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Financial Instruments of Economic Mechanisms for Strategic Development of Science and Education: Ecosystem Approach

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ABSTRACT

The authors substantiate the importance of choosing efficient financing instruments for the successful functioning of economic mechanisms that ensure the implementation of strategic priorities for economic development. The study shows that the spheres of science and education have a direct positive impact on the growth of the economy, being important priorities and drivers of economic development. Accordingly, it is necessary to develop clear strategic guidelines for the development of these areas and define financial instruments embedded in economic mechanisms to ensure their practical implementation. In this regard, **the aim** of the study is to conduct a retrospective analysis of science and education funding, considering international and domestic experience, to propose the conceptual content of sectoral strategies for the development of science and education at different levels of the economic hierarchy, and to identify financial instruments to ensure appropriate strategies. Based on the use of theoretical, empirical, comparative, institutional, and evolutionary analysis of international and domestic experience in science and education funding, the expediency of implementing an ecosystem approach to the development and funding of these areas is substantiated, which makes it possible to unite all interested participants in socio-economic ecosystems through partnerships and resource flows. The paper substantiates the importance of distinguishing between sectoral strategies for the development of science and education and suggests the content of the corresponding strategies at the macro-, meso-and micro-levels of the economy. The research contains a comprehensive analysis of the financing instruments and economic mechanisms for the development of science and education in Russia from 1992 to the present, taking into account their effectiveness. It also includes the study of new promising instruments for science and education. Based on the results of this analysis, the authors **conclude** that it is advisable to rely on those financing instruments that have a self-reproducing nature and allow forming the economy of science on the basis of the ecosystem approach and assume a balance of private and public funding.

Keywords: financial instruments; science and higher education funding; strategic development; transformation of the spheres of science and education; ecosystem approach; economic mechanisms; sectoral strategies

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INTRODUCTION

Finance in the modern world of science and education needs effective instrumental support. This will enable financial support instruments to become a basic element of economic mechanisms, determining the effectiveness of the implementation of various priorities for the development of society. The effectiveness of financial instruments in ensuring economic performance is determined by how correctly strategic priorities and adequate development mechanisms are chosen and the tools for their financial support are correctly formed. It is about the importance of coordinating relations in the system of "strategic development priorities — economic mechanisms for their implementation — financial instruments of support".

In the transformation of the Russian economy in accordance with the given principles, directions and mechanisms of strategic development, the role of the main driver reasonably belongs to science and education. The scientific sphere creates a scientific and technological basis for the modernization of industries and territories, which ensures economic growth and brings the economy to a new technological level. The results of scientific research are associated with sectoral priorities for the transformation of the economy and focuses of industrial policy, with the achievement of sustainable development goals and the mitigation of strategic risks and threats to national security.

According to the results of varous research, there is a close positive relationship between scientific and technological achievements and economic growth [1]. Jokanović, B. Lalic, M. Milovančević, N. Simeunović and D. Marković prove the impact of scientific and technological development on economic growth using artificial neural networks [2].

The study of the function of knowledge production, which is central to growth models based on research and development, is carried out in the studues of Yasser Abdih and Frederick Joutz [3].

Mingran Wu, Min Zhao, Zhaodan Wu prove that scientific and technological innovations are a key driving factor in economic development and social progress on the example of the regions of eastern China [4].

Philippe Aghion and co-authors explore the impact of science, technology and innovation on economic development and growth [5, 6] and attempt to apply "systems-theoretic" approaches to the interdependent study of policy issues related to the dynamics of science, technology and innovation and economic growth [7]. Scholars point out that technology and innovation policies for economic growth are widely recognized, but they immediately become politically controversial when their implementation goes beyond supporting "far from commercialization" research and includes specific details that affect various markets, institutions and industries [7].

Further, high-quality education, ultimately focused on the use of modern digital transformation opportunities, is the main condition for the development of human capital, improving the quality of life and well-being of the population, as well as the most important factor in economic development in general [8, 9]. The underdevelopment and spread of education are the reasons why a number of developing countries cannot realize the full package of benefits of technological progress [10].

Studies conducted using empirical data for Bosnia and Herzegovina confirm the significant positive role of science and education in economic development [11].

An assessment of the relationship between higher education and economic growth obtained as a result of a longitudinal study of European regions over 2000–2017, showed that an increase in the number of universities in a region contributes to stronger economic growth in this region, and the growth of GRP per

capita is largely due to the expansion of higher education [12].

The study of Fateh Habibi and Mohamad Amjad Zabardast shows the relationship between education and the impact of digitalization on economic growth [13]. For example, in countries with better access to education, information and communication technologies have a more beneficial effect on economic growth and contribute to the expansion of economic value creation through the Internet [13].

Various studies confirm the positive impact of education on economic growth [14, 15]. At the same time, it is necessary to increase the efficiency of investments in higher education, optimize the distribution of resources in the system of higher education and science, and improve the quality of higher education to ensure the dynamic development of the economy [16].

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Consequently, science and education play a key role in modern society, determining the progress of modern high-tech production and the success of the sustainable transformation of the economy. Moreover, it is important how the development of science and education is regulated. For example, in Russia, the Strategy for Scientific and Technological Development of the Russian Federation notes that between 2004 and 2018, "the number of scientific workers under the age of 39 has increased by about 30 percent, and the general age structure of scientific personnel has noticeably leveled off. Russian schoolchildren and students traditionally find themselves among the leaders of international competitions in the field of natural and technical disciplines, but not all of them fulfill their potential in this area. This does not allow overcoming the existing negative trends in terms of the demographic state, qualifications and level of mobility of Russian researchers".[1] In this context, on the one hand, it is necessary to develop strategies for the development of these sectors of the economy, search for mechanisms and development tools that are adequate to the conditions of the internal and external environment. On the other hand, in practice those strategies are implemented that have sufficient and effective financial support, which determines the importance of choosing the appropriate tools.

Studies of sources and financial instruments for ensuring the development of science and education are conducted actively by various countries, invariably maintaining their relevance and debatableness [18–26].

Foreign experience and best practices in financing science and education can and should be used, but rationally and partially, since financial instruments should be formed in accordance with the content of countries' strategies for the development of science and education and take into account the effectiveness of the accumulated experience of their financing. The analysis showed that in the scientific literature there is a gap between the recognition of the leading role of science and education in economic development and the content of strategies and tools for financial support for the development of these areas. With this in mind, this study is aimed at a retrospective analysis of the financial instruments for science and education, considering world and domestic experience, the conceptual content of the strategies for the development of science and education at different levels of the hierarchy of the economy and the specification of financial

[1] Decree of the President of the Russian Federation of December 1, 2016, No. 642 "On the Strategy for the Scientific and Technological Development of the Russian Federation". URL: http://kremlin.ru/acts/bank/41449 (accessed on 02.07.2021).

Table 1

Expenditure on education, 2018

Country	Expenditure on education, mln USD	Expenditure on education, % of GDP	Government expenditure on education, % of GDP	Non-government expenditure on education, % of GDP
Russia	156,250.6	4.1	3.6	0.5
Australia	80,880.1	6.6	4.3	2.3
US	198,028.5	6.7	4.5	2.2
Germany	229,517.5	5.2	4.5	0.7
Italy	110,769.6	4.4	3.8	0.6
New Zealand	13,708.5	7.3	5.4	1.9
USA	–	6.1	4.2	1.9

Source: compiled by the authors.

instruments for providing appropriate strategies. At the same time, the main attention is focused on the areas of higher education and science and universities as their main subjects.

WORLD EXPERIENCE IN HIGHER EDUCATION AND SCIENCE FUNDING: INSTRUMENTAL COMPONENT

An analysis of the world experience in financing science and higher education shows that the effectiveness of specific financial instruments is determined by the consistency of their integration into existing economic mechanisms. Financial instruments should be considered in their respective social and economic context. Higher efficiency is demonstrated by those tools that are adaptive in relation to other economic factors.

In most continental European countries, higher education is primarily free. At the same time in other advanced economies (including the US, UK, Australia, and New Zealand) students must pay university fees, often using loans. Different higher education financing instruments show different performances in different countries. Thus, Ngo Van Long believes that a state-run conditional income loan scheme (according to which the amounts that people must pay in a certain period depend on their income in this period) is an effective and fair way to finance higher education [15]. Further, a number of scholars note that the US student loan system is experiencing significant difficulties; in 2018, about 7 million borrowers were in default, and the amount of overdue debt amounted to more than $ 1.3 trillion [27]. This is largely determined by the characteristics of the education financing instrument (fixed payments over a certain period to pay off a student loan). The instruments of England and Australia, which use the system of loan repayment considering income in a specific period of time, are considered to be more flexible and efficient [27]. *Table 1* shows spending on education in different countries in an aggregated form.

It should be noted that it is in Australia, England, New Zealand and the United States

that non-state expenditure on education in relation to GDP is about 2%.

