics of oil prices [Kossov, 2016], the presence of patterns in the institutionalization of market participants [Blokhin, Gridin, 2021], the formation of government spending [Afanasyev, Afanasyev, 2009], etc. Some studies reveal similar cyclical patterns in the behavioral component of the general economic cycle [Maslennikov, Larionov, 2020b], Economics, taxes & law]. The explanation of the patterns of the economic cycle requires considering the cumulative influence on it not only of material, but also behavioral factors. The latter can be implemented by formalizing the concept of the behavioral cycle.

The behavioral cycle is a change in the dominant moods of actors with different types of behavior regarding the economic changes [Maslennikov, Larionov, 2020c]. Dominant emotions reflect the prevailing reaction of actors with a certain type of behavior that occurs against the background of economic fluctuations. The reaction of actors is expressed in the performance of operations characteristic of actors with a certain type of behavior. For example, actors that tend to avoid making transactions with a currency will not react to fluctuations in its value. Thus, in economics, actors demonstrate actions related to their type of behavior.

The formation of the actor’s behavior occurs under the influence of the external environment and the prevailing expectations in relation to individual events, considering the accumulated human, social, and financial capital [Maslennikov, Larionov, Gagarina, 2022]. Once an actor forms a certain type of behavior, it directly affects the propensity for the former to make the respective economic decisions¹. The type of behavior is the actor’s internal constant feature. An important difference between the type of behavior and expectations is the constancy of the type of behavior over a long period of time.

A particular danger for the economy is the overlap and mutual reinforcement at the extremes of waves of the material and behavioral components of the economic cycle. During such periods, there might be threats of crises or, an overheating of the economy. It is important not only to monitor the dynamics of the factors of

¹ The concept of behavior types can also be used to analyze economic processes at the micro level.

the material component, but also to smooth the amplitude of the behavioral cycle. The latter can be implemented using state regulations [Kapelyushnikov, 2013].

Traditionally, economics describes an actor from the perspective of their unique characteristics, i. e., the level of expected utility, the level of risk, or a set of individual preferences [Mas-Colell, Whinston, Green, 1995]. These characteristics are constantly changing, while the type of behavior determines the range of predicted reactions to the occurred fluctuations. The diversity of people's behavior determines not only time lags in the reaction rate of various groups of actors to information flows, but also their role in the formation of economic processes. Therefore, the behavioral cycle should be considered as a separate component of the economic cycle. For this purpose, we formulate the concept of the behavioral cycle and propose a methodology for identifying its phases.

The problem of identifying the phases of the behavioral cycle is linked to the need to consider the propensity of actors to perform operations. Considering the available data, in this study, the identification of the behavioral cycle is implemented using expectation indices². To confirm the existence of a behavioral cycle, it is essential to prove two key facts: the presence of long-term patterns within the formation of a certain behavior of actors and the existence of patterns in the change of the behavioral cycle's phases. Combining the behavioral cycle with the phases of the economic cycle points to the relationship between the behavioral and material cycles that form the overall economic cycle. The purpose of this study is to conceptualize the behavioral cycle and assess its impact on the economic cycle.

This study is organized as follows. First, a literature review is conducted, revealing the main approaches to the identification of the behavioral cycle, and research hypotheses are formulated. Second, a method for analyzing the behavioral cycle is proposed, considering the approach outlined in the work of Harding and Pagan [Harding, Pagan, 2002]. Third, an empirical test of the formulated hypotheses is carried out, using fractal analysis. Finally, the article gives practical recommendations on applying the concept of the behavioral cycle.

Literature Review

The inclusion of a behavioral component in the macroanalysis allows taking a fresh look at the economic problems associated with crisis phenomena [Sergeev, 2009]. The importance of expectations for predicting the choice of actors has long been confirmed in economics [Mas-Colell et al., 1995]. Expectations have an impact on consumption, savings, and investment. Considering their expectations, the actor evaluates the "utility" of performing an operation. The rationality of the assessment and further actions depend on the actor's type of behavior. Depending on a certain type of behavior, an actor acts in accordance with the changes in the external environment, adaptation, or passive reaction. The actors obviously face the problem of performing suboptimal actions caused by informa-

² Expectations are not equivalent to the type of behavior of actors. Expectations are the consequence and, to some extent, the cause of the formed type of behavior of the actor. To identify the behavioral cycle, considering the available statistical data, with a certain degree of assumptions, it is possible to use expectation indices. However, such an assumption is forced. In the future, it is necessary to collect specialized data to analyze the behavior of actors.

tion asymmetry, moral hazard, etc. [Akerlof, 1970]. The latter is considered by the state when developing policies aimed at maintaining the sustainability of economic development [Rubinshtein, 2020]. It seems appropriate to consider the concept of “behavior” of actors and determine the role of the behavioral factor in the cyclical nature of the economy.

