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The epistemological concept of the anthropogenic nature of uncertainty and risks in socio-economic processes

El concepto epistemológico de la naturaleza antropogénica de la incertidumbre y los riesgos en el proceso socioeconómico.

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ABSTRACT:
In the present article, it is shown that the uncertainty and risks in the economy result from the heteromorphicity and heterogeneity of current expectations and preferences of the economic agents, which, in turn, are formed taking into account the current technological structure prevailing in society, as well as the existing institutional and resource constraints. Based on detailed consideration of general characteristics of the current expectations and preferences of the economic agents, it is shown that the expectations and preferences of the economic agents change over time, while current volatility can be used as a quantitative aggregated measure of heteromorphicity of interests (motivation) of the economic agents in financial markets. The authors consider it necessary to conduct further studies of socio-economic processes in order to identify the essential attributes of intersubjective relations in the economy (their qualitative or quantitative characteristics) and to develop new (or adapt existing) models for analyzing and predicting the dominant type of interdisciplinary relationships in the economy that will make it possible to take managerial decisions with increased efficiency and reasonableness.
Keywords: socio-economic system, socio-economic

RESUMEN:
En el presente artículo, se muestra que la incertidumbre y los riesgos en la economía resultan de la heteromorfidad y la heterogeneidad de las expectativas y preferencias actuales de los agentes económicos, que, a su vez, se forman teniendo en cuenta la estructura tecnológica actual que prevalece en la sociedad. así como las limitaciones institucionales y de recursos existentes. Sobre la base de una consideración detallada de las características generales de las expectativas y preferencias actuales de los agentes económicos, se muestra que las expectativas y preferencias de los agentes económicos cambian con el tiempo, mientras que la volatilidad actual se puede utilizar como una medida cuantitativa agregada de heteromorficidad de intereses (Motivación) de los agentes económicos en los mercados financieros. Los autores consideran necesario realizar estudios adicionales de los procesos socioeconómicos para identificar los atributos esenciales de las relaciones intersubjetivas en la economía (sus características cualitativas o cuantitativas) y desarrollar nuevos (o adaptar los existentes) modelos para analizar y predecir los factores dominantes. Tipo de relaciones interdisciplinares en la economía que permitirán tomar decisiones gerenciales con mayor eficiencia y

processes, economic agent, heteromorphicity, heterogeneity, intersubjective relations, uncertainty, risks.

razonabilidad.
Palabras clave: sistema socioeconómico, procesos socioeconómicos, agente económico, heteromorfismo, heterogeneidad, relaciones intersubjetivas, incertidumbre, riesgos.

1. Introduction

Scientific paradigms in economy transform over time breaking new ground in the worldview, determined by the latest achievements of scientific, technical, and technological advancement. Economic science of the 21st century has faced with the need to rethink its conceptual foundations. Unfortunately, traditional economic theory does not have a universal conceptual framework to adequately describe most socio-economic processes and, therefore, it is not yet able to give practical recommendations on the choice of their further development trajectory.

The problem of the economic theory consists in the lack of a holistic systematic methodology for studying social processes (Kaluzhsky, 2013). This can be explained, among other things, by the fact that socio-economic systems (SES) are characterized, as a rule, by the nonlinearity of their development, significant dependence on the variation of initial conditions, the presence of alternative evolution trajectories, and the possibility of choosing from such alternatives. At that, both the choice itself, and criteria of choosing the optimal evolution trajectory of the SES out of the variety of alternatives are a rather challenging task, which not always has a unique solution, and, as a rule, largely has the nature of a heterogeneous subjectivity.

All this has predetermined the authors' research concerning the nature of risks in social and economic processes.

Since SES are quite diverse in nature and, as a consequence, the processes occurring in the SES have different basic features, the present work considers the processes taking place in the financial markets, which are taken as an example illustrating the main concepts under study. However, most of the findings are applicable to the SES of arbitrary nature.

