Modeling the Management and Efficiency of the Speculative Capital Market

George Abuselidze[1](✉), Olena Kireitseva[2], Oksana Sydorenko[3], Viktor Gryschko[4], and Mariia Hunchenko[4]

[1] Batumi Shota Rustaveli State University, Ninoshvili, 35, 6010 Batumi, Georgia
george.abuselidze@bsu.edu.ge
[2] National University of Life and Environmental Sciences of Ukraine, Heroiv Oborony, 11, Kiev 03041, Ukraine
[3] National University of Kyiv-Mohyla Academy, Skovorody, 2, Kyiv 04070, Ukraine
[4] National University «Yuri Kondratyuk Poltava Polytechnic», Pershotravnevyi Avenue, 24, Poltava 36011, Ukraine

Abstract. The paper proves that as a result of the experience accumulation in using rigidly deterministic models, real opportunities have been created for the successful application of a more advanced methodology promoting modeling economic processes to consider stochastic and uncertainty: carrying out multivariate calculations and model experiments with a variation of the model design and its initial data; studying stability and reliability of the obtained solutions, identifying the zone of uncertainty, including reserves in the model: the use of techniques increasing the adaptability of the economic decisions in probable and unforeseen situations. The study outlines the general classification of economic and mathematical models including more than ten main features with the development of economic and mathematical research. The process of integration of different types models into more complex model constructions is carried out. It has also been proven that the formulated mathematical problem of the economic analysis can be solved by one of the most developed mathematical methods. It is emphasized that economic cybernetics makes it possible to analyze economic phenomena and processes as very complex systems from the point of view of the laws and mechanisms of control and the movement of information in them. It has been proven that many economic processes are studied by using econometric models, including ARMA models (mixed process of auto regression and moving average), GARCH (regressive models with conditional heteroscedastic errors), ECM (deviation correction models) and VAR (vector auto regression models). Accordingly, one of the important achievements is the ability to illustrate, using the constructed model, medium-term periodic fluctuations in technological changes and resource utilization due to external shocks associated with the development of technologies.

Keywords: Capital market · Speculative operations · Securities · Investment instruments · Speculator

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1 Introduction

Ensuring the stable development of the national market of speculative capital SOE is a prerequisite for the successful development of the real sector of the economy, since it provides the economy with a certain mobility, contributing to the overflow of financial resources from one industry to another and the technological modernization of the domestic economy. Currently, the capital coming from the export of agricultural and metallurgical products is not enough to reinvest in the modernization of the national economy. The development of high-tech and infrastructure industries in SOE, taking into account global demand trends, will allow the rapid accumulation of the capital within the country, and then it will be possible to invest in further transformation of the national economy.

The acceleration of the integration of the domestic economy into the world of economy increases the likelihood of external threats to the financial security of the country, because at the beginning of the economic crisis, capital outflows from regional financial markets abroad leading to the devaluation of the national currency, intensification of inflationary processes and the destabilization of the economic system [1, 2]. Taking this into account, research and disclosure of the economic essence, trends and contradictions in the development of the national market of speculative capital, the features of the mechanisms of its systemic regulation in the context of achieving the financial security of the country becomes relevant in the context of financial globalization. In addition, it is important to develop a modern financial theory of the systemic regulation of the capital market with the actualization of financial and competition policies.

The purpose of the article is to study the theoretical and methodological foundations of management and efficiency of the speculative capital market.

The theoretical foundations and practice of the securities market functioning, as well as the mechanisms for transforming the savings of business entities into investments through the securities market occupy a rather important place in the scientific research of foreign scientists: Pazarbasioglu & Ötker; C. A. Rodriguez; W. F. Bello et al.; Kletzer & Spiegel; A. Slobodianyk et al., and among others [3–7]. Modern features of the development of the securities market are considered in the works of the following scientists G. Abuselidze; J. Hull; I. Blank; J. Davis; T. Norfield; K. Singh; A. Steiner et al.; Xiao & Aydemir; J. D. Curto et al.; Zhang & Yue; Miao & LU; K. H. Liow; among others [8–20]. The research of both foreign and domestic scientists, are devoted to the problems of the stock market functioning and the study of the speculative movement of the investment capital E. Lesmana et al.; T. Choudhry et al.; Arnade & Hoffman; Floros & Vougas; W.F. Bello et al.; Slobodianyk & Abuselidze; Jylhä & Suominen; J. Rasmus; K. Peterson; D. Leblang [21–34]. Paying tribute to the scientific achievements of domestic and foreign scientists in the study of the development and functioning of the speculative capital market, it should be noted that the methodological foundations of the management and efficiency of the speculative capital market remain controversial and require further research.

2 Methodological Foundations

The theoretical and methodological basis are the principles of scientific knowledge, scientific achievements, reflected in the publications of domestic and foreign scientists in the field of economics, assessment and analysis of the management of the securities market, as well as forecasting heterogeneous financial time series.