The concept of “behavior”

Calculating their expected utility, actors evaluate the specific set of actions that they can perform. This approach considers the static choice of an actor at a certain period. An actor performs operations constantly, for instance when going to the shops, paying for education, looking for a job, etc. Some actors aim at an active style of economic life, while others demonstrate a passive lifestyle. It is possible to assume the existence of the propensity of actors to commit a certain set of actions over time, depending on their type of behavior [Maslennikov, Larionov, 2020c]. If the actor’s expectations are constantly changing, then behavior acts as their constant feature, evolving under the influence of only particularly significant events or time³. Thus, behavior is a more fundamental characteristic than expectations. To analyze the behavior of actors, it is necessary to determine an additional feature, which is the types of behavior that classify actors into groups.

Following Blauger’s approach, this research identifies three main types of behavior, namely active, adaptive, and reactive [Maslennikov, 2002]. Those with an active type of behavior perform actions aimed at changing the state of the external environment. An example of an actor with an active type of behavior is George Soros, who successfully broke the Bank of England⁴. Actors with an adaptive type of behavior, focusing on the actions of actors with an active type of behavior, perform adaptive actions, but with some delay. Those with a reactive type of behavior do not aim at changing the external environment at all. A clear example is someone who possesses readily available resources, but does not manage their currency basket, investments, or consumption level depending on economic dynamics. Each type of behavior forms under the influence of accumulated human, social, and financial capital, as well as basic parameters (e. g., age) (figure 1). Actors with each type of behavior have certain expectations that can be further identified in accordance with their reactions. The actions performed lead to changes in all types of the actor’s capital.

The formed type of behavior defines the actor for a long period of time, influencing their expectations regarding various actions [Maslennikov, Larionov, 2020c]. Applying the concept of expectations, it is possible to conclude that actors with adaptive and reactive behaviors tend to demonstrate adaptive expectations, while actors with active behaviors systematically show rational expectations [Muth, 1961]⁵. The formed type of actor’s behavior persists for a long period of time (sometimes for years), determining their patterns of thinking and affecting a set of constant-

³ For example, due to age.

⁴ Blinov S. (2016) Negative Consequences of Smooth Devaluation. *Munich Personal RePEc Archive*. MPRA Paper No. 70292. P. 1—19. URL: https://mpra.ub.uni-muenchen.de/70292/1/MPRA_paper_70292.pdf (accessed: 14.02.2023).

⁵ The concepts of adaptive and rational expectations are revealed in more detail in profile studies.

ly changing expectations⁶. The type of behavior is a long-term feature, while the expectations are short-term. The stability of each type of behavior makes it possible to analyze the structure of society according to the type of behavior and predict the reaction to changes. For the analysis, it is important to formalize several definitions used in the behavioral cycle concept (table 1).

Fig. 1. The relationship between each type of actor's behavior and expectations

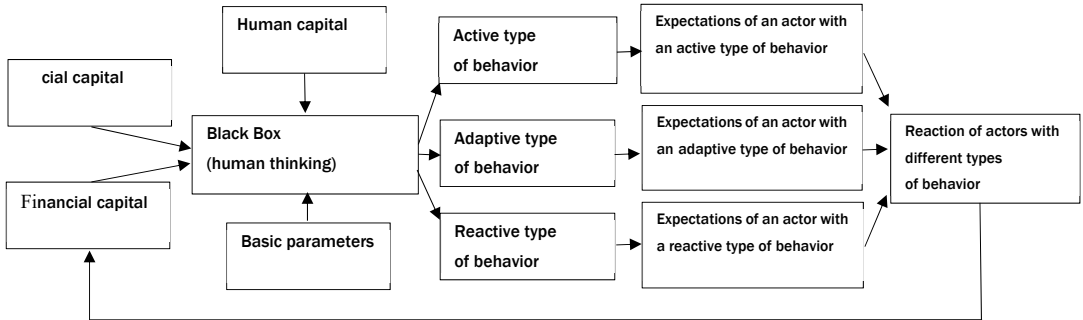


Table 1. Definitions used in the concept of the behavioral cycle

Term	Definition
Behavior	Propensity of actors to commit actions
Type of behavior	An internal constant feature of the actor's behavior similar to other actors of the same type
Reaction of actors	Actions performed by actors in response to changes in the economic situation
Dominant emotions	The prevailing reaction of actors with a certain type of behavior that occurs against the background of economic fluctuations
Behavioral cycle	Change of the dominant emotions of actors with different types of behavior regarding economic fluctuations

⁶ The existence of a relationship between expectations and behavior determines the possibility of applying expectations to characterize the behavior of actors. As the concept of the behavioral cycle develops, it seems appropriate to provide targeted monitoring of the distribution of actors by type of behavior in the economy.

The existence of a behavioral cycle is the result of a change in dominant emotions and consistent actions of groups of actors with different types of behavior. The actions are triggered by increased volatility in the economy or its changes⁷. During periods of stability, the actions of actors are relatively similar as there is no chance for actors with an active type of behavior to acquire additional economic benefits. However, if there is such an option, actors with an active type of behavior expand their activities. If the result of the respective actions is significant, then it is possible to expect actors with an adaptive type of behavior to act. The actions carried out by the actors with a reactive type of behavior are economically unsound and as a result, their assets “sponsor the entire process”⁸. The initiators of changes in the economy are actors with an active type of behavior, while other actors reinforce the already established trends. The action rate of groups of actors with different types of behavior determines the cyclical nature of behavioral reactions, allowing to put forward the concept of a behavioral cycle reflecting the dynamics of changes in the emotions.