2. On subjectivity in economics

Economics is not an exact science such as mathematics. Given the noted phenomenon of heterogeneous subjectivity, the definition of various terms by different authors in economic theory may differ (in terms of semantic content, the difference can be quite significant) even within the same scientific school, textbook, or article. The same term may have different definitions, or different terms may have roughly the same definition.

To explain the phenomenon of heterogeneous subjectivity, social sciences use the German term Verstehen, which denotes a comprehension of the essence of a process or phenomenon from inside through intuition and empathy, as opposed to knowledge obtained from outside through observations and calculations (Blaug, 1993). It is the concept of Verstehen that distinguishes social sciences from natural sciences, in which the observer is not a party to the process.

According to R. Heilbroner (1991), the problem of the conceptual framework in economics concerns, among others, the presence of invisible sociopolitical load (primarily of subjective nature) in the content of many economic terms. It is the subjectivity of economics as a scope of activity (see the phenomenon of Verstehen), and the anthropogenic nature of the economic theory provisions that make the economy difficult for a full-fledged formalized study. Indeed, all or almost all economic, financial, managerial, and other decisions are made by specific people, based on their subjective expectations and preferences concerning the future dynamics in a particular SES development. Below, the expectations and preferences of economic agents are discussed in more detail.

When evaluating the subjective nature of economics, the well-known physicist J.-P. Bouchaud (2008) notes that economic theory is based on too strong assumptions, which for some reason quickly become "paradigms" (for example, rational behavior of economic

agents, the invisible hand of the market, the effectiveness of the market), despite the fact that most of them do not stand the test of practice over time.

Therefore, often epistemological constructions of economic theory and, as a consequence, the conclusions, drawn from them, are characterized by the anthropogenic heteromorphicity and heterogeneity.

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3. Concerning the use of behavioral economics in research

Considering the modern tools of economics, it is impossible not to mention the growing popularity of methodological approaches based on the achievements of social psychology (the so-called, behavioral economics).

These approaches are being used for just a few decades, and therefore there are still few shreds of evidence proving the acceptability of their practical provisions in order to finally recognize the effectiveness of the application of social psychology in economic research.

In 2001, Professor E. Balatsky commented on the practical value of behavioral economics: "How to quantify the degree of trust or distrust of economic agents in relation to a particular firm, project, or event? If we cannot measure fundamental conditions and preferences, we cannot test a theory based on these concepts" (Balatsky, 2001).

On the above-mentioned remark of E. Balatsky, one can note that as early as in 1941, the work was published authored by T. Haavelmo "On the theory and measurement of economic relations" (1941), which offers not only theoretical and methodological approaches to the quantitative measurements of relations in the economy, but also the mathematical tools used for such measurements. Another article "Measuring expectations" was published by Ch. Manski in 2004, in which the author discusses the methodological aspects of measuring the expectations of economic agents (Manski, 2004). Moreover, in 2015, M. Kussy published the monograph "Current volatility. Methodological and applied aspects" (Kussy, 2015a), which considers the indicator of current volatility as an aggregate quantitative measure of expectations and preferences of economic agents with respect to the future dynamics of the market price as a financial instrument.

In addition to the above-mentioned works, one can propose at least an approach to quantitative modeling of heterogeneous behavior in the economy, presented in (Pennings et al., 2005), as well as mental models proposed by (de Figueiredo et al., 2006).

To protect the methodological utility of behavioral economics, it may also be recalled that G. Becker (1992), R. Lucas, Jr. (1995), D. Kahneman and V.L. Smith (2002), E. Ostrom and O.E. Williamson (2009), as well as R. Thaler (2017), were already awarded the Nobel Prize in Economics for their research in this field.

Consequently, a consistent study of the processes taking place in SES is impossible without taking into account the behavioral (anthropogenic) aspect inherent in such systems.

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4. Intersubjective relations in the economy as uncertainty and risk generator

4.1. General characteristics of preferences and expectations of economic agents and their impact on SES

The use of behavioral economics leads to the need to study the characteristics of the category such as "economic agent".