In turn, Limor Hatsor notes that during the transition of a number of countries from public to private financing of higher education (through student loans), the corresponding financial decisions have become an individual choice, the risks of which are due to the inevitable collision of potential students with uncertainty about their future human capital [18].

Economic factors influencing the educational choice of potential students (predicted future salary, tuition costs, the possibility of budgetary support, etc.) were analyzed using fuzzy logic methods in the studies of A. A. Tarasyev, G. A. Agarkov, C.A. Ospina Acosta, V.A. Koksharov [28].

Attempts to form effective instruments for financing higher education, involving a combination of public and private funding, but with a predominant reliance on the private sector, are being undertaken by South Korea [30].

W. James Jacob, Ka Ho Mok, Sheng Yao Cheng, Weiyan Xiong show that in today's global environment, national competitiveness is determined by university innovation and development based on a large-scale study of the development effectiveness and financing mechanisms of higher education systems in China, Hong Kong and Taiwan. Since the beginning of the 21st century, higher education in this region has been privatized, universities are forced to look for alternative sources of funding, and not depend solely on the state. There is also a growing need for partnerships between universities and industry [31].

An analysis of the European experience shows that the partnership of universities and corporations can create conditions for expanding the participation of the industry in the financing of higher education, but the growth of investment in education must be accompanied by an adequate performance by universities of their role in the triple helix model, which is implemented in close interaction between the state, universities and business in the innovation process [20].

Over the last 40+ years, higher education in the UK has moved from a publicly funded system to a mixed public and private funding system driven by a consumer market based on student loans, in which both the postgraduate student and the institution share a significant responsibility in the total cost of tight state control [32]. Restrictions on public funding, increased competition, and drastic reductions in resources per student have institutionalized constant pressure on universities to reduce costs, leading to the development of effective financial management. This has become the main factor in the formation of market culture and the high efficiency of higher education in the UK in terms of the ratio of invested financial resources and the results obtained [32].

When considering the scientific and technological areas in the activities of institutions of higher education and science, it is important to note that world experience indicates that the lack of funding to ensure the transfer of scientific ideas and developments from universities to industry is a serious obstacle to the effective commercialization of university technologies [21–23]. To address this problem, universities have invested in creating internal funding mechanisms to support translational research and stimulate the growth of academic spin-offs, often in collaboration with government agencies [21]. Various support mechanisms aim to address funding gaps, both as a general policy framework and through specific institutional initiatives, including university accelerators and incubators, innovation programs, start-up competitions, and university-run seed funds [33–35]. At the same time, administrators of financial programs to support technology transfer at universities should strive to establish and develop fruitful and systematic links and cooperation with external investors to create a comprehensive and effective funding system [36].

As the analysis of foreign experience shows, despite the different combination of funding tools for science and education and their different performance, the relevance of co-financing the development of universities with the involvement of various actors and sources and building partnerships with industry and the state to achieve significant results is consistently recognized. Scientists also highlight the importance of coordinating relations and interaction of all participants in the financing of higher education in student loan mechanisms (students, banks, universities) [37]. This gives grounds to conclude that it is expedient to develop tools for financing science and education from the standpoint of the ecosystem approach. Under the socio-economic ecosystem in this case, in accordance with the definition of G.B. Kleiner is understood as "a localized complex of organizations, business processes, innovative projects and infrastructure formations, capable of long-term independent functioning due to the turnover of resources, products and systems" [38]. In the conditions of the new economy, it is ecosystems that have significant opportunities in the context of solving the problems of strategic development [39]. In this case, we are talking about financing not individual entities in the field of science and education, but about creating financial incentives for scientific and educational ecosystems, in which symbiotic and partnership relations ensure more efficient distribution and rational use of financial resources.

INSTRUMENTS FOR FINANCING SCIENCE AND EDUCATION IN RUSSIA

In the Russian Federation for the period from 1995 to 2021, a number of economic, financial and legal instruments related to the innovative transformation of science and education have been implemented and continue to be implemented. At the same time, the problem remains important in terms of the use of financial instruments in the scientific sphere, the assessment of the payback of developments, the expected return from them, and the overall impact on the technological development of the economy [40].

One of such financial instruments of the transformation mechanism is the Order of the Government of the Russian Federation of April 9, 2010 No. 218[2] (hereinafter — Order-218). Order-218 provides for state support for the development of cooperation between enterprises in the industrial sector, Russian educational institutions of higher education, and scientific organizations through joint research and development work ordered by enterprises in the real sector of the economy from universities and scientific institutions.

The mechanism proposed by the state in the form of Order-218 is implemented through subsidizing research and development work in order to stimulate scientific and educational activities in Russian universities, use the potential of Russian educational and scientific organizations for industrial enterprises to develop science-intensive production and innovative activities in the Russian economy. It should be noted that in accordance with the requirements for the implementation of the project, for 1 invested state ruble, it is necessary to attract 1 ruble of extra-budgetary funds, i.e. ensure 100% co-financing of the project. Each organization — the winner of the competition receives up to 100 million rubles per year, and the project is carried out for three years.

This financial instrument of the transformation mechanism has been implemented for more than 10 years (from 2010 to the present), and its financial support for the entire period of the project is more than 50 billion rubles of subsidies and

[2] Order of the Government of the Russian Federation of April 9, 2010, No. 218 "On approval of the Rules for granting subsidies for the development of cooperation between Russian educational institutions of higher education, state scientific institutions and organizations in the real sector of the economy in order to implement comprehensive projects to create high-tech industries" (as amended on February 15, 2021).

more than 64 billion rubles of co-financing from extrabudgetary sources. From 2010 to 2018, 10 competitions were held, as a result of which 364 projects for the formation of high-tech production were implemented and continue to be implemented.[3]

Further, it should be noted that over the eight years of the implementation of this financial instrument of the transformation mechanism, a wide range of results have been achieved:

1. More than 5000 students, 2000 graduate students, and 4000 young scientists took part in R&D, the share of their salaries was more than 55% [41]. More than 8,000 jobs have also been created, including about 5,000 jobs for young scientists (specialists), which makes it possible to call this financial instrument an effective element of a transformational mechanism for supporting young scientists, graduate students, and students.

2. During the implementation of this measure, 6352 scientific articles were published, including 1385 articles in foreign journals indexed in the Web of Science, Scopus, Web of Knowledge, Astrophysics, PubMed, Mathematics, Chemical Abstracts, Springer, Agris, GeoRef. Also, the significant scientific results of the project include the number of Russian and foreign patents filed and received — 1854 applications and 1214 patents, respectively.

3. During the implementation of Order-218 as a financial instrument of the scientific and technological transfer mechanism, about 500 units of innovative products were developed, of which 316 were sold at the stage of mass industrial production and in general over 2010–2017 new (improved) products were produced with worth more than 770 billion rubles.[4]

The effectiveness of this financial instrument is confirmed by the fact that for each ruble of budgetary funds, products worth at least 11 rubles were produced, and if extra-budgetary co-financing is taken into account, then within the framework of the project, products worth 5.5 rubles were produced for each ruble of subsidy received.

Table 2

Financial support for Project 5–100

Year	Subsidies, mln rubles
2013	8,700
2014	10,150
2015	10,140
2016	10,927
2017	10,310
2018	9,908
2019	9,901
2020	10,072
Total	80,108

Source: compiled by the authors on the basis of the Decree of the Government of the Russian Federation "On subsidies provided from the federal budget for state support of the leading universities of the Russian Federation in 2013–2020".

Moreover, as a tool, it should be noted the action plan for the development of leading universities, which provides for increasing their competitiveness among the world's leading scientific and educational centers (Project 5–100),[5] which was implemented in 2013 and was aimed at improving the quality of education, developing science, strengthening interaction with enterprises in the real sector of the economy, the development of human resources, internationalization and the formation

[3] Analytical materials of the Ministry of Education and Science of Russia. URL: http://p218.ru/ (accessed on 28.06.2021).

[4] Analytical materials of the Ministry of Education and Science of Russia. URL: http://p218.ru/ (accessed on 28.06.2021).

[5] Order of the Government of the Russian Federation of October 29, 2012, No. 2006-r "On approval of the action plan for the development of leading universities, providing for increasing their competitiveness among the world's leading scientific and educational centers".

of a reputation both among the academic community and among employers.[6] The implementation of this project was carried out by 21 universities: in 2013, 15 universities were selected, and in 2015–6 universities.

It should be noted that over the six years of the implementation of this project, a wide range of results have been achieved[7]:

- the number of enterprises that are practice bases increased from 15,673 in 2013 to 36,006 in 2018;
- in 2018, 409 educational programs leading to obtaining double diplomas were implemented, since 2013 more than 1.5 thousand new educational programs have been introduced, developed jointly with leading foreign and Russian educational institutions of higher education;
- since 2013, the number of young scientific and educational research workers (ERWs) involved [42] has amounted to about 7.5 thousand people;
- in 2019, more than 10 thousand programs of international and domestic academic mobility of the ERWs were implemented in the form of internships, advanced training, professional retraining and other forms, an increase compared to 2013 amounted to 2.5 times (2013–3924 programs); also, in 2019, 21,598 foreign and Russian faculty members visited the winning universities;
- the proportion of foreign citizens from among the ERWs in the total number of ERWs increased five times (from 2013–0.8% to 2018–4%); the number of foreign researchers — by 3.9 times (from 2013–428 people to 2018–1664 people).