The work applies the methods of logical, statistical, comparative analysis. In addition to general theoretical research methods, in the work, in order to build economic and mathematical models, methods for assessing forecast calculations, scenario modeling, factorial and graphical analysis were applied.

Classification of models for studying the economic processes and substantive problems, the models of the national economy as a whole and its individual subsystems and industries, regions, complexes of models of production, consumption, formation and distribution of income, labor resources, pricing, financial ties are distinguished.

In studies, at the national level, structural or structural-functional models are more often applied, since the interconnections of subsystems are of great importance for planning and management. Functional models are widely applied in economic regulation.

We can distinguish descriptive and normative models. Descriptive models explain observed facts or provide a probabilistic forecast. Normative models answer to the question: how should it be? An example of a normative model is the model of optimal planning, formalizing in one way or another the goals of economic development, opportunities and means of achieving them.

The descriptive approach is used to establish statistical patterns of economic processes, to study the possible development ways of any processes that do not change under conditions or proceed without external influences. Examples of descriptive models are production functions and customer demand functions based on the processing of statistical data. By the nature of the reflection of cause-and-effect relationships, there are rigidly determined models and models that take into account randomness and uncertainty. As a result of the accumulation of experience in using rigidly deterministic models, real opportunities have been created for the successful application of a more advanced methodology for modeling economic processes that take into account stochastics and uncertainty: carrying out multivariate calculations and model experiments with a variation of the model design and its initial data; studying the stability and reliability of the solutions obtained, identifying the zone of uncertainty, including reserves in the model: the use of techniques that increase the adaptability of economic decisions to probable and unforeseen situations. Models are spreading, they directly reflect the stochastics and uncertainty of economic processes and apply the appropriate mathematical apparatus: probability theory and mathematical statistics, game theory and statistical decisions, queuing theory, theory of random processes.

According to the ways of reflecting the time factor, economic and mathematical models are divided into: statistical and dynamic. In statistical models, all dependencies refer to one point in time. Dynamic models characterize the change in economic processes over time.

3 Results and Discussion

The general classification of economic and mathematical models includes more than ten main features. With the development of economic and mathematical research, the problem of classifying the applied models becomes more complicated. Along with the emergence of new types of models (especially mixed types) and new signs of their classification, the process of integrating models of different types into more complex model constructions is under way.

Economic and mathematical methods are applied in the field of mathematics, mathematical statistics and mathematical logic. The computer solution of economic and mathematical problems is implemented by using computational mathematics and the theory of algorithms.

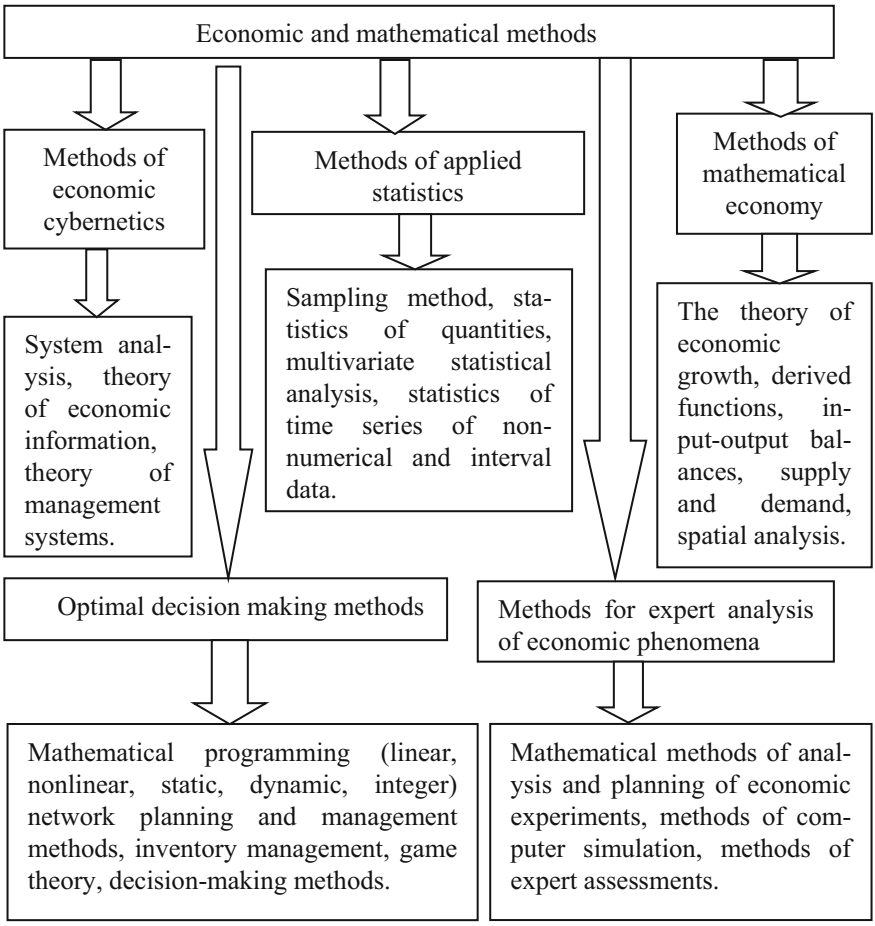


Fig. 1. Economic and mathematical methods in the study of management processes and the efficiency of the speculative capital market. Source: researched by the author based on summarizing research