The role of the behavioral cycle in the economic cycle

The economic cycle is a set of different waves reflecting the cyclicity of significant material and behavioral parameters. The combined analysis of the dynamics of these parameters enables identifying the current phase of the economic cycle. When determining the cycle, it is possible to use three main categories of variables, namely material variables, behavioral variables, and general variables (table 2).

Table 2. Categories of variables used to determine the economic cycle

Category	Description
Material variables	They include resource constraints, including the amount of labor, technological constraints, the state of logistics, the amount of available financial resources, etc. Material factors include not only the volume, but also the quality of the available resources [Maslennikov, Lariionov, 2020a]
Behavioral variables	They include emotions estimated expectation indices [Yaremenko, 2000]. It is possible to consider the level of business activity of actors [Kitrar, Lipkind, 2020]
Common variables	They consider both the material and behavioral aspects. General variables are represented by GDP indicators [Kitrar, Lipkind, 2021], industrial production index, volume of loans, unemployment rate, etc.

⁷ Blinov S. (2016) Negative Consequences of Smooth Devaluation. Munich Personal RePEc Archive. MPRA Paper No. 70292. P. 1—19. URL: https://mpra.ub.uni-muenchen.de/70292/1/MPRA_paper_70292.pdf (accessed: 14.02.2023).

⁸ Due to the delayed actions of actors with a reactive type of behavior, their readily available funds are redistributed in favor of actors with an active and, in some cases, with an adaptive type of behavior.

General variables are calculated and are often used to date the phases of the economic cycle [Akerlof, 2002]. They are considered when implementing government policies, and while analyzing the impact of fiscal policy [Dubovskij, Kofanov, Sosunov, 2015]. The applicability of general variables to identify phases of the economic cycle is that they simultaneously include the material and behavioral components. The use of only general variables does not always make it possible to unambiguously determine which of the components had the greatest impact on the change of the phase of the economic cycle. It is necessary to apply material and behavioral variables to better assess the sources of cyclicity in the economy.

The confirmation of significance of material factors has been demonstrated in various studies [Kitrar, Lipkind, 2021]. The discrepancy between the material and economic cycle indicates the presence of an additional factor explaining the dynamics of economic activity, which is known as the behavioral cycle. The behavior of actors determines the emergence of connections between the elements of the material cycle.

The role of behavior in the formation of behavioral economics has been confirmed in several studies, and, in particular, in the study of the Nobel Prize winner in Economics, George Akerlof [Akerlof, 2002]. However, according to the authors, such studies do not consider the formation of a behavioral cycle. The identification of the existing phase of the behavioral cycle is a significant task for state regulation. The demonstration by actors of various types of economic behavior leads to the formation of an uneven level of economic activity. For an effective regulation of the economy, it is necessary to identify actors by type of behavior for further assessment of the overall structure and economic potential of each group. Accurate information about the types of behavior of actors might enable a preventive regulatory effect on each of the groups, more purposefully influencing their activity depending on the phase of the cycle. The latter determines the need to develop an original methodology for the study of the behavioral cycle.

Behavioral cycle research methodology and data description

The methodology of the behavioral cycle research involves the implementation of three main stages:

- (1) The formation of a set of indicators reflecting the dynamics of the behavioral cycle;
- (2) The identification of the phases of the behavioral cycle using the obtained data;
- (3) The superimposition of the identified stages of the behavioral cycle on the previously identified stages of the economic cycle.

Stage 1. Understanding the behavioral cycle determines the need to form a set of indicators used to determine the current phase of the behavioral cycle. Given that the behavior of actors is evaluated based on the results of sociological research, there are no long time series available to analyze the behavioral cycle⁹. The em-

⁹ To identify the behavioral cycle, it is possible to use longitudinal surveys, such as the "The Russia Longitudinal Monitoring Survey — Higher School of Economics (RLMS-HSE)". However, the identification of the economic cycle is most often carried out using monthly and quarterly data. For this reason, longitudinal examinations are not used for the purposes of this study. The possibilities of their application should be evaluated in further studies.

phasis in research is mostly on the analysis of expectations, which are the result of a more constant characteristic, known as “the type of behavior” [Maslennikov et al., 2022]. In this regard, it is important to look for similar indicators that consider the dominant type of behavior. This approach is forced due to the lack of accumulated information on actors with different types of behavior. The indicators used to identify the behavioral cycle must have several characteristics:

- Indicators must be collected regularly to form time series;
- The time series used must demonstrate the presence of the dependence on previous values (be persistent)¹⁰.