It is important to note that the financial support of Project 5–100 from 2013 to 2020 at the expense of subsidies amounted to about 80 billion rubles (*Table 2*). At the same time, co-financing from extrabudgetary sources, which is mandatory in accordance with the requirements for the implementation of Project 5–100, amounted to more than 55 billion rubles for the entire implementation period.

Many governments use financial mechanisms similar to the Russian Project 5–100: China Excellence Initiatives (Project 211), Centres of Excellence in Finland. These projects/programs have been implemented since 1995. In South Korea (Brain Korea 21) since 1999, in Canada (Canada Research Chairs Program) since 2000.[8] Their specific design is determined by the content of the respective strategies for the development of science and education.

STRATEGIC COMPONENT OF REALIZING THE POTENTIAL OF SCIENCE AND EDUCATION: ECOSYSTEM APPROACH

Despite many connections that permeate the spheres of science and education, their interconnectedness and interdependence, the corresponding systems solve different problems of transforming the economy. This actualizes the development of sectoral strategies for the development of the education system and the system of science and higher education. Currently, there are no coherent strategies for the development of these systems and corresponding funding mechanisms.

Various goals, objectives, institutions, and mechanisms associated with the transformation of these areas in accordance with the responses to major challenges and more local problems are distributed across various strategies, programs, and projects of different directions and levels, development efficiency is often recorded as secondary formal indicators. As a result, a large number of barriers, both semantic and resource-based, arise to the systematic development

[6] Order of the Government of the Russian Federation of March 16, 2013, No. 211 "On measures of state support for leading universities of the Russian Federation in order to increase their competitiveness among the world's leading scientific and educational centers".

[7] Analytical materials of the Ministry of Education and Science of Russia. URL: https://www.5top100.ru/news/ (accessed on 28.06.2021).

[8] The main results of the implementation of Project 5–100 in 2013–2020 FGANU "Center for Sociological Research". Moscow; 2020. p. 68.

of the scientific and educational spheres, which, in turn, acts as a deterrent to the transformation of the country's economy at all levels of government. Socio-economic, scientific, technical, digital, educational, financial inequality is accumulating between different economic entities, which, on the one hand, significantly reduces the connectivity of the entire economic system, on the other hand, does not allow reaching a critical mass of human capital with those qualitative characteristics that necessary for a successful systemic transformation of the economy.

In order for the systems of science and education to realize (to achieve) their purpose (mission) in this context, it is first of all necessary to develop specialized sectoral strategies for the development of these systems and to carry out their structural decomposition. Such a division will make it possible to form clear guidelines and identify a qualified customers of multi-level systems working to implement the overall strategy for transforming the Russian economy. Thus, from the personnel point of view, the goal of the strategy for the development of the system of science and higher education is the reproduction of scientific and educational research personnel. A necessary condition for achieving this goal is the creation of a qualified customer in the face of industrial partners, universities, research organizations and other entities interested in scientific transfer.

Despite the importance of strategizing the systems of science and education at the macro level, the high heterogeneity of territories, environments and spaces of Russia requires a combination of a universal strategic macroeconomic component with meso-economic strategies for the development of the territories under consideration, determined by territorial and sectoral features and embedded in them microeconomic strategies for the development of institutions of science and education.

Accordingly, at the macro level, the main accompanying guidelines for the development strategies of science and education systems should be:

- determination and fixation of sustainable transparent strategic goals on the long-term horizon of planning the development of science and education in conjunction with other economic development strategies;
- formation of an actual educational and scientific agenda;
- consolidation on one methodological platform of both new and already tested mechanisms and tools for the development of science and education, taking into account their institutional, organizational, managerial and resource support;
- development of new substantive criteria for the development of science and education with long-term trends and guidelines;
- development and creation of an intelligent mechanism for managing the development of science and education systems based on the concept of data-based management using digital technologies and building feedback [40];
- integration of information on a single platform of science and education and the formation of a verified knowledge space using digital technologies (primarily blockchain), the creation of verified knowledge bases, "live" laboratories for the implementation of relevant projects, which will make it possible to make a transition to a knowledge economy;
- development of conditions and creation of mechanisms for involving stakeholders in the development and implementation of strategies for the development of science and education on the basis of network and partnership mechanisms, including scientific and research and production organizations, educational institutions of all levels of training, alumni associations, industrial partners, specialized non-profit organizations, etc. Such mechanisms are joint working groups and development

Table 3

Science and education financial mechanisms

Implementation year	Financial mechanism — projects/programs	Project / program objectives	Financial support for the project/program
1992	Creation of the Russian Foundation for Basic Research (Decree of the President of the Russian Federation of April 27, 1992, No. 426 "On Urgent Measures to Preserve the Scientific and Technical Potential of the Russian Federation")	Conducting a competitive selection of the best science projects from among those submitted by scientists on their own initiative, and subsequent organizational and financial support for supported projects	Annually, financial support changed from 18 million rubles in 1993 to 11,578 million rubles in 2017 [Website of the Russian Foundation for Basic Research. URL: https://www.rfbr.ru/rffi/ru/fundbudget (accessed on 02.07.2021)]
1993	Formation of large scholarship programs (Scholarships of the President of the Russian Federation (Decree of the President of the Russian Federation of September 6, 1993, No. 613-rp "Regulations on Scholarships of the President of the Russian Federation") and scholarships of the Government of the Russian Federation) (Order of the Government of the Russian Federation of April 6, 1995, No. 309 "On the Establishment of the Russian Government Scholarships for Graduate Students and Students of State Organizations Engaged in Educational Activities on Educational Programs of Secondary Vocational Education and Higher Education")	Preservation and development of the intellectual potential of the Russian Federation and strengthening of state support for students and graduate students of educational institutions of higher professional education	The annual amount of financial support has changed since 2009 and amounted to 56 million rubles and 2.4 million US dollars for studying abroad
1994	The establishment of the Russian Humanitarian Science Foundation (Order of the Government of the Russian Federation of September 8, 1994, No. 1023 "On the Russian Humanitarian Science Foundation")	Support for the development of the humanities, the enhancement of accumulated scientific knowledge and its wide dissemination in society, and the revival of the traditions of domestic humanities	Financial support changed annually, in 2016 it amounted to 1,800 million rubles
1997	Federal target program "State Support for the Integration of Higher Education and Fundamental Science in 1997–2000" (Decree of the President of the Russian Federation of June 13, 1996, No. 884 "On the Doctrine of the Development of Russian Science")	Deepening the expansion of interaction between academic and university science, improving the quality of education in order to preserve and develop the scientific and technical potential of the country	Total financial support of the project is 3.158 billion rubles (in 1996 prices)
2005	Priority National Project "Education"	Stimulation of innovations in the field of education; modernization of schools; support for talented youth; organizing a network of national universities and business schools; development of a system of motivation for teachers	Financial support of the project is 61,952 million rubles (A.S. Matienko. Priority National Project "Education": Essence and Problems of Implementation. Yearbook of Russian educational legislation. 2007. Vol. 2. p. 188–210. URL: https://elibrary.ru/item.asp?id=15552053& (accessed on 02.07.2021)

Table 3 (continued)

Imple-menta-tion year	Financial mechanism — projects/programs	Project / program objectives	Financial support for the project/program
2006	Formation of a network of federal universities (Decree of the President of the Russian Federation of May 7, 2008, No. 716 "On Federal Universities")	Assistance in the systemic modernization of higher professional education based on the integration of science, education and production, training qualified personnel to meet the long-term needs of an innovative economy	Financial support of the project was carried out within the framework of the Priority National Project "Education".
2008	Formation of a network of national research universities (Decree of the President of the Russian Federation of October 7, 2008, No. 1448 "On the Implementation of a Pilot Project to Create National Research Universities")	Implementation of priority areas for the development of science, technical, technological, scientific and personnel support for the needs of the economy and social sphere	Financial support of the project was part of the Priority National Project "Education"
2009	Federal Target Program "Scientific and Educational Research Personnel of Innovative Russia"	Improving the living standards and professionalism of domestic specialists, creating a clear system to stimulate the influx and retention of young promising scientists.	Total financial support of the project is 80 billion rubles.
2010	A set of resolutions of the Government of the Russian Federation (Order of the Government of the Russian Federation dated 09.04.2010 No. 218 "On Approval of the Rules For Granting Subsidies for the Development of Cooperation Between Russian Educational Institutions of Higher Education, State Scientific Institutions and Organizations in the Real Sector of the Economy in Order to Implement Integrated Projects to Create High-Tech Industries" (as amended on February 15, 2021); (Order of the Government of the Russian Federation dated April 9, 2010, No. 219 "On State Support for the Development of Innovative Infrastructure in Federal Educational Institutions of Higher Professional Education"	Order-218 — development of cooperation between Russian higher educational institutions, scientific institutions and industrial enterprises. Order-219 — development of innovative infrastructure, including support for small innovative entrepreneurship, in federal educational institutions of higher education. Order-220 — creation under the guidance of world-class scientists of laboratories conducting research at the forefront of the development of science and technology (Order of the Government of the Russian Federation of 04/09/2010 No. 220 «On Measures to Attract Leading Scientists to Russian Educational Organizations of Higher Education, Scientific Institutions and State Scientific Centers of the Russian Federation"	Financial support of the project in total: Order-218 more than 50 billion rubles Order-219 more than 3 billion rubles Order-220 more than 12 billion rubles