Mathematical methods applied in the analysis can be systematized according to various criteria. The most appropriate is the classification of economic and mathematical methods by the content of the methods, that is, by belonging to a certain section of modern mathematics. Figure 1 shows the classification of economic-mathematical methods in accordance with the most frequently used sections of modern mathematics.

The formulated mathematical problem of economic analysis can be solved by one of the most developed mathematical methods. Therefore, the classification is largely arbitrary. For example, the problem of inventory management can be solved by mathematical programming methods and using queuing theory. A wide variety of methods can be applied in network planning and management. Operations research is sometimes defined so broadly that it encompasses all economic and mathematical methods.

The methods of elementary mathematics are applied in conventional traditional economic calculations when justifying resource requirements, accounting for production costs, justifying plans, projects, and balance sheet calculations.

The selection of classical methods of mathematical analysis in Fig. 1 is due to the fact that they are used not only within the framework of other methods, for example, methods of mathematical statistics and mathematical programming, but also separately. Thus, factor analysis of changes in many economic indicators can be carried out by using differentiation and other methods developed on the basis of differentiation.

Methods of mathematical statistics and probability theory are widely applied in economic analysis. These methods are applied in cases where the change in the analyzed indicators can be represented as a random process.

Statistical methods as the main means of studying massive, repetitive phenomena play an important role in predicting the behavior of economic indicators. When the relationship between the considered characteristics is not deterministic, but stochastic, then statistical and probabilistic methods are practically the only research tool. The most widely used mathematical and statistical methods in economic analysis are methods of multiple and pair correlation analysis.

To study one-dimensional statistical populations, a variational series, distribution laws, and a sampling method are applied. To study multivariate statistical populations, correlations, regression, variance and factor analysis are applied.

Econometric methods are based on the synthesis of three areas of knowledge: economics, mathematics and statistics. The basis of econometrics is an economic model, which is understood as a schematic representation of an economic phenomenon or process using scientific abstraction, reflecting their characteristic features. The most widely used method of analysis is "input-output". These are matrix (balance) models, built according to a checkerboard scheme and allowing representing the relationship between costs and production results in the most compact form. Convenience of calculations and clarity of economic interpretation are the main features of matrix models. This is important when creating systems for computer data processing. Mathematical programming is an important branch of modern applied mathematics. Methods of mathematical (primarily linear) programming are the main means of solving problems of optimization of production and economic activities. In essence, these methods are a means of planned calculations. Their value for the economic analysis of the fulfillment of the plans is that they allow to assess the intensity of planned targets, determine the limit of equipment

groups, types of raw materials, and obtain estimates of the scarcity of the produced resources.

Heuristic methods (solution) are non-formalized methods for solving analytical problems associated with a survey and expert assessments of specialists, express their opinion on the basis of intuition, experience, with mathematical processing of various opinions to find the correct solution.

It is obvious that all existing models can be conditionally divided into two classes - material models, that is, objectively existing ones, and abstract models, existing in human consciousness. One of the subclasses of abstract models are mathematical models.

The application of mathematical methods significantly expands the possibilities of economic analysis, making it possible to formulate new statements of economic problems, and improving the quality of management decisions.

Mathematical models of the economy, reflecting with the help of mathematical relationships the basic properties of economic processes and phenomena, are an effective tool for studying complex economic problems. In modern scientific and technical activities, mathematical models are the most important form of modeling, and in economic research and the practice of planning and management, they are the dominant form.

Capital market participants apply to supply and demand information while making the decision on buying and selling. Ordinary people buy more goods for lower prices and less when prices rise. In the financial market, players are not inferior to them in practicality. Each price is an instant agreement on value that is reached by all market participants, each price reflects the actions or lack thereof - of all market participants. Thus, the chart can provide a look at the psychological state of the capital market participants. Chart analysis - analysis of the behavior of market participants.

Chart analysts study the behavior of the market, trying to identify the current price patterns. According to the axiom about “repeating history in the market”, their goal is to find a winning option when repeating these models. It can take a trader from several months to several years of practical and theoretical work to study the “qualitative” identification of patterns on charts.