The most promising group of indicators to describe behavior are various indicators of the population’s expectations¹¹, e. g., the indicator *Index of changes in the Russian economy*¹². The time series associated with expectations will obviously depend on previous values, since the expectations of actors regarding the future may accumulate due to an increase in human, social, and financial capital. The period of accumulation of expectations within one generation is limited¹³. Expectations allow describing the dominant type of behavior with a certain margin of error.

To identify the behavioral cycle, it is necessary to use sociological indices that consider the moods of the actors (table 3). Similar data for Russia is available on the Rosstat website for the period from Q4 1998 to Q2 2021, which confirms their compliance with the first data requirement described earlier. If these series correspond to the persistence property, they could be used in the empirical testing of the methodology for identifying the behavioral cycle. Since the type of behavior depends on the accumulated human, social, and financial capital, all the indices of expectations collected by Rosstat, considering the past, present and future, can be used to identify the phases of the behavioral cycle.

Table 3. A system of indicators available for identifying the phases of the behavioral cycle*

The name of the indicator	Characteristic	Average value
Index of the current state of the Russian economy	Evaluates how positively respondents assess the state of the economy in Russia	-22,28
Index of favorable conditions for large purchases	Evaluates how much respondents are willing to make large purchases	-31,86
Index of the expected change in the number of unemployed	Evaluates the respondents’ attitude to the current state of unemployment	-34,26

¹⁰ The persistence of the series demonstrates the presence of patterns in the formation of values.

¹¹ Expectations reflect the type of behavior of actors only partially. However, due to the absence of a time series evaluating the type of behavior of actors in this study, expectation indicators are used to identify the phases of the behavioral cycle.

¹² This index is significant because of its connection with accumulated human capital.

¹³ It is likely that the limitation of the duration of expectations of actors is associated with the duration of the economically active period of life of one generation, i. e., expectations can be formed during the lifetime of one generation. It is impossible to exclude the possibility of transferring expectations beyond one generation by transferring experience. The study of this process should be the subject of a separate study.

The name of the indicator	Characteristic	Average value
Index of expected changes in the economic situation in Russia in a year	Evaluates respondents' expectations in the short term	-5,2
Index of changes in the economic situation in Russia	Assesses how positive the changes in the Russian economy have been	-15,51
Index of expected changes in the economic situation in Russia in five years	Assesses respondents' long-term expectations regarding the economic situation in Russia	8,92
Index of expected price changes	Evaluates respondents' expectations regarding inflation. The balance of ratings is the difference between the sum of the percentages of definitely positive and ½ rather positive responses and the sum of the percentages of definitely negative and ½ rather negative responses. Neutral answers are not considered	-71,91
Index of changes in personal financial situation for the year	Assess the respondent's personal attitude regarding changes in financial situation	-13,91
Index of expected changes in personal financial situation	Evaluates the respondent's expectations regarding changes in personal financial situation	-7,79
Consumer Confidence Index	It is calculated as the arithmetic mean of indices that consider past and expected changes in personal financial situation, past and expected changes in the economic situation in Russia, etc.	-14,82

* Source: compiled by the authors based on Rosstat data.

To form a set of indicators characterizing the behavioral cycle, it is necessary to select those that depend on previous values. It is possible to use fractal analysis to assess the degree of the volatility of the examined indicator [Belyaev, Lariionov, Sil'vestrov, 2021; Opokina, 2019]. Based on the calculations performed, the value of the Hurst indicator is obtained. The Hurst indicator is calculated according to the following formula:

$$\ln(R/S) = \ln(c) + H \cdot \ln(m),$$

where H is the Hurst indicator,

R/S is the average value of the normalized span,

m is the number of observations in the group,

c is a constant.

The Hurst indicator value is obtained by applying the ordinary least squares.

It is possible to obtain three main variants of the indicator values:

- (1) A Hurst indicator greater than 0.5 means that the time series is persistent;
- (2) The Hurst indicator less than 0.5 means that the series is anti-persistent;
- (3) A Hurst indicator of 0.5 means that the values are random.

Because expectations within the behavioral cycle are closely related to the process of forming behavioral types, it is possible to suggest a dependence in the

dynamics of the behavioral cycle. This assumption allows formulating the following hypothesis:

(H1): *Expectation indices demonstrate a predominant dependence on previous values.*

Expectations are formed under the influence of social, human, and financial capital [Maslennikov et al., 2022]. The previous experience of the actors largely determines their actions in the future. The indicators of expectations for which this hypothesis will be confirmed can be used to identify the phases of the behavioral cycle.

Stage 2. After determining the list of indicators that have continuity of values, it is necessary to evaluate the phases of the behavioral cycle using existing procedures. To do this, various methods are used in international and domestic practice, including the Harding and Pagan algorithm [Harding, Pagan, 2006] and the Hamilton-Shave method [Chauve, Hamilton, 2005]. To date the behavioral cycle, it seems appropriate to use the Harding-Peigan method [Harding, Pagan, 2002].