Table 3 (continued)

Implementation year	Financial mechanism — projects/programs	Project / program objectives	Financial support for the project/program
2013	Project 5–100 (Order of the Government of the Russian Federation dated March 16, 2013, No. 211 "On Measures of State Support for Leading Universities of the Russian Federation in Order to Increase their Competitiveness Among the World's Leading Scientific and Educational Centers")	Maximizing the competitive position of a group of leading Russian universities in the global market for educational services and research programs	Total financial support of the project is 80 billion rubles
2013	Pilot project on the creation and development of centers for breakthrough research in the field of information technology	The project is aimed at creating scientific centers based on scientific organizations and universities that carry out breakthrough research and development in the field of world-class IT and targeted training of personnel, as well as the implementation of effective principles and forms of science integration, education and business	Total financial support of the project is 4 billion rubles
2013–2014	Support programs for engineering centers (State Program of the Russian Federation «Development of Industry and Increasing its Competitiveness», approved by Order of the Government of the Russian Federation of April 15, 2014, No. 328)	The development of the engineering industry and the formation of the domestic industrial design industry, the development of small and medium-sized businesses in the engineering and industrial design industry	Financial support of the program: 2013–500 million rubles 2014–530 million rubles
2013–2014	Federal target program "Research and development in priority areas of development of the scientific and technological complex of Russia in 2014–2021" (Order of the Government of Russia dated May 21, 2013, No. 426 "On the Federal Target Program «Research and Development in Priority Areas of Development of a Scientific and Technological Complex of Russia in 2014–2020")	Creation and support of an innovative infrastructure designed to connect the research sector with the subjects of a market economy, to ensure the conversion of knowledge, and their transformation into a market product	The financial support of the program is only 171 billion rubles. [Website of the Federal Target Program. URL: http://fcpir.ru/about/ (accessed on 02.07.2021)]
2014	FTP: Federal target program "Scientific and educational research personnel of innovative Russia" in 2014–2020» (Order of the Government of the Russian Federation dated 08.05.2013 No. 760-r "On the Concept of the Federal Target Program "Scientific and Educational Research personnel of Innovative Russia" in 2014–2020"	Development of a system for the effective reproduction of highly professional personnel in the scientific and scientific-educational sphere and increasing their competitiveness at the global level	Total financial support for the program is 201 billion rubles. [Website of the Federal Target Program. URL: https://fcp.economy.gov.ru/cgi-bin/cis/fcp.cgi/Fcp/Passport/View/2014/415/ (accessed on 02.07.2021)]
2014	Establishment of the Russian Science Foundation (Federal Law of November 2, 2013, No. 291-FZ "On the Russian Science Foundation and Amendments to Certain Legislative Acts of the Russian Federation")	Financial and organizational support for fundamental scientific research and exploratory scientific research, training of scientific personnel, and development of scientific teams	The annual financial support changed from 7.59 billion rubles in 2014 to 21 billion rubles in 2020 [RFBR website. URL: https://www.rfbr.ru/rffi/ru/fundbudget (accessed on 02.07.2021)]

Table 3 (continued)

Implementation year	Financial mechanism — projects/programs	Project / program objectives	Financial support for the project/program
2014	Programs of the National Technology Initiative	Formation of fundamentally new markets and creation of conditions for the global technological leadership of Russia by 2035	Financial support is secured within the framework of individual competitions
2015	Formation of a network of flagship universities (Order of the Ministry of Education and Science of Russia dated August 7, 2015, No. 811 "On the Competitive Selection of Educational Institutions of Higher Education for Financial Support of Development Programs for Federal State Educational Institutions of Higher Education at the Expense of the Federal Budget in 2016–2018")	Creating conditions for the effective development of Russian education, aimed at ensuring the availability of quality education that meets the requirements of the modern innovative socially oriented development of the Russian Federation	Total financial support of the project is 1,594 million rubles
2016	Priority project "Universities as Centers of Space for Creating Innovations". The priority project "Universities as centers of space for creating innovations" was approved by the Presidium of the Council under the President of the Russian Federation for Strategic Development and Priority Projects (dated October 25, 2016 No. 9)	Ensuring the global competitiveness of leading Russian universities	Total financial support of the project is 44 618 million rubles
2018	National Projects "Science" and "Education" (as amended in 2020 National Projects "Education" and "Science and Universities")	Education — providing opportunities for self-realization and development of talents. Science and universities — ensuring the presence of the Russian Federation in the top ten countries in the world in terms of research and development, including through the creation of an effective system of higher education	Total financial support of the project: education — 810 billion rubles; science and universities — 562 billion rubles
2021	Priority 2030 Program (Order of the Government of the Russian Federation of May 13, 2021, No. 729 "On Measures to Implement the Priority 2030 Strategic Academic Leadership Program")	Support for university development programs and assistance in increasing the contribution of Russian universities to the achievement of the national development goals of the Russian Federation for the period up to 2030	Financial support for the project as part of the National Project "Science and Universities"

Source: compiled by the authors.

teams, open collection of proposals, stage-by-stage examination of strategic developments, discussion platforms, "live" research laboratories, and joint projects, permanent digital analytical platforms that support all stages of development and implementation.

At the meso-level, the content of the strategic development of science and education is supplemented by the following guidelines:

- Implementation of the ecosystem approach to the development of the scientific and educational spheres, which involves building close ties between universities and regional authorities for a joint coordinated solution of a whole range of tasks, ranging from a territorial and sectoral adaptation of the target orientation of the development of science and production and educational centers, removal of barriers to the implementation of regional development projects, comprehensive economic, legal and organizational support for macro-regional programs and projects.
- Transition to "smart" integrated territorial and sectoral planning in the space of the new economy with an extended time horizon of coverage, which involves the creation of modern infrastructures in regional ecosystems for the sustainable development of enterprises and organizations and end-to-end mechanisms in the system of relations "human — education — employment — living standards" aimed at reducing all types of inequality and improving the well-being of the population. The subjects of the sphere of science and education in this case are not just connected to this process, but play the role of initiators, drivers and integrators.
- Development of regional strategies for the development of science and education, which determine the content of the transformation of this area, firstly, as a major employer (about 8% of graduates become teachers, 8–10% ensure the reproduction of scientific personnel); secondly, as suppliers of personnel for the new economy; thirdly, as a source of scientific and technological solutions for the territorial and sectoral development of the innovation economy and the knowledge economy.
- Creation of centers of concentrated growth based on the activation of talent management, subject to overcoming digital and educational inequality by searching for mechanisms to increase the overall minimum level of education with the involvement of schools, secondary vocational education institutions, universities and regional government entities, increasing the proportion of graduates with a higher level of education in their total number.
- Economic, social and legal support of digital platforms for testing and maintaining knowledge bases.

The lack of funding to ensure the transfer of scientific ideas and developments from universities to industry is a serious obstacle to the effective commercialization of university technologies.

At the micro-level, the strategic content of the development of scientific, scientific, educational and educational organizations in the proposed content framework is associated with the creation of professional communities corresponding to new tasks and goals (in the format of an ecosystem) and full immersion in the mechanisms of digitalization of the economy, both in terms of training personnel for the digital economy, and in the development of scientific, technological, organizational and managerial solutions for the systemic transformation of the Russian economy, as well as in the promotion and popularization of all implemented state super services that allow the use of digital platforms to support the needs of society and improve the living standards.

DEVELOPMENT OF FINANCIAL INSTRUMENTS IN THE FIELD OF SCIENCE AND EDUCATION TO ENSURE THE TRANSFORMATION OF THE RUSSIAN ECONOMY

Financial instruments are a fairly effective mechanism for achieving results if it is necessary to transform the Russian economy in accordance with the given principles. Thus, in order to achieve strategic goals in the field of science and education over the past 20 years, a number of financial mechanisms have been implemented in the Russian Federation and continue to be implemented at the present time, presented in *Table 3*.

The development of the transfer of scientific and educational technologies requires the constant development of economic, financial and legal instruments that accompany their promotion in the form of removing barriers and identifying risks, which makes it possible to form a management decision-making system based on financial and economic indicators.