Assuming that history repeats in the market, therefore, it is necessary to develop a system capable of “remembering” past market situations and their corresponding consequences (that is, their continuation) in order to further compare with difficult situations in the market. The simplest solution to this problem would be a database in which you can record market situations encoded in a certain way. To make a forecast, it will be necessary to view all the records, which must be a huge number to achieve the forecast of the required accuracy. This idea is not constructive due to the complexity of data access, complexity of the criteria for comparing information.

The ability to “memorize” is inherent in systems implementing neural network principles of data processing. It is known that the forecast of a system based on artificial neural networks (ANN) can be trained in sufficiently large amounts of information, in which the system can detect dependencies, it cannot be detected when using other information processing methods.

The ANN idea has been developing for about half a century. Today, a large theoretical base has been accumulated in this area. In practice, predict systems based on neural network technologies are being introduced at an increasing pace (mainly in the USA).

The human brain neuron network is a highly efficient complex system with parallel information processing. It is able to organize (tune) neurons in such a way as to realize the perception of an image, its recognition many times faster than these tasks will be solved by the most modern computers. So, recognition of a familiar face takes place in the human brain in 100–120 ms, while a computer takes minutes or even hours for this.

Today, as it was 40 years ago, there is no doubt that the human brain works in a fundamentally different and more efficient way than any computer created by man. It is the fact stimulating and guiding the work of scientists on the creation and research of artificial neural networks for a number of years. The first experiments to reveal the secrets of the anatomical organization of the brain can be attributed to the research of Santiago Ramon y Cajal (1911) [35]. Using the method of staining neurons with silver salts, developed earlier by Camillo Golgi (silver selectively penetrates neurons, but does not impregnate other brain cells), Cajal saw that the brain has a cellular architecture. Cajal described neurons as polarized cells receiving signals from highly branched processes, called dendrites, and sendng information through unbranched processes called axons. The axon contacts the dendrites of other neurons through special structures - synapses affecting the strength of the impulse.

Golgi staining revealed a huge variety of neurons in terms of body shape, branching of dendritic parts, and axon length. Cajal found differences between cells with short axons interacting with neighboring neurons and cells with long axons projecting into other parts of the brain. Despite the differences in structure, all neurons conduct information in the same way. Connections between neurons are mediated by chemical transmitters - neurotransmitters - released from the endings of neuronal processes in synapses. We can assume that when passing through the synapse, the strength of the impulse changes by a certain number of times, which we will call the synapse weight. The impulses arriving at the neuron simultaneously via several dendrites are summed up. If the total impulse exceeds a certain threshold, the neuron is excited, forming its own impulse and transmiting it further along the axon. It is important to note that the weights of synapses can change over time, which means that the behavior of the corresponding neuron also changes. At the beginning of the century, neurophysiologists became aware of the extremely important role of synapses in the learning process. Indeed, brain signals passing through them can be amplified or attenuated in different ways. Noteworthy is the following fact, the brain of a newborn and an adult contains approximately the same number of neurons but only in an adult does it differ in the ordering of interneuronal synaptic connections. Perhaps, brain studying is the process of changing the architecture of the neural network, accompanied by the tuning of synapses.

Econometric methods of analysis are widely applied among researchers. Many economic processes are studied applying econometric models, including ARMA models (mixed process autoregression and moving average), GARCH (regression models with conditional heteroscedastic errors), ECM (deviation correction models) and VAR (vector autoregression models) [9, 14, 17–22, 36–48].

The model of the mixed process of autoregression and moving average order (p, q) is described by the following equation:

$$x_i = a_{i-1} + \cdots + a_p x_{i-p} + E_i - b_i E_{i-1} - \cdots - b_q E_{i-q} \tag{1}$$

where, xi is the value of the time series, iε1: n, n is the number of values of the series, E_i are independent, equally distributed random variables with an expectation equal to 0, αk, where kε1: p, bl, where l ε1: q are the coefficients of the model.

As a rule, research of ARMA models consists of several stages. At the first stage, the information is analyzed for stationarity. For this, visual analysis, analysis of the regression graph and its residuals, analysis of the graph of autocorrelation and partial autocorrelation functions, and Dickey-Fuller tests for unit roots are applied. If necessary, the output is modified to meet the requirements of the stationary process.

The next step is to evaluate the model. Modern computer packages include various methods for estimating ARMA (p, q) models: linear or nonlinear least squares method, maximum likelihood method. In particular, the estimates of the model coefficients must be significant, and the regression residuals e must be indistinguishable from the implementation of the white noise process (i.e., a process with constant mathematical expectation and variance and covariance function does not depend on a particular moment in time). To assess the significance of the coefficients, the Box-Pierce and Lewing-Box tests are applied. If the regression errors do not meet the necessary requirements, the model is modified and reevaluated.