The algorithm uses a time series, the analysis of which makes it possible to determine the peaks and the troughs of the cycle according to the indicator under consideration, as well as its main characteristics in terms of cycle duration and the amplitude of oscillations. The peak for the time series Y occurs at time t under the condition:

$$Y_{t-k}, \dots, Y_{t-k+1} < Y_t > Y_{t+1}, \dots, Y_{t+k},$$

where k for quarterly data equals two, and for monthly data equals five¹⁴. With the help of this condition, the search for turning points for the series under consideration is provided. For quarterly data, restrictions are set on the minimum cycle length (five quarters), the minimum cycle length (two quarters)¹⁵. The peaks and troughs of the cycles are determined for each time series to identify the behavioral cycle. The coincidence of extremes for a few indicators is considered as a phase change in the behavioral cycle.

Stage 3. The overlap of the identified stages of the behavioral cycle with the previously identified stages of the economic cycle will determine the relationship between the phases of the economic and behavioral cycles. In some cases, the behavioral cycle is likely to anticipate the economic cycle, while in other cases, the phase change of the behavioral cycle will occur after the phase change of the economic cycle.

The behavioral cycle anticipates the economic cycle. Actors may worsen their expectations considering incoming information, which will lead to “self-fulfilling expectations” and a further deterioration of economic dynamics. This situation may occur with an early change in the news background before the dynamics of the material cycle change.

¹⁴ Luvsannyam D., Batmunkh K. Dissecting the Business Cycle and the BBQ Add-In // *EViews. Econometric Analysis Insight Blog*. 2018. September URL: <http://blog.eviews.com/2018/09/dissecting-business-cycle-and-bbq-add-in.html> (accessed: 08.02.2022).

¹⁵ Similar restrictions are applied in the analysis of cycles in international practice [Harding, Pagan, 2002].

The behavioral cycle follows the economic cycle. This assumes that the change in the phase of the behavioral cycle is the result of the negative economic dynamics that have arisen. Due to the deterioration of the material component of the economic cycle, the news background deteriorates, which ultimately leads to a change in the dynamics of the behavioral cycle.

Ultimately, a situation of coincidence of the behavioral and material cycle is possible.

The coincidence of the waves of the behavioral and material cycles at the points of the minimum reflects the onset of an economic crisis, which allows us to formulate the following hypothesis:

*(H2): The coincidence of the minima of indicators reflecting the behavioral cycle is an indicator of the onset of an economic crisis*¹⁶.

In addition to the material and behavioral components of the economic cycle, it is also influenced by non-cyclical extraordinary processes, often figuratively called “black swans” [Taleb, 2007], “white swans” [Roubini, Mihm, 2010] or “... and chance, God is the inventor”¹⁷. Such events are difficult to predict using existing tools¹⁸. They do not have an obvious periodicity, but they can also significantly affect the dynamics of the economic cycle, and sometimes even lead to a change in the development paradigm.

An empirical assessment of the above hypotheses confirms the existence of a behavioral cycle in the economy and allows to predict the change of phases of the economic cycle.

Empirical analysis

The implementation of the three stages of the methodology described above allows us to determine the dynamics of the behavioral cycle and empirically evaluate the hypotheses.

Stage 1. Formation of a set of indicators reflecting the dynamics of the behavioral cycle

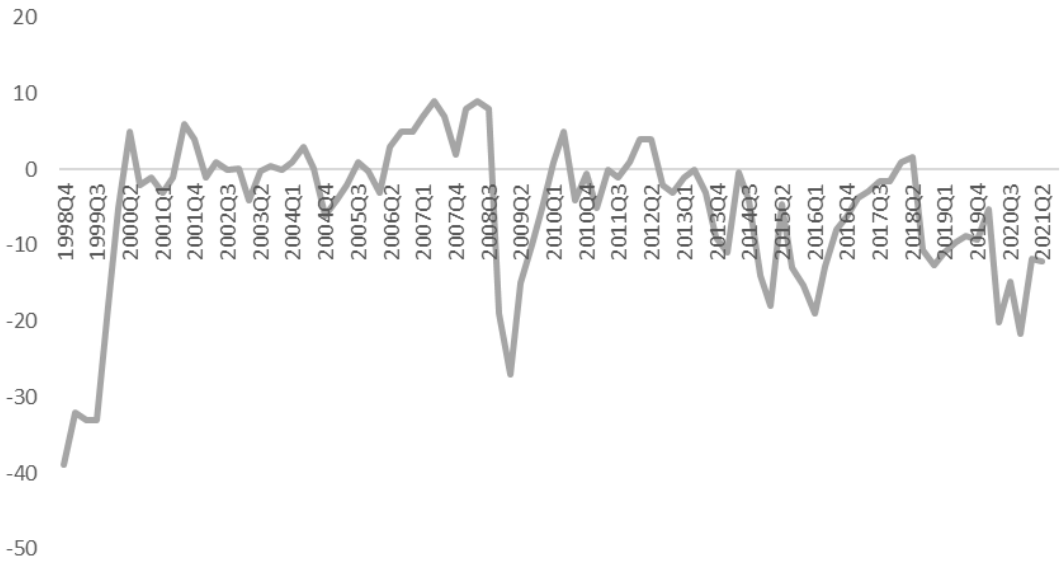
It is advisable to use persistent indicators for identifying the behavioral cycle. To solve this problem, the value of the Hurst indicator is calculated, which allows estimating the type of time series, for instance, the indicator “Index of expected changes in the economic situation in Russia in a year” (figure 2). The graphical analysis demonstrates the existence of certain patterns in the dynamics of this indicator. Dips in the values of the index of expected changes in the economic situation in Russia in a year are observed during crisis periods, like the global financial crisis of 2008.