Financial support for the strategic development of science and higher education in Russia is planned as part of, among other things, the Priority 2030 program, the main goal of which is to support university development programs and promote an increase in the contribution of Russian universities to the achievement of the national development goals of the Russian Federation for the period up to 2030, balanced spatial development of the country, ensuring the availability of high-quality higher education in the constituent entities of the Russian Federation.[9] Three basic products of universities are identified that underlie those effects that are primarily embodied in students and graduates as active elements that change society, which the state, society and the economy can expect from higher education: scientific knowledge; development of human capital; technology and innovation.

Another financial instrument of the emerging mechanism for transforming the achievement of indicators of the strategic development of science and education through the development of the Priority 2030 Program is closely related to the national development priorities of the country, reflected in the Decree and instructions of the President of the Russian Federation,[10] national projects,[11] the Strategy for scientific and technological development,,[12] spatial development,[13] socio-economic development[14] and involves a minimum grant of 100 million rubles annually. It is also expected to co-finance activities through income-generating activities in the planned 10-year period, which will attract industrial partners, regional companies, etc. to the implementation of the relevant tasks.

RESULTS AND CONCLUSIONS

Thus, the study allows us to draw several interrelated conclusions. First of all, the instruments of financial support for the development of science and education in Russia should be linked to the content of development strategies for these areas at different levels of the economic hierarchy and built into more general economic mechanisms. To ensure not only short-term results but also long-term positive effects of the development of science and education, it is necessary to implement an ecosystem approach. This will bring

[9] Order of the Government of the Russian Federation of May 13, 2021, No. 729 "On Measures to Implement the Program of Strategic Academic Leadership "Priority 2030".

[10] Decree of the President of the Russian Federation of July 21, 2020, No. 474 "On the National Development Goals of the Russian Federation for the Period up to 2030".

[11] National Project "Science and Universities". Federal project "Personnel for the Digital Economy" of the national program "Digital Economy of the Russian Federation".

[12] Decree of the President of the Russian Federation of December 1, 2016, No. 642 "On the Strategy of Scientific and Technological Development of the Russian Federation".

[13] Order of the Government of the Russian Federation of February 13, 2019, No. 207-r.

[14] Strategies for socio-economic development of the relevant regions of the Russian Federation and sectoral documents of strategic planning of the Russian Federation.

together partnerships and resource flows of all stakeholders, ensuring their mutually coordinated activities within a common ecosystem. Only with a balance of private and public funding, and full-scale multi-channel co-financing for the development of science and education, it is possible to achieve significant long-term effects in the area under study. The ecosystem approach in this case allows not only to accumulate large resources but also to more reasonably choose investment objects and use financial resources efficiently. It is advisable to rely on financing instruments that have proven their effectiveness, can be successfully replicated, have a self-reproducing nature and allow the introduction of new approaches to the formation of the science economy. This opens up new areas of research related to the development of methodology and methodological tools that allow not only legal support for the creation and transfer of new scientific results but also to evaluate their economic efficiency.

The combination on the platform of economic mechanisms of various financial instruments that have powerful stimulating, and not just providing potential, allows for regulating the development of science and education by balancing the volumes, methods, and conditions for the provision of financial resources, taking into account territorial and sectoral factors, features of the development of specific scientific and educational institutions. All of this makes it possible to track long-term trends in the development of the economy, meet the current needs of science and education, and predict and design the future development of universities.

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M. A. Borovskaya — defined the problem and the objectives of the study, developed the logic and wrote the conclusions of the research.
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M. R. Bechvaya — performed the critical analysis of programs and projects, analyzed the legal acts, compiled the tables.
O. A. Chernichenko — collected statistical data, developed a tabular presentation of the results.

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The Impact of Corporate Governance on the Capital Structure of Domestic Companies

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ABSTRACT

The choice of the optimal capital structure is one of the biggest challenges that the company's top management faces due to the fact that the right strategy secures the company's financial stability, sustainable development and capital-raising potential. This study **aims** at establishing a connection between the capital structure of Russian companies and corporate governance. Literature background of the paper consists of foreign and Russian authors' works in the field of behavioral finance. Observations from 60 Russian companies were employed in the study. **The major findings** obtained by economic and mathematical modeling are as follows: 1. positive connection was established between the size of board of directors, number of independent directors and debt in capital structure; 2. positive connection between CEO's age and short-term debt in capital structure; 3. no correlation between gender of directors and debt. The findings of this study may be used for determining the optimal capital structure strategy. Moreover, this information may be taken into account by top-management, directors, etc. for internal valuation of a company's operations including sound valuation of the corporate governance factors that influenced the company's capital structure.

***Keywords*:** corporate governance; capital structure; financial indicators; corporate governance indicators

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INTRODUCTION

Choosing the optimal capital structure is one of the most difficult tasks for the company's management. The financial stability and investment attractiveness of the enterprise, as well as further relationships between the management of the enterprise, owners, and creditors, depend on the correctly chosen strategy. In most cases, the company's management determines the capital structure based on the financial goals (S. Orlova, J. Harper, Li Sun [1]). However, in addition to financial factors, corporate governance also has a significant impact. For example, H. Cronqvist, A. K. Makhija and S. E. Yonker [2], based on the "theory of personality" developed by G. W. Allport [3] and D. C. Funder, C. R. Colvin [4], analyzed 605 large US companies included in the S&P 1500 index and established the relationship between corporate governance factors and capital structure. In the scientific works of both Russian (E. T. Rusanova [5], M. V. Popov [6]) and foreign (Kavaus Ardalan, Mohammed Sowkat Hossain) authors, there is a lot of research on the influence of various internal and external factors on the main financial indicators of enterprises. Obviously, companies that provide services in the same industry and have similar indicators and characteristics may have different capital structure. Hence, it becomes necessary to understand and determine the impact of not only financial but also non-financial factors. Non-financial sources of influence most often include various features of corporate governance, in particular, the role and personal data of the general director (CEO) (Chief Executive Officer) [7], the structure and size of the board of directors [8]. This is due to the fact that it is the top management that largely determines the key vector of the company's development, including financial decision-making [9].

Despite a fairly large number of similar scientific papers, there is no universal and generally accepted theory establishing one and only way for the company's financing, which determines the relevance of the chosen topic.

This work aims at analyzing and determining the impact of corporate governance on the capital structure of Russian companies using economic and mathematical modeling.

LITERATURE REVIEW AND RESEARCH HYPOTHESES

There are three main theories of capital structure: trade-off theory, pecking order theory, and agency cost theory.

Trade-Off Theory

The trade-off theory was developed and described by Kraus and Litzenberger in 1973 [10]. This theory is based on the fact that borrowed capital costs the enterprise less than its own since interest on it is not taxed. However, it should also be taken into account that too much leverage in the capital structure can lead to the financial instability of the company, so the task of management is to find a compromise between the benefits of borrowing and the costs of financial instability that the company will incur in the event of bankruptcy. Costs can be either direct or indirect. The direct ones include, for example, a decrease in the value of assets in the bankruptcy process, and the indirect ones include legal and administrative costs [6].

Pecking Order Theory

The pecking order theory or hierarchy theory was first described by S. Myers in 1984 [11]. According to this theory, the company's management chooses sources of financing in a strictly established manner. Internal sources are mobilized first, such as accumulated retained earnings, then borrowed funds, with preference given to a less risky short-term loan. The next source of financing will be a long-term loan, and only if the borrowed capital can no longer be used, the company issues additional shares [12].

Agency Cost Theory

In the framework of agency cost theory, the choice of capital structure can be viewed as a mean of resolving agency conflicts. Such conflicts can arise between the owners and management of the company, management and creditors, owners and creditors. The essence of the disagreement lies in the fact that the owners, as a rule, want to increase the value

of the company, while the management may be more concerned about their own reputation, career growth, salary, i.e. their interests may diverge, which in turn may lead to the fact that the company's management will make decisions that are unfavorable for the company, "give way" to inefficient projects, etc. In this regard, the owners bear agency costs in order to control the actual management of the company. The capital structure, in turn, plays a very important role, and the right choice will help to avoid conflicts. For example, raising borrowed funds can affect the efficiency of the company's management, since a large share of debt obligations can put the company in a financially unstable position, in which case additional efforts will be required from management, a competent choice of corporate management strategy in order to maintain their work and, accordingly, improve the financial position of the company. It should be noted that in this case, the goals of both parties coincide [13].

However, at the moment there is no theory that can fully explain why companies operating in the same industry and with similar characteristics can have very different capital structures.

That is why studies of the influence of corporate governance factors on the capital structure have recently become very popular. As a rule, the composition of the board of directors is considered as the main indicator, including its size, the proportion of independent directors, the proportion of women and the ownership structure of the company [14–16].