Economic agent is the subject of socio-economic relations, determined by the current development processes of a particular SES, implementing the current individual socio-economic functions, formed on the basis of current expectations and preferences of the economic agent, within the framework of its current subjective set of goals (with regard to a particular SES) and current restrictions, which by its actions (or inaction) can affect the

processes of adoption and implementation of socio-economic decisions in a particular SES.

In this definition, "current" is a keyword (important for further considerations), since the processes in the SES are dynamic in nature. Consequently, the functions, expectations, and preferences, as well as the totality of the economic agent's goals may change over time. The same observation can be attributed to the relevance of the constraints (technological, institutional, resource, and others) within which economic agent operates since they also change in time.

The notion of "economic agent" includes not only a specific individual involved in socio-economic processes (SEP), but also a set of subjects (starting with the state and intergovernmental organizations – to a group of individuals), united by a single set of socio-economic goals, not contrary to the individual sets of goals of each economic agent included in this aggregate. At that, SES can also act as an economic agent.

The set of economic agent's goals (in relation to the analyzed SES) is determined by:

• individual current expectations and preferences of the economic agent based on alternative evolution vectors of SES;

• current opportunities of the influence of the economic agent on the system (levers, available to the economic agent, which influence the processes taking place in the system);

• current constraints.

Constraints affecting the current set of economic agent's objectives and its capabilities to affect the processes taking place in the SES may be as follows:

• resource constraints in the broadest sense of the word (natural, labor, financial, and other resources needed to achieve a specific economic agent's objective);

• institutional constraints (any economic agent, when achieving the goal, must act within the existing rules of the game, defined by relevant institutions of a normative or formal nature, as well as relevant institutions of an informal nature, formed in a modern society);

• technical and technological constraints related to the current financial and economic activities of SES and economic agent;

• constraints of individual nature (individual characteristics of economic agent, determined by the specifics of qualification, life experience, and skills, mentality, psychology, etc.).

Economic agents can:

• collect, process, create, and distort information in the course of decision-making on effective impacts on SES, focusing on their own current expectations and preferences;

• change the current set of goals, focusing on their own current expectations and preferences, as well as the current state of the external (in relation to a specific economic agent) environment, and the current state of affairs in the SES itself;

• change the efficiency of their activity, adapting it in accordance with its current goals and information about its current state, the current state of the SES, and the current state of the external (in relation to a specific economic agent) environment;

• be willing and able to carry out actions in accordance with their current individual set of goals (personal interests) within existing constraints to achieve these goals.

Economic agents not only endogenously affect the changes taking place in SES (here economic agents act as thinking elements of SES), but also are a source of disturbances of exogenous nature in the SES dynamics (in this case, as a rule, economic agents are not elements of SES).

It should also be borne in mind that the expectations and preferences of a particular economic agent change over time. This is facilitated by the following factors:

• current changes taking place in the external (in relation to economic agent) environment (including technological, institutional, economic, political, and other changes affecting the current expectations and preferences of a particular economic agent);

• reflective processes occurring in a social medium that affect current expectations and preferences of particular economic agent;

• changes taking place in the resource base and in the system of constraints of a particular economic agent;

• other factors (primarily of socio-economic nature).

Depending on the strength and direction of such impacts, as well as capabilities, SES either accepts these impacts if they fit within its systemic set of objectives and constraints, or seeks resources and mechanisms to counter such impacts if these impacts conflict with the systemic set of objectives and constraints of the SES.

4.2. On heteromorphicity and heterogeneity of expectations and preferences of economic agents

SEP occur under the influence of various impacts on the socio-economic system, multidirectional and different in magnitude, caused by economic agents, (heteromorphicity). It should be noted that these impacts are formed based on the expectations and preferences of the economic agent, having a diverse, usually subjective nature of origin (heterogeneity).

It is exactly the heteromorphicity and heterogeneity of the current expectations of economic agent (individual understanding of alternative possibilities of the future evolution of the analyzed SES as a result of various endogenous and exogenous effects on the system including that caused by the economic agent), and current preferences of economic agent (individual views on the desired evolution direction of a particular SES from the standpoint of a particular economic agent), in accordance with the authors' hypothesis, that are a generator of uncertainty and associated risks in the SEP. Here, the word "current" is also important, because both the expectations and preferences of each economic agent can change over time.