If several models turned out to be adequate, then the choice between models of different orders is carried out according to two criteria: Akaike and Schwarz. Both criteria include 2 terms. The first term directly depends on the indexes of the order of the model p and q, and the second includes the sum of the squares of the residuals. The principle of model selection is to minimize the sum of the squares of the residuals and the order of the model. Therefore, in the best model, the values of the Akaike and Schwarz criteria are lower.

In a situation where for a regression model of the form:

$$x_i = \beta_l + \beta_2 z_{i2} + ... + \beta_k z_{ik} + u_i \tag{2}$$

where ui, are independent identically distributed centered random variables, it is assumed that the variance of errors at time it is equal to the conditional variance

$$\sigma_i^2 = V(u_1 | u_{i-1}, u_{i-2}, \ldots, u_{i-p}) = E^2\left(u_i^2 | u_{i-1}, u_{i-2}, \ldots, u_{i-p}\right)\Big) \tag{3}$$

and the conditional mathematical expectation E(ui | ui−1, ui−2,…, ui−n) is equal to zero, speaks of a model with conditional Heteroscedasticity [3, 20]. Such models are convenient for describing economic processes in which the amplitude of fluctuations of the indicator relative to its average tends to form temporary clusters - alternating periods of significant and minor deviations.

Various methods can be applied to simulate ui errors. In particular, they can be described as an autoregressive process, or as an ARMA (p, q) process. In the latter case, the model is called a generalized autoregressive model with conditional heteroscedasticity GARCH (p, q).

It can be shown that despite the fact that the conditional variance of errors in such models depends on time, the unconditional variance does not depend on time. Therefore, standard econometric procedures can be applied to evaluate the model.

When studying economic processes, a researcher often has several processes at his disposal, which, on the one hand, are non-stationary, and on the other hand, are related

to each other for economic reasons. If it turns out that the indicated processes of the first order of integration (that is, their first differences are stationary), and some linear combination of these processes is stationary, then a stable long-term relationship between the quantities under study can be expected. In other words, if, for example, in the period ti−1 consumption exceeded income, then in the period ti consumption will decrease, and vice versa. That is the tendency to return (in the long term) to some kind of sustainable development.

Similar patterns can be described using the vidhlin correction model, which in a situation for two rows is set as follows:

$$\Delta x_i = c_1 + c_2 \Delta z_i + c_3 (x_{i-1} - \beta_0 - \beta_1 z_{i-1}) + E_i \tag{4}$$

de x_i i z_i, i ∈ 1: n is a pair of studied indicators, E_i, i ∈ 1: n are independent identically distributed random variables, and the expression in brackets is a deviation correction mechanism.

For the successful application of such models, several conditions must be met. In particular, all coefficients ck, k are 1: 3 must be significant, coefficient c3 must be negative, and there must be no autocorrelation in the residuals.

A separate problem when using ESM models is finding the coefficient βl, l ∈ 1: 2. One of the most common methods for solving it is the construction of a regression xi on zi. From a theoretical point of view, estimates of the coefficients of such regression and estimates of their significance obtained using the least squares method do not make sense, since the processes xi on zi are nonstationary. However, the obtained linear combination, as the tests show, can satisfy the stationarity requirements.

In 1980, Christopher Sims proposed a new method for modeling economic equations, in which the traditional division into endo and exogenous variables did not occur [7, 30, 48]. In addition, there were no prior constraints on the variables. Instead, the economic model appeared directly in the analysis process. The proposed method of analysis is called the method of constructing vector autoregression models.

The construction of the model begins with setting a single vector of endo and exogenous variables xi, i ∈ 1: n. The model itself is described by us as follows:

$$\mathrm{X_i} = \sum\nolimits_{\mathrm{k-1}}^{\mathrm{t}} \mathrm{A_k X_{i-k}} + \varepsilon_\mathrm{i} \tag{5}$$

de $\mathrm{A_k}$, k ∈ 1 : l is a matrix of coefficients of the corresponding size, ε_i, i ∈ 1 : n is a vector of grants.

Suppose that the series $\mathrm{X_i}$ is stationary, and the following requirements are met for the error vector:

- $\mathrm{E}\varepsilon_\mathrm{I} = 0$;
- $\mathrm{corr}\left(\varepsilon_{\mathrm{i}_1}; \varepsilon_{\mathrm{i}_2}\right) = 0, \mathrm{i}_1 \neq \mathrm{i}_2$, then there is no autocorrelation of errors;
- The components of the vector ε_I at each fixed time instant $\mathrm{t_i}$ can generally correlate, that is, ϵ corr $(\varepsilon_{\mathrm{kt1}}; \varepsilon_{\mathrm{kt2}}) \neq 0, \mathrm{t}_1 = \mathrm{i}_2, \mathrm{k} \neq \varepsilon$.