Gender Factor

It is worth noting that as early as 1991, Cox put forward a hypothesis that since the movement for equal rights for men and women began to gain momentum, companies with women on the board of directors began to show better financial results [17]. In his research, he explains this as follows: gender diversity on the board of directors contributes to the management's multifaceted and broader view of the company's future path, which in turn enhances the firm's reputation, and attracts clients and investors. The influence of the managers' gender on the financial performance of an organization is also studied in the work of E. Peni [9], where it is stated that women are more careful in making decisions than men, who are characterized as more inclined to take a risk. Thus, men are predisposed to attracting more borrowed capital, which contributes to the growth of financial risks.

In their work Y. Liu, Z. Wei, F. Xie [18], on a sample of 2000 Chinese companies analyzed not only the connection between women directors and such indicators as return on equity and assets but also determined the correlation between the number of women in the structure of management board, board of directors and company's performance. After conducting a study, the authors concluded that the proportion of women on the board of directors has a positive effect on the company's performance. In addition, D.D. Zelechowski, D. Bilimoria [19], having conducted a study in 73 countries from 1998 to 2008, arrived at the conclusion that companies in which the proportion of women on the board of directors was higher had better financial performance than companies in which the proportion of women on the board of directors was lower or with no women on the board of directors. They also stated that women were inherently more prudent and tried to reduce the company's risks, therefore, the share of borrowed funds in the capital structure was lower.

Age

One factor in corporate governance that influences capital structure decisions is the age of the CEO. The relationship between the indicators is described in the works of J.R. Graham, C.R. Harvey [20], L. Barros, A. Silveira [21]. However, there is no consensus on the nature of the influence. It is generally assumed that older and more experienced managers, in most cases support a conservative money management policy, and mostly raise their own rather than borrowed funds. Such managers are less prone to unprincipled and emotional behavior [22].

At the same time, a number of scientists in their works note that before retirement,

the manager prefers short-term projects [23]. Moreover, according to M.A. Serfling [24], as they grow older, executives prefer to pursue a less risky policy. Since the large companies usually use debt financing to fund their operations, the organization is forced to attract borrowed funds, in this case, in accordance with the pecking order theory of financing, an older manager prefers to use short-term loans, which are less risky compared to long-term ones.

Board of Directors

The board of directors is one of the main instruments of corporate governance, the importance of which in the company's structure is explained by its main functions, including the representation, and defending the interests of the owners, the appointment of the company's management. Members of the Board of Directors directly influence the adoption of the most significant and strategic decisions with regards to the operations and development of the company, set key performance benchmarks. Hence the interest arises in terms of the number of board members and its direct impact on the company's financial performance.

Y.T. Mak, Y. Kusnadi [25], after conducting a study, found that in companies with a large board of directors, the share of borrowed funds in the capital structure is greater than in companies where the board of directors is not so numerous.

Independent directors

Recently, the boards of directors of large companies increasingly include independent directors, who are an important link in decision-making, responsible for monitoring the implementation of management decisions, internal audits, and risk management. In this regard, the question arises: what is the nature and degree of influence of the presence of independent directors on the financial performance of the company? The scientist M.S. Weisbach [26] states that the CEO will expect more control if there are more independent directors. With increased oversight by the board, management autonomy may be reduced, which in turn will affect the company's financial performance.

As a result of studying and analyzing the abovementioned works of foreign and Russian authors, we formulate the following hypotheses:

Hypothesis 1. The more women on the board of directors, the lower the share of borrowed funds in the capital structure (Peni [9], Liu, Wei, Xie [18], Zelechowski [19]).

Hypothesis 2. The older the CEO, the greater the share of short-term liabilities in the capital structure (M.A. Serfling [24], A. Silveira [21]).

Hypothesis 3. The larger the size of the board of directors (B of D), the higher the share of borrowed funds in the capital structure (Y.T. Mak, Y. Kusnadi [25], T. Tychinskaya [8]).

Hypothesis 4. The more independent directors, the higher the share of borrowed funds in the capital structure (M.S. Weisbach [26]).

Research Methodology

There are several ways to determine the capital structure, presented in *Table 1*. For example, H. Cronqvist, A.K. Makhija and S.E. Yonker [2] in their work use the ratio of short-term and long-term liabilities to the market value of assets as a variable "capital structure". In addition, the ratio of total liabilities to the company's book value is often used. For example, T. Vo. Minh uses it in his works [27]. In his work, the ratio of short-term liabilities to book value and long-term liabilities to book value of the company is often taken separately for the capital structure variable.

In this paper, the ratio of debt variable to the company's assets is taken as the dependent variable "capital structure". In turn, the debt variable is represented both by the amount of liabilities and separately by short-term and long-term liabilities. In this regard, the capital structure in the study is presented in the form of three coefficients (*Table 2*).

The following indicators were taken as explanatory variables: the number of members on the board of directors, the proportion of independent directors on the board of directors, the proportion of women on the board of directors, the average annual board of directors' salary per member, the number of members of the management board, and the age of the CEO.

It is worth noting that, of course, the choice of the capital structure is determined not only

Table 1

Capital structure research methods review

Author	Debt variable	Capital structure variable
Cronqvist H., Makhija A.K., Yonker S.E. [2, p. 20]	The amount of short-term and long-term liabilities	1. Variable debt/assets. 2. Variable debt/company market value
Barros L., Silveira A. [21, p. 293–335]	Long-term liabilities	Variable debt/assets
Minh T. Vo [27]	1. Short-term liabilities. 2. Long-term liabilities. 3. The amount of short-term and long-term liabilities	1. Short-term liabilities/assets. 2. Long-term liabilities/assets. 3. The amount of short-term and long-term liabilities/assets

Source: compiled by the authors.

Table 2

Dependent variables

Designation	Capital structure ratio
Y_1	Short-term liabilities / Book value of assets
Y_2	Long-term liabilities / Book value of assets
Y_3	Liabilities / Book value of assets

Source: compiled by the authors.

by corporate governance factors, but both industry specifics and the efficiency of the company's operations are also considered. That is why the indicators of the financial condition of the company (return on equity (ROE), company value, coverage ratio and quick liquidity ratio) were chosen as control variables C. Chang, X. Chen, G. Liao [28].

The main model is as follows:

$$Y = a_0 + \sum a_i CG_i + \sum b_i F_i + \varepsilon, \quad (1)$$

where the content and designation of the variables included in the equation are presented in *Table 3*.

The presented table separately shows the variables of corporate governance and the financial health of the company. Linear regression will be used as a research method.

DATA ANALYSIS

The sample of companies was formed with the help of Ruslana-Bureau van Dijk and information obtained directly from the annual reports of the companies included in the sample. It contains both absolute and relative indicators, the values of which were found and calculated based on the available data. The empirical base of the study includes financial performance and corporate governance indicators of 60 large Russian companies in 2018.

Table 4 provides descriptive statistics for corporate governance variables and domestic company financial health variables.

According to the descriptive statistics, there are corporations among the analyzed companies whose board of directors and management boards do not have independent directors, foreigners, and women. In addition, the sample includes organizations whose boards of directors consist only from foreigners. The maximum share of women on the board of directors and management board of corporations is 40% and 50% respectively.

It can also be noticed that the indicator of the number of managers on the management

board varies significantly — from 2 to 25 people. There is a great difference in the CEO age: the youngest is 36 years old, and the oldest is 79 years old.

The analysis of descriptive statistics revealed the average composition of the board of directors and the management board of Russian companies, shown in *Fig. 1 and 2*.

On average, the board of directors of Russian companies consists of 10 people, four of which have the status of an independent director, and three are foreign citizens. The gender diversity of board members remains low, as there is predominantly only one woman on the board of directors (*Fig. 1*). The average annual salary of a member of the board of directors in the analyzed companies amounted to 18.4 million rubles.

Let us turn to the consideration of the average composition of the management board of domestic enterprises (*Fig. 2*).

The executive management team of corporations on average includes 10 top managers, only one of which is a female. The team is headed by the CEO, whose average age is 54 years (*Fig. 2*).

According to statistics, the presence of women in the composition of the board of directors and the management board of Russian companies is not widespread today, in the share ratio, it is only 7% of the total number of participants.

To analyze the relationship between the selected indicators, a correlation matrix was built (*Fig. 3*)

According to the matrix, a strong correlation between financial indicators and such corporate governance variables as the size of the board of directors, the proportion of independent directors, the number of members of the management board, and the age of the CEO is observed.

RESEARCH RESULTS

Based on the results of the analysis of the correlation matrix, regressors were selected and the models presented in *Table 5* were calculated.

The cells opposite the variables indicate the value of the coefficient for each indicator, and in parentheses — the standard error.

Table 3

Description of variables

Designation	Content
Corporate governance variables	
CG_1	Number of members on the board of directors
CG_2	Share of independent directors in the board of directors
CG_3	Share of women on the board of directors
CG_4	Average annual board of directors salary per member
CG_5	Number of members of the management board
CG_6	Average director salary (in the board of directors)
CG_7	Age of the Chairman of the Management Board (CEO)
CG_8	Share of foreigners on the board of directors
Control variables (variables of the financial health of the company)	
F_1	Return on equity
F_2	Return on assets
F_3	Return on capital employed
F_4	Profit
F_5	Coverage ratio
F_6	Quick liquidity ratio
F_7	Company value

Source: compiled by the authors.