¹⁶ An indicator of an economic crisis is not only the coincidence of the minima of the material and behavioral cycle, but also the fact that without a minimum of the behavioral cycle, the economic cycle occurs extremely rarely. This aspect needs further research.

¹⁷ Pushkin A. S. Collected works: In 16 volumes. Vol. 3. Poems, 1826—1836. Fairy Tales. Moscow: Fiction, 1948. P. 464.

¹⁸ This aspect is not the actor of study in the framework of this research.

Fig. 2. Index of expected changes in Russia's economic situation in a year¹⁹



Considering that the data were available on a quarterly basis, the time series for all indicators was divided into five classes (table 3). The “average value of the normalized span” (R/S) was calculated. Similar calculations were carried out for all available indicators reflecting the expectations of the actors (table 4).

Table 4. **The results of fractal analysis for the indicator “Index of expected changes in the economic situation in Russia in a year”**

	Class 1	Class 2	Class 3	Class 4	Class 5
M	10	15	18	30	45
R/S	2.649994	3.300655	3.8808	5.404757	7.033964
ln(m)	2.302585	2.70805	2.890372	3.401197	3.806662
ln(R/S)	0.974557	1.194121	1.356041	1.687279	1.95075

Based on the calculated logarithms of the values of the “average normalized span” indicators (ln(R/S)), as well as the logarithms of the values of “number of observations in each group” (ln(m)), individual values of the Hurst index were obtained (table 5). The analysis demonstrated that most indicators of expectations are persistent. This result confirms hypothesis 1. When forming expectations, ac-

¹⁹ Constructed by the authors based on Rosstat data.

tors consider previous experience of crises, accumulated social, human, and financial capital, and focus on the future.

Table 5. Fractal analysis results for various behavioral indicators

The name of the indicator	The meaning of Hurst indicator
Index of the current state of the Russian economy	0.67
Index of favorable conditions for large purchases	0.75
Index of the expected change in the number of unemployed	0.51
Index of expected changes in the economic situation in Russia in a year	0.66
Index of changes in the economic situation in Russia	0.66
Index of expected changes in the economic situation in Russia in five years	0.44
Index of expected price changes	0.62
Index of changes in personal financial situation for the year	0.73
Index of expected changes in personal financial situation	0.77
Consumer Confidence Index	0.68

The only indicator that is anti-persistent is the indicator *Index of expected changes in the economic situation in Russia in five years*. The value of the Hurst indicator is 0.44. This indicator largely depends on the current values extrapolated beyond the horizon available for foresight by most actors, and, therefore, does not fully identify the phases of the behavioral cycle. Other indicators, the Hurst indicator for which are greater than 0.5, can be used to analyze the behavioral cycle and implement the second stage of the methodology.

It should be noted that the indicators are averaged across groups of actors with all three dominant types of behavior, among which the group with a reactive type of behavior might dominate numerically. This also explains the anti-persistence of the most long-term of the estimated indicators. It can be assumed that the same indicator for a group with an active type of behavior would already be persistent and very valuable for research. Solving the problem of identifying the distribution of actors by types of behavior determines the need for targeted sociological research.

Stage 2. Identification of the phases of the behavioral cycle

The introduction of the behavioral cycle concept into the practice of analysis complements the previously known “waves” that determine cyclicity in the economy. To analyze the phases of the behavioral cycle, nine indicators presented in table 5 were used, apart from the *Index of Expected changes in the economic situation in Russia in five years* (figure 3). The analysis of their dynamics demonstrates the presence of shared patterns, which confirms the possibility of the existence of common causes of their changes. The most negative trends in the values of the indicators are observed in crisis.

Fig. 3. Dynamics of several indicators used to identify the phases of the behavioral cycle²⁰



For the selected indicators of the actors' expectations, the procedure described in the Harding-Pagan methodology was implemented. The calculations were carried out in the Eviews 8 program. Considering the analysis, it is possible to distinguish the following stages of the behavioral cycle (table 6).

As a phase, dates were selected in which there was a coincidence of the dynamics of indicators for four out of nine indicators characterizing the expectations of the population. The match was considered with a lag of one quarter²¹. In accord-

²⁰ Compiled by the authors based on Rosstat data.