Since, in the above assumptions, the autocorrelation formula of the residuals, the least squares method allows us to obtain consistent estimates. However, given that the

correlation matrix is not diagonal, it makes sense to use multiple estimates of the least squares method.

The choice of the lag order l apply the general-to-specific principle using the likelihood method. First, the regressions with the number of lags l and l - 1 are sequentially estimated, then for each of the obtained regressions the natural logarithm of the likelihood function is calculated. The difference between the calculated values follows the distribution law x2, if the model coefficients with lag l are insignificant. Accordingly, based on the obtained value of the statistics, it is possible to draw a conclusion about the significance of the corresponding coefficients and exclude/leave them in the model.

As a result of using the above described models and their modifications, the researchers managed to obtain a number of practical results. In particular, Torben Andersen, Tim Bollerslev, Francis Diebold and Clara Vega, having studied the dynamics of exchange rates, found that unexpected macroeconomic events cause abrupt changes in the conditional average of the studied indicators [6, 27, 30]. At the same time, the market reaction is asymmetric: negative news causes stronger changes than positive news. In addition, the researchers obtained a number of interesting facts about macroeconomic news which are significant for exchange rates, influencing "controversial" factors, how the indicators of the currency market are related to the indicators of the stock market. Many of the obtained results are also confirmed by the works of Martin Evans and Richard Lyon, Peter Veronesi and Pierre-Luigi Balduzzi, G. Abuselidze, J. Davis, T. Norfield, Slobodianyk and Abuselidze [8, 11, 12, 27].

In another work, Ted Jaditz, using econometric tools, explores seasonal fluctuations in the variance of various macroeconomic indicators [10]. In the course of his research, Jadits comes to the conclusion that a significant part of macroeconomic indicators are subject to significant seasonal fluctuations, which must be taken into account both when predicting their dynamics and when trying to control them. Another important conclusion of the researcher is the assumption that for a successful analysis of economic indicators it is necessary to decompose them into a trend, a periodic component and seasonal deviations.

When studying the periodic components in the dynamics of certain macroeconomic indicators, researchers are most often interested in how periodic seasonal fluctuations and business cycles are related [28]. In particular, in their work [3, 4, 25] Diego Comin and Mark Gertler, using econometric methods, evaluated a model allowing to take into account the influence of short- and medium-term fluctuations in output at the stage of business cycles. The constructed model incorporated the influence of such variables as technological progress, resource utilization, investment in research and development, labor costs, and others. One of the important achievements is the ability to illustrate, using the constructed model, medium-term periodic fluctuations in technological changes and resource utilization due to external shocks associated with the development of technologies.

4 Conclusions

In studies, structural or structural-functional models are often applied, since the interconnections of subsystems are of great importance for planning and management. Functional models are widely applied in economic regulation.

The general classification of economic and mathematical models includes more than ten main features. With the development of economic and mathematical research, the problem of classifying the applied models becomes more complicated. Along with the emergence of new types of models (especially mixed types) and new signs of their classification, the process of integrating models of different types into more complex model constructions is under way.

Economic cybernetics allows you to analyze economic phenomena and processes as very complex systems from the point of view of the laws and mechanisms of control and the movement of information in them. Methods of cybernetic modeling and systems analysis are most widely used in economic analysis. The mathematical theory of optimal processes is used to control technical and economic processes and resources.

Having studied the dynamics of exchange rates, we found that unexpected macroeconomic events cause abrupt changes in the conditional average of the studied indicators. At the same time, the market reaction is asymmetric: negative news causes stronger changes than positive news.

Accordingly, we have reviewed the main existing methods of analysis and forecasting of indicators of the futures contracts market. The features of these indicators that we have indicated determine the fact that the main attention is paid to the methods of identifying the periodic components of their dynamics. The revealed advantages and disadvantages of the existing methods were taken into account when developing a modification of the spectral analysis method.

References

1. Abuselidze, G.: European integration of georgia and financial-economic condition: achievements and challenges. Euro. J. Sustain. Develop. **8**(1), 53–68 (2019). https://doi.org/10.14207/ejsd.2019.v8n1p53
2. Abuselidze, G., Mamaladze, L.: The impact of the COVID-19 outbreak on the socio-economic issues of the black sea region countries. In: Gervasi, O., et al. (eds.) ICCSA 2020. LNCS, vol. 12253, pp. 453–467. Springer, Cham (2020). https://doi.org/10.1007/978-3-030-58814-4_32
3. Pazarbasioglu, C., Ötker, I.: Exchange market pressures and speculative capital flows in selected European countries. IMF Work. Papers **94**(21), 1–72 (1994). https://doi.org/10.5089/9781451921571.001
4. Rodriguez, C.A.: Managed float: an evaluation of alternative rules in the presence of speculative capital flows. Am. Econ. Rev. **71**(1), 256–260 (1981)
5. Kletzer, K., Spiegel, M.M.: Speculative capital inflows and exchange rate targeting in the Pacific Basin: theory and evidence. Managing Capital Flows and Exchange Rates: Perspectives from the Pacific Basin. Cambridge University Press (UK) for Federal Reserve Bank of San Francisco (1998)
6. Abuselidze, G., Slobodianyk, A.: Investment of the financial instruments and their influence on the exchange stock market development. In: Econ. Sci. Rur. Develop. Conf. Proc. **52**, 203–221 (2019)
7. Copeland, T., Koller, T., Murrin, J.: Measuring and Managing the Value of Companies. Wiley, New Jersey, USA (2001)
8. Abuselidze, G.: Georgia's capital market: functioning problems and development directions in association with European Union. J. Appl. Econ. Sci. **13**(7), 1929–1938 (2018)
9. Hull, J.: Options, Futures and Other Derivatives. University of Toronto, Prentice Hall, Englewood Cliffs. New Jersey. USA (2016)