Statistical significance at the level: 0 “***”; 0,001 “**”; 0,01 “*”; 0,05 “.”; 0.1 “ ” 1.

Thus, according to the results of the study, we can conclude that there is an influence of the indicators included in the model on the dependent variable of the model — the capital

Table 4

Descriptive statistics

Variable name	mean	sd	median	min	max
Board of Directors	11.05	2.41	10.00	5.00	15
Share of independent directors	30.93	16.93	28.79	0.00	77.78
Share of foreign directors	26.32	27.25	19.09	0.00	100
Share of women on the board of directors	7.67	9.03	7.42	0.00	40
Number of members of the management board	9.5	4.09	9.00	2	25
Share of women on the management board	15.67	13.99	14.29	0.00	50
Average salary on the board of directors	18 353 454	23 503 056	9 998 261	260 400	144 000 000
Average salary on the board of directors (logarithm)	6.99	0.54	7.00	5.42	8.16
Age of the CEO	53.62	10.78	51.00	36	79
Return on equity	25.07	59.45	15.09	–83.52	358.87
Return on capital raised	16.18	50.10	9.20	–46.59	366.83
Return on assets	5.52	11.42	3.88	–43.02	32.74
Coverage ratio	1.26	0.73	1.05	0.14	3.59
Profit margin	10.91	19.39	7.06	–45.09	54.41
Liquidity ratio	1.14	0.85	0.84	0.06	3.43
Company value	640 035 622	1 108 838 353	186 600 000	143 500	458 400 0000
Company value (logarithm)	8.12	0.97	8.27	5	10
Asset value	1 728 212 861	4 643 190 055	299 459 696	1 202 293	27 112 200 000
Short-term liabilities	468 022 515	1 449 075 719	78 467 204	660 311	9 470 480 000
Long term duties	698 739 148	2 243 664 235	86 314 300	9 181	14 205 720 000
Short-term liabilities/assets	0.31	0.24	0.25	0.02	0.97
Long-term liabilities/assets	0.30	0.23	0.27	0.01	0.93
All liabilities/assets	0.61	0.28	0.64	0.10	1

Source: compiled by the authors.

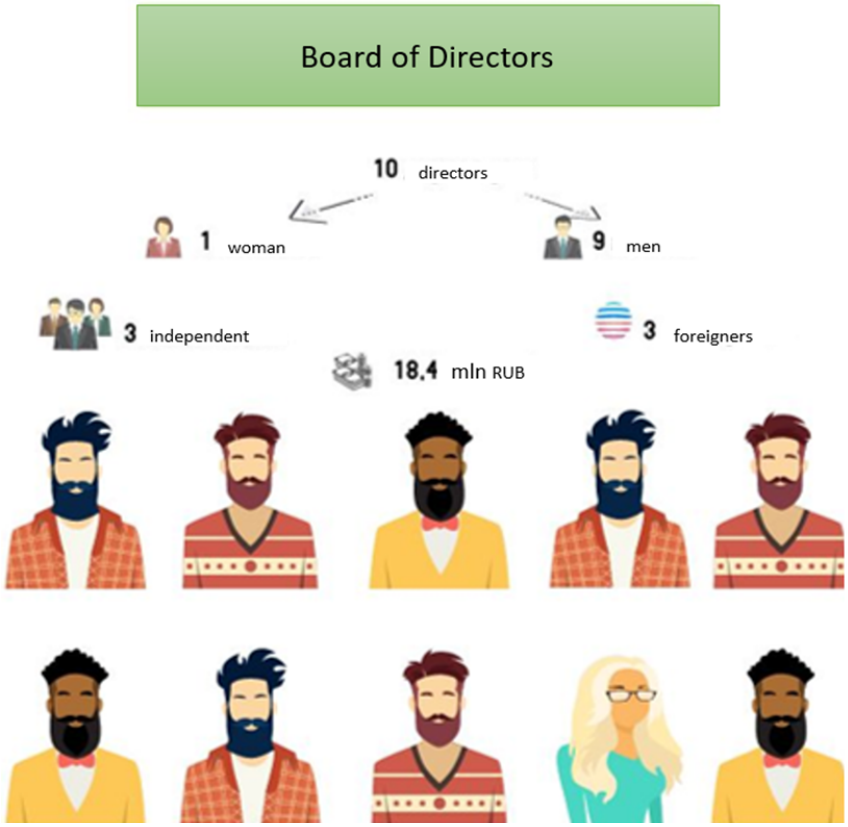

Fig. 1. **Russian average board of directors**

Source: compiled by the authors.

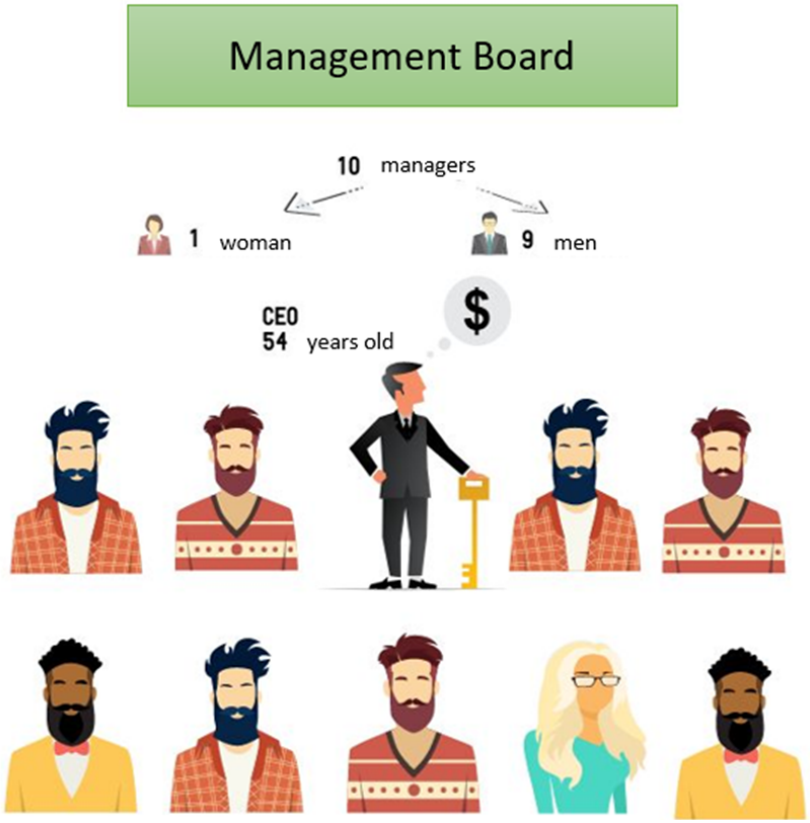

Fig. 2. **Russian average management team**

Source: compiled by the authors.