The 1988 Nobel Prize winner in Economics M. Allais came to the conclusion that the vast majority of seemingly random events taking place in the SES, have an anthropogenic nature: random event in the SES seems random only at first thought, but a detailed retrospective study of the issue reveals the cause-and-effect relations influencing this randomness of anthropogenic factors (Allais, 1995).

Similar judgments about the anthropogenic nature of randomness in SEP are stated by R. Caballero and A. Krishnamurthy (Caballero and Krishnamurthy, 2008).

Therefore, the anthropogenic factor should be considered as the main source generating randomness, and, consequently, the occurrence of uncertainty and associated risks in SEP. It can be argued that in the majority, SEP are the dynamic result of joint interactions of current heteromorphic and heterogeneous expectations and preferences of the various economic agents, and their aggregate current impact on the SES under study.

In support of the previously stated hypothesis about the anthropogenic nature of impacts on SEP, one finds the following interpretation of the role of economic agent in the SEP: "Here appears in a sense the highest type of determinism determinism with an understanding of the ambiguity of the future and with the possibility of reaching the desired future. This is determinism that enhances the role of human" (Knyazeva and Kurdyumov, 1992, p. 20).

This hypothesis of the anthropogenic nature of uncertainty in SEP was confirmed in the works of V. Popov. "When studying the category of randomness in the framework of the philosophy of history and social philosophy, it is fair to note that the subject itself can act as a specific kind of randomness, and such a situation will be a good demonstration of the fact that the social subject is quite effectively able to influence both its internal development in terms of its prospects, and the totality of various processes, including economic, historical, and social ones" (Popov et al., 2015).

Confirmation of the thesis concerning heteromorphicity in the behavior of economic agent can be found in the works of L. Hansen and T. Sargent (2012). Heterogeneity in the behavior of economic agents, taking into account the diversity of their preferences, is considered by R. Radner (1979) and B. Allen (1981).

It is the anthropogenic nature of expectations and preferences of economic agent, as well as

the associated heterogeneity and heteromorphicity of subsequent impacts of economic agent on SES that complicate (in the most general case) the relevant analysis of SEP, and the prediction of SES behavior. It should also be noted that the expectations and preferences of economic agent, as well as the associated heterogeneity and heteromorphicity of subsequent impacts of economic agent on SES, should be considered in real-time mode (since not only the strength of such impacts changes over time but also the set of current impacts).

4.3. On heteromorphicity and heterogeneity of expectations and preferences of economic agents

Determinism in SEP coexists with randomnesses and interacts with them making the process of analysis and forecasting of SEP nontrivial.

Illustrating the last thesis and discussing the assumption of P.-S. de Laplace about universal determinism and the possibility of unambiguous prediction of the future (including forecasting of the SEP), expressed by him as early as in 1814, L. Mlodinow (2008) notes that several conditions should be fulfilled to make this statement rightful. First, the laws of nature must dictate a certain future, and one must know these laws. Secondly, one needs access to all data that fully describe the concerned system, and which is not subject to unforeseen influences. Finally, one needs a sufficiently broad mind or sufficient computing power to understand what the future, according to these laws, awaits society at the specified parameters of the present. However, writes L. Mlodinov, a serious question remains unsolved: "how the randomness affects our current status and how accurately we can predict future developments" (Mlodinov, 2008).

The aspects noted by L. Mlodinov complicate the analysis of SEP, because, as a rule, these conditions are practically not fulfilled in the course of such processes.

As for the generation of randomness in SEP and associated uncertainties and risks, the authors' interpretation of such a mechanism is briefly described below.

Within the framework of the current set of goals and constraints, a particular economic agent forms its current individual expectations and preferences with respect to the current state of affairs in a particular SES and possible trajectories of system evolution, which are most favorable for achieving the goals of this economic agent. Based on the formed current individual expectations and preferences, economic agent affects the SES within the framework of relevant restrictions and goal setting.