10. Blank, I.A.: Enterprise asset and capital management (2003)
11. Davis, J.: Speculative capital in the global age. Race Class. **44**(3), 1–22 (2003). https://doi.org/10.1177/0306396803044003022
12. Norfield, T.: Derivatives and capitalist markets: the speculative heart of capital. Hist. Mater. **20**(1), 103–132 (2012). https://doi.org/10.1163/156920612x634735
13. Singh, K.: Emerging markets consider capital controls to regulate speculative capital flows. VOX Research-based policy analysis and commentary from leading economists, vol. 5, (2010)
14. Steiner, A., Steinkamp, S., Westermann, F.: Exit strategies, capital flight and speculative attacks: Europe's version of the trilemma. Eur. J. Polit. Econ. **59**, 83–96 (2019). https://doi.org/10.1016/j.ejpoleco.2019.02.003
15. Slobodianyk, A., Abuselidze, G., Tarasovych, L.: The mechanism of integration of the Ukrainian stock market in the world stock market. E3S Web Conf. **157**, 04034 (2020). https://doi.org/10.1051/e3sconf/202015704034
16. Liow, K.H.: Dynamic relationship between stock and property markets. Appl. Finan. Econ. **16**(5), 371–376 (2006). https://doi.org/10.1080/09603100500390885
17. Xiao, L., Aydemir, A.: Volatility modelling and forecasting in finance. In: Forecasting volatility in the financial markets, pp. 1–45. Butterworth-Heinemann (2007). https://doi.org/10.1016/B978-075066942-9.50003-0
18. Curto, J.D., Pinto, J.C., Tavares, G.N.: Modeling stock markets' volatility using GARCH models with Normal, Student's t and stable Paretian distributions. Stat. Pap. **50**(2), 311 (2009). https://doi.org/10.1007/s00362-007-0080-5
19. Zhang, B., Yue, L.: Do the exchange rates matter for chinese stock market: evidence from ARDL-ECM estimation. J. Finan. **7**, 26–35 (2002)
20. Miao, S. S., Lu, Q.: Transmission effects of international rice price on domestic market: Based on ECM model. Finance Trade Res. **1**, 27–34 (2012)
21. Lesmana, E., Susanti, D., Napitupulu, H., Hidayat, Y.: Estimating the value-at-risk for some stocks at the capital market in Indonesia based on ARMA-FIGARCH models. J. Phys: Conf. Ser. **909**, 012040 (2017). https://doi.org/10.1088/1742-6596/909/1/012040
22. Choudhry, T., Hasan, M., Zhang, Y.: Forecasting the daily dynamic hedge ratios in emerging European stock futures markets: evidence from GARCH models. Int. J. Bank. Account. Financ. **10**(1), 67–100 (2019). https://doi.org/10.1504/IJBAAF.2019.099316
23. Arnade, C., Hoffman, L.: The impact of price variability on cash/futures market relationships: implications for market efficiency and price discovery. J. Agric. Appl. Econ. **47**(4), 539–559 (2015). https://doi.org/10.1017/aae.2015.24
24. Floros, C., Vougas, D.V.: Hedge ratios in Greek stock index futures market. Appl Finan Econ. **14**(15), 1125–1136 (2004). https://doi.org/10.1080/09603100412331297702
25. Bello, W.F., Bullard, N., Malhotra, K., Malhotra, A.: Global Finance: New Thinking on Regulating Speculative Capital Markets. Zed Books (2000)
26. Abuselidze, G., Beridze, L.: The role of alternative investments in the development of capital markets: in terms of the transformation of Georgia with the EU. In: Proceedings of the 4th International Conference on European Integration (ICEI), pp. 29–41 (2018)
27. Slobodianyk, A., Abuselidze, G.: Influence of speculative operations on the investment capital: an empirical analysis of capital markets. E3S Web Conf. **234**, 00084 (2021). https://doi.org/10.1051/e3sconf/202123400084
28. Jylhä, P., Suominen, M.: Speculative capital and currency carry trades. J. Financ. Econ. **99**(1), 60–75 (2011). https://doi.org/10.1016/j.jfineco.2010.07.006
29. Rasmus, J.: Speculative capital, financial crisis and emerging epic recession. Critique. **37**(1), 31–49 (2009). https://doi.org/10.1080/03017600802598179
30. Peterson, K.: Speculative Markets: Drug circuits and Derivative Life in Nigeria. Duke University Press (2014). https://doi.org/10.1215/9780822376477