²¹ The lag of Q1 for the identification of the behavioral cycle is since behavior is derived from expectations combined with other factors. When identifying the peaks and bottoms of the cycle, we observe extremes defined for specific groups. Since the waves in the considered indicators did not always coincide, it is advisable to identify phase changes in the behavioral cycle during periods of coincidences of dynamics simultaneously by several indicators. This limitation is since the identification of the phases of the behavioral cycle occurs using indirect indicators of expectations.

ance with the premise that many actors demonstrate a reactive type of behavior, we see a certain expectation of a reactive majority. The peaks of the behavioral cycle are shifted towards the expectations of most people with a reactive type of behavior. The behavioral cycle is formed under the influence of individual groups that have their own characteristics at each stage of the cycle. It was possible to identify seven full-fledged behavioral cycles, starting from the fourth quarter of 1998. The eighth cycle has just begun at the time of the research.

Table 6. Identification of the phases of the behavioral cycle

Phase	Period	Number of matches	Cycle
Peak	3 rd –4 th quarter of 2001	4	Cycle 1
Bottom	1 st quarter of 2003	6	
Peak	2 nd quarter of 2004	5	Cycle 2
Bottom	1 st quarter of 2005	5	
Peak	2 nd quarter of 2007	5	Cycle 3
Bottom	4 th quarter of 2007	4	
Peak	3 rd quarter of 2008	8	Cycle 4
Bottom	1 st quarter of 2009	9	
Peak	2 nd quarter of 2010	7	Cycle 5
Bottom	1 st quarter of 2011	6	
Peak	2 nd quarter 2012	6	Cycle 6
Bottom	1 st quarter of 2016	4	
Peak	2 nd quarter of 2018	9	Cycle 7
Bottom	4 th quarter of 2018	9	
Peak	1 st quarter 2020	9	Cycle 8 (beginning)

It should be noted that the phases of the behavioral cycle have different degrees of intensity. In particular, the overall dynamics of the indicators under consideration are demonstrated during a period of significant challenges for the global economy, such as the Global Financial Crisis of 2008, as well as the COVID-19 pandemic. To assess the relationship between the considered indicators, it seems appropriate to analyze the conjugacy of the phases of the behavioral and economic cycle.

Stage 3. Superimposition of the identified stages of the behavioral cycle on the previously identified stages of the economic cycle

It is necessary to compare the existing phases of the behavioral and economic cycle. It is advisable to impose previously defined phases of the behavioral cycle

on the phases of the economic cycle to assess the level of their conjugacy. When assessing the conjugacy, it seems appropriate to use existing studies that have determined the phases of the economic cycle for the Russian economy²². The phases of the economic cycle do not always coincide, which determines the need for further studies of the material aspects of the economic cycle, as well as the high dependence of the results on the selected indicators (table 7). The discrepancy between the phases of economic cycles may be due to insufficient consideration of the behavioral component in the analysis and the orientation of general variables only on the material aspect of the economy.

Table 7. Assessment of the degree of conjugacy of the economic and behavioral cycles

Phase	[Dubovsky et al., 2015]	[Smirnov, 2020]	The coincidence of the economic and behavioral cycles
Peak	—	November 1997	There is no data on the behavioral cycle
Bottom	Q4 1998	September 1998	There is no data on the behavioral cycle
Peak	Q2 2008	May 2008	Q3 2008: peak of the behavioral cycle. At the same time, the cycle is shifted by Q1
Bottom	Q2 2009	May 2009	Q1 2009: bottom of the behavioral cycle. The bottom came earlier than the bottom of the general economic cycle
Peak	Q3 2012	—	The dating of the behavioral cycle partially coincided. Q2 2012: peak of the behavioral cycle
	—	December 2014	
Bottom	—	June 2016	The dating of the behavioral cycle coincided. Q1 2016: bottom of the behavioral cycle

A comparative analysis of the waves of the behavioral cycle with the general economic cycle shows their partial coincidence in different time periods. The coincidence is observed during the global financial crisis of 2008 and the crisis of 2014. Thus, the phases of the behavioral cycle coincide with the phases of the general economic cycle and, therefore, behavior can indeed be considered as an important component of the cyclical economy. When analyzing the economic cycle, it is advisable to consider both material and behavioral components.

As a result, the second hypothesis was confirmed. The coincidence of the phases of the behavioral and general economic cycles is probably linked to a signifi-

²² In further studies, it is possible, along with the behavioral cycle, to independently determine the general economic cycle as well. This step would significantly increase this study's volume, not allowing the authors to fully disclose the concept of the behavioral cycle.

cant external negative influence. The behavioral cycle is observed separately from the general economic cycle (the waves do not always coincide). However, during periods of economic upheavals, the degree of conjugation of the actors' moods with the dynamics of the material cycle increases, which leads to a change in the phase of the general economic cycle.

At the same time, there are small lags in the dating of cycles. The presence of lags is probably due to differences in the sources of the onset of the economic crisis. If the crisis has external causes, it initially takes place in the global economy, and is subsequently transmitted to the national economy. This fact was observed during the 2008 Global Financial Crisis, when the bottom of the behavioral cycle came in the 1st quarter of 2009, at a time when the bottom of the general economic cycle in the Russian economy came in the 2nd quarter of 2009²³. The deterioration of the dynamics of the global economy led to a distortion of the information background, because of which the bottom of the behavioral cycle was reached. The change in the behavioral component affected the dynamics of the overall economic cycle. When analyzing the conjugacy of the behavioral and general economic cycle, it is necessary to consider factors determining changes in the emotions of actors, for instance the dynamics of cash flows, the state of the information background, etc.