Given the multiplicity of economic agents in relation to the analyzed SES, these impacts are heterogeneous, not always rational in terms of optimizing the cost of available resources and maximizing the expected profit of economic agent, as well as heteromorphic (sometimes even mutually opposed).

At that, the intersubjective relations emerge among various economic agents, as well as between particular economic agent and investigated SES. These relations also change in time under the influence of various factors (first of all anthropogenic in nature).

Intersubjective relations among different economic agents and those between a particular economic agent and the analyzed SES are characterized by dynamic reflexive nature, which can be of the following types (depending on kind of impact on the SES evolution):

• reflexive intersubjective relations of a friendly type, influencing the evolution of SES in a single vector direction and, as a rule, increasing joint impacts on SES;

• reflexive intersubjective relations of antagonistic type, influencing the evolution of SES in opposite vector directions and, as a rule, reducing joint impacts on SES;

• reflexive relations of neutral type, which have little influence on the SES evolution.

The indicated reflexive processes in intersubjective relations among different economic agents and between the specific economic agent and SES are of dynamic iterative-subjective nature that is an additional source generating uncertainty and associated risks in the SEP.

Reflexivity, as a property of SES, makes the processes taking place in SES, outwardly

"random". In addition, most of the processes taking place in the SES are accompanied by bifurcations. At such points of possible branching of process dynamics, it is not always clear, which particular group of expectations and preferences of different economic agents will be stronger and will direct the process to the course which is most expected and preferred for the majority of economic agents affecting SES.

In this case, determinism in SES is a kind of aggregated complex attribute, which depends on the set of cause-effect chains formed as a result of dynamic interactions of current heterogeneous and heteromorphic expectations and preferences of different economic agents. It is the result of their joint impact on the studied SES, taking into account the reflexive nature of such processes, that forms the trajectory of the SES evolution.

But, since the formation of current expectations and preferences by specific economic agents is difficult to formalize, heterogeneity and heteromorphicity of such preferences and expectations (given the multiplicity of economic agents and the reflexive nature of any SEP, as shown by the example of financial markets (Kussy, 2015b), which are also little formalized, make it very difficult to determine the future evolution trajectory of the studied SES.

As can be seen from previous considerations, it is the anthropogenic factor that is a significant source of uncertainty and associated risks in SEP.

As for the quantitative measure of the level of heteromorphicity of expectations and preferences of economic agents in financial markets, it can be measured through the current volatility (Kussy, 2015a). Current volatility can also be seen as a measure of the risk of losses in transactions, as shown for financial markets (Kussy, 2017).

Various conflict situations can be observed in the SES: lack of mutual understanding between partners, unexpected illness of a principal project performer, untimely actions of suppliers and contractors, etc. All these circumstances are examples of anthropogenic factors in the SES, which affect the current intersubjective relations in the economy and can lead to increased uncertainty and associated risks in the SES.

As for the aggregate quantitative measure of the heteromorphicity of expectations and preferences of economic agent for SEP, not related to the financial market, it seems that the current volatility can also be used as such. But verifying this hypothesis requires additional research.

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5. Conclusion

As can be seen from the above, the source of generation of uncertainty and associated risks of SEP, in most cases, has an anthropogenic nature. It is associated with heteromorphicity and heterogeneity of expectations and preferences of economic agents, as well as further processes that accompany the formation of intersubjective relations in the economy.

The complexity and ambiguity of these processes, shown in the course of research, are determined primarily by factors of a subjective nature.

Economic agents are limited in the choice of their actions by technological opportunities, relevant institutional and other resource constraints. At that, it is impossible to conduct correct studies of SEP without taking these factors into account.

Further research should be carried out in order to identify the essential attributes of intersubjective relations in the economy (their qualitative or quantitative characteristics) and to develop new (or adapt existing) models for analyzing and predicting the dominant type of interdisciplinary relationships in the economy that will make it possible to take managerial decisions with increased efficiency and reasonableness.

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