31. Leblang, D.: Political uncertainty and speculative attacks. Coping with globalization: Cross-national patterns in domestic governance and policy performance (2002)
32. Abuselidze, G., Slobodianyk, A.: Value Assessment of Shares of Corporate Issuers by Applying the Methods of Fundamental Analysis in the Stock Exchange Market. In: Bogoviz, A.V. (eds.) The Challenge of Sustainability in Agricultural Systems. LNNS, vol. 206, pp. 25–39. Springer, Cham (2021). https://doi.org/10.1007/978-3-030-72110-7
33. Vasylieva, D., Kudyk, T., Lisovska, V., Abuselidze, G., Hryvkivska, O.: Ensuring the issuance of investment-attractive corporate bonds. E3S Web Conf. **295**, 01008 (2021). https://doi.org/10.1051/e3sconf/202129501008
34. Slobodianyk, A., Abuselidze, G., Buriak, R., Muzychenko, A., Momot, O., Romanova, L.: Stock trading indices: a mechanism for attracting speculative capital. In: Beskopylny, A., Shamtsyan, M. (eds.) XIV International Scientific Conference "INTERAGROMASH 2021." LNNS, vol. 246, pp. 897–905. Springer, Cham (2022). https://doi.org/10.1007/978-3-030-81619-3_100
35. Ramón y Cajal, S.: Histología del sistema nervioso del hombre y de los vertebrados. Madrid, Ministerio de Sanidad y Consumo, CSIC (1911)
36. Wurtz, D., Chalabi, Y., Luksan, L.: Parameter estimation of ARMA models with GARCH/APARCH errors an R and S plus software implementation. J. Stat. Softw. **55**(2), 28–33 (2006)
37. Karanasos, M.: Prediction in ARMA models with GARCH in mean effects. J. Time Ser. Anal. **22**(5), 555–576 (2001). https://doi.org/10.1111/1467-9892.00241
38. Ghahramani, M., Thavaneswaran, A.: Financial applications of ARMA models with GARCH errors. J. Risk Finan. **7**(5), 525–543 (2006). https://doi.org/10.1108/15265940610712678
39. Boubacar Maïnassara, Y., Saussereau, B.: Diagnostic checking in multivariate ARMA models with dependent errors using normalized residual autocorrelations. J. Am. Stat. Assoc. **113**(524), 1813–1827 (2018). https://doi.org/10.1080/01621459.2017.1380030
40. Sun, H., Yan, D., Zhao, N., Zhou, J.: Empirical investigation on modeling solar radiation series with ARMA–GARCH models. Energy Convers. Manage. **92**, 385–395 (2015). https://doi.org/10.1016/j.enconman.2014.12.072
41. Wang, Y., Wu, C.: Forecasting energy market volatility using GARCH models: can multivariate models beat univariate models? Energy Econ. **34**(6), 2167–2181 (2012). https://doi.org/10.1016/j.eneco.2012.03.010
42. Paolella, M.S.: Linear Models and Time-Series Analysis: Regression, ANOVA, ARMA and GARCH. Wiley (2018). https://doi.org/10.1002/9781119432036
43. Thornton, M.A., Chambers, M.J.: The exact discretisation of CARMA models with applications in finance. J. Empir. Financ. **38**, 739–761 (2016). https://doi.org/10.1016/j.jempfin.2016.03.006
44. Nwogugu, M.: Further critique of GARCH/ARMA/VAR/EVT Stochastic-Volatility models and related approaches. Appl. Math. Comput. **182**(2), 1735–1748 (2006). https://doi.org/10.1016/j.amc.2006.01.080
45. LeSage, J.P.: A comparison of the forecasting ability of ECM and VAR models. Rev. Econ. Stat. **70**(4), 664–671 (1990). https://doi.org/10.2307/2109607
46. OECD Composite Leading Indicators: Turning Points of Reference Series and Component Series (2014)
47. The international banking market report: Statistical Annex (2021). https://www.bis.org/statistics/index.htm?m=1037
48. The world federation of exchanges 2017 full year market highlights. https://www.world-exchanges.org/home/index.php/news/world-exchange-news/the-world-federation-of-exchanges-publishes-2017-full-year-market-highlights