Conclusion

The study confirmed the existence of a behavioral cycle determining the change in the dynamics of actors' emotions. The behavioral cycle complements the general economic cycle by considering the propensity of actors to perform certain operations. The overlap of the waves of the material cycle with those of the behavioral cycle can lead to large-scale crises. The economic cycle cannot be stopped, but it is possible to affect the amplitude and adjust the timing of its onset, ensuring the necessary level of economic sustainability. The latter can be implemented by using behavioral tools.

Considering the behavioral cycle among the factors that form the economic cycle means abandoning the "mechanistic approach" that arises when explaining the cyclical nature of the economy only by the dynamics of material factors. Ignoring behavioral factors in predicting economic cycles reduces the ability of government agencies to implement countercyclical policies aimed at achieving the goals of national security and sustainable socio-economic development. The theoretical foundations laid down in the analysis of the behavioral cycle can be applied to the development of a strategic planning system.

The study proposes an original method of analyzing the behavioral cycle. Its empirical approbation was carried out on the example of the behavioral cycle in Russia. Empirical testing made it possible to confirm the formulated hypotheses. Considering the conjugacy of the behavioral cycle with the general economy, it is advisable to point out several key aspects.

²³ If there are external causes of the crisis, the behavior is likely to induce the appearance of a recession in the national economic cycle, acting as a channel for transmitting negative influence from the global economy.

First, it is necessary to identify the factors determining the dynamics of the behavioral cycle and the change of phases in the periods of increasing and decreasing waves. Since the end of 1998, seven complete phases of the behavioral cycle have occurred in Russia, varying in severity. The behavioral cycle is part of the economic cycle, and therefore the behavioral component is always present in the economic cycle. The coincidence of phases, especially at the minimum points, indicates the high role of the behavior of actors, formalized as a behavioral cycle, forming conditions for the development of crises. The key issue is to determine the factors of changing the phases of the behavioral cycle, as well as its relationship with various spheres of economic activity, i. e., the existence of a relationship between cash flows and financial volatility. The consequences of the behavioral cycle can be amplified due to the active digitalization of the economy, which significantly contributes to the structuring of the behavior of actors [Maslennikov, Lariionov, 2020a].

Secondly, an important aspect is the analysis of the duration of the phase of the behavioral cycle and structural conditions during which the dominant type of behavior of actors persists. In this study, the existence of short behavioral cycles was demonstrated. It can also be assumed that in addition to short-term cycles, there are also medium and long cycles²⁴. It is necessary, by analogy with the economic cycle, to identify different types of behavioral cycles depending on their duration. The existence of average behavioral cycles is associated with the dynamics of economic activity of different generations of actors. Long-term behavioral cycles may be associated with the retirement of generations of actors due to demographic factors, as well as a gradual change in the dominant type of behavior as the population ages. It is possible to assume, if its existence is confirmed, that the long behavioral cycle does not exceed 40 years.

Thirdly, the behavioral cycle describes the manifestation of various dominant types of behavior in society, reflecting dominant emotions. The behavioral cycle identifies the dominant moods of actors without singling out separate groups of actors with active, adaptive, and reactive behaviors. To develop methods for predicting behavioral dynamics and the formation of mechanisms for public administration of the behavior of actors, it is necessary to develop tools that allow for classifying actors depending on their type of behavior, as well as to research these groups not only according to their static characteristics, such as age, education, financial condition, level of expectations, and propensity to active economic actions, but also analyze these characteristics as they fluctuate. An example of such a policy is the practice of behavioral supervision implemented by the Bank of Russia²⁵.

It seems appropriate to introduce additional indicators to identify actors with different types of behavior with greater precision. The limitation for the analysis of the types of actors' behavior is the tendency of sociological surveys to assess the expectations of actors. Expectations are a more volatile indicator, the frequency of collection and interpretation of which is very limited. The type of behavior of

²⁴ The assumption of the existence of various types of behavioral cycles may also be the subject of other studies. Their confirmation requires obtaining high-frequency data on the mood of economic actors (at least monthly) for a long period of time.

²⁵ Report on the Results of the Behavioral Examination of Testing of Unqualified Investors. (2021) Moscow: Bank of Russia. URL: https://cbr.ru/Content/Document/File/120017/report_results_testing.pdf (accessed 06.01.2022).

the actor is a constant feature. Statistically assessing the distribution of actors by types of behavior could help to consider future behavioral reactions to economic fluctuations. Further research should be aimed at developing approaches to identifying the phases of the behavioral cycle in relation to various categories of actors demonstrating active, adaptive, and reactive types of behavior, as well as developing approaches to classifying types of behavioral cycles.

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