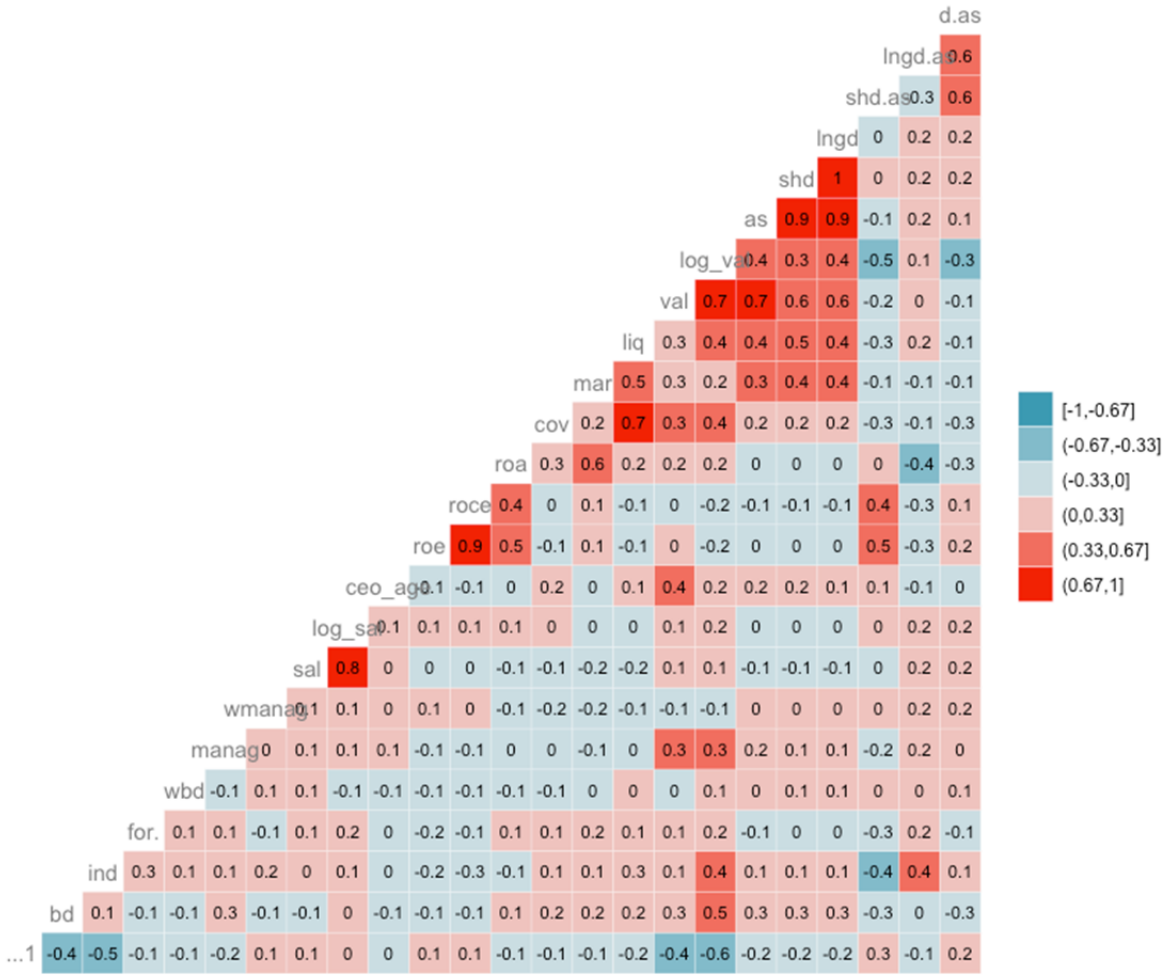

Fig. 3. **Correlation matrix**

Source: compiled by the authors.

structure. This means that our hypotheses were partially confirmed, the results are given in *Table 6*.

Based on the data obtained, it can be argued that the coefficient for the indicator "the share of women on the board of directors" is insignificant, respectively, hypothesis 1 that the more women there are on the board of directors, the less borrowed funds the company uses, was not confirmed. It is worth noting the fact that these results do not completely contradict the hypotheses put forward by foreign authors, for example, Y. Liu, Z. Wei, F. Xie [17], D.D. Zelechowski, D. Bilimoria [19], since, according to the descriptive statistics provided, there is on average only one woman on the board of directors of a large Russian company, which differs significantly from the number of women in the management of foreign companies. Based on this, it can be assumed that this factor is significant. However, in Russian realities, due to the weak gender diversity, this indicator does not have a special impact on the capital structure.

Hypothesis No. 2 was confirmed, according to which the older the CEO of the company, the greater the share of short-term borrowed funds in the capital structure. The data obtained are consistent with the results of earlier studies by M.A. Serfling [24]. The coefficient of the indicator "age of the CEO" is positive and significant, which indicates the presence of a direct relationship between the variables.

Based on the results obtained, the coefficient "the size of the board of directors" turned out to be significant, hence hypothesis 3 was

Table 5

Research results

Variable	Model 1	Model 2	Model 3
Non-financial indicators			
Company value log	−0.1182549 (0.0248227) ***		
Age of the CEO	0.0042298 (0.0022041)*		
Board of directors			0.0256454 (0.0128185)
Share of women on the board of directors	0.0023019 (0.0026010)	−0.0007659 (0.0025762)	−0.0004548 (0.0033271)
Share of independent directors		0.0040483 (0.0014464)**	
Management board		0.0087869 (0.0056402)	
Salary log		0.0909936 (0.0429113)*	
Financial indicators			
Return on assets		−0.0082338 (0.0021021)***	−0.0114820 (0.0033499)**
Return on equity	0.0015417 (0.0004034)***		0.0019316 (0.0006241)**
Coverage ratio		−0.0952991 (0.0472095)*	−0.1595280 (0.0620133)*
Liquidity ratio		0.1112057 (0.0406046)**	0.1312256 (0.0514884)*
Model indicators			
R-Squared	0.4603	0.4973	0.393
Adj. R-Squared	0.421	0.4296	0.3243
F-statistic	11.73	7.349	5.719
p-value	5.89e-07	4.005e-06	0.0001217

Source: compiled by the authors.

put forward, stating that the larger the size of the board of directors, the higher the share of borrowed funds in the capital structure, was confirmed. The result coincides with the conclusions of Y.T. Mak, Y. Kusnadi [25].

The coefficient for the "share of independent directors" indicator is also positive and significant, which indicates a direct relationship and proves that the more independent directors on the board of directors, the greater the share of borrowed funds compared to equity in the company's capital structure of domestic companies.

CONCLUSIONS

By conducting an econometric analysis using linear regression, it was confirmed that corporate governance factors affect the capital structure of domestic companies. In particular, a positive relationship was found between the share of borrowed funds in the capital structure of domestic companies and the size of the board

Table 6

Analysis of the research results

Hypotheses	Factors	Results
Hypothesis 1. The more women on the management board/board of directors, the less borrowed funds the company uses	The share of women on the management board/board of directors	Not confirmed
Hypothesis 2. The older the CEO, the greater the share of short-term liabilities in the capital structure	The age of the CEO	Confirmed
Hypothesis 3. The larger the size of the board of directors (B of D), the higher the share of borrowed funds in the capital structure	The size of the board of directors	Confirmed
Hypothesis 4. The more independent directors, the higher the share of borrowed funds in the capital structure	The number of independent directors on the board of directors	Confirmed

Source: compiled by the authors.

of directors, which is explained by the fact that when a decision is made by a large number of people, responsibility is blurred, and this, in turn, entails making more risky decisions, including in terms of capital structure. The positive relationship between the number of independent directors and the share of borrowed funds in the capital structure only confirms the above. In addition, the study found a positive relationship between the share of short-term borrowings in the capital structure and the age of the CEO, which coincides with the hypotheses put forward by foreign authors earlier, stating that the older the manager, the greater the share of short-term loans from the enterprise due to the fact that he is committed to completing as many projects as possible before the end of his career and therefore expects all loans to be repaid before the end of his career.

The choice of capital structure is a strategically important decision, the responsibility for which lies with the company's management. In this regard, managers and other stakeholders should have a clear understanding of the role and nature of the influence of certain factors, including corporate governance factors, on the capital structure. That is why this study is relevant today. It complements the existing work in the framework of the agency cost theory of capital structure and can become the basis for further research in this area.

In addition, the results obtained during the study can be applied in forecasting and determining the capital structure, which can be useful to the top management of Russian enterprises, members of the boards of directors, analysts, financial analysts, and other interested parties.

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A.Yu. Maximova — statistics collection, description of the results.
V.D. Emel'yanova — data visualization design, conclusions.

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A Study on Impact of Merger and Acquisition on Financial Performance of Agri-Food Companies

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ABSTRACT

The purpose of this study is to explore the expansion of merger and acquisition (M&A) literature in the context of Indian studies and examine the impact of mergers and acquisitions on various financial performance parameters of India's Agri-Food companies. The period of study is from 2011 to 2019, and Wilcoxon Sign Rank methodology has been used. The study hypothesized that there is significant growth in Indian literature of M&A and there is a significant difference in the operating performance, financial performance and shareholders' return of acquiring firms during the period of pre-M&A and post-M&A. The study findings state that the literature of M&A in India increases significantly, and the operating ratio, financial ratio, and shareholder return also exhibit a significant improvement whereas the expense ratio related to the operating ratio shows no improvement in performance. The study concludes that the India Agri-Food company's financial performance has improved overall for the acquiring firms during the post-M&A period.
***Keywords*:** Mergers and Acquisitions (M&A); Financial Performance; Wilcoxon Sign Rank Test; Ratio Analysis

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INTRODUCTION

Mergers and acquisitions (M&A) as a form of inorganic growth are being used to restructure leading business companies worldwide. M&A has been racked up over the years, both in volume and value. In order to meet increasing domestic and global demand, Indian companies are aggressively expanding their capacity through mergers and acquisitions.

The Agri-Food sector in India contributes 16 percent of GDP and employs 49 percent of the population [1]. The industry has a substantial indirect impact on the rural economy's linked sectors, as well as a significant ripple effect on the manufacturing and service sectors of the national economy. In order to double farmers' incomes by 2022, the government is also asking for implementable proposals and solutions from diverse stakeholders [1]. The unprecedented growth in demand for food, need for scale and access to market distribution, branding and technology, will continue to drive more Mergers & Acquisitions in the sector.

Review of literature is the foundation stone of any research. This study reviews the existing literature rigorously, intending to take stock on which areas/sectors have already been examined. The literature review [2] attempts to define existing literature and discuss potential research avenues. A reexamination of the current state of the research is needed to advance any expanding discipline. This paper differentiates from the existing literature of M&A in the sense that it analyses the growing state of M&A literature in India as compared to international studies and secondly, examines the pre and post-merger financial performance. Thus, this study makes a modest attempt to enrich the literature in the Indian context.

The accounting measure (ratio analysis) has been used for the assessment of the performance of India's Agri-Food companies. Despite the substantial amount of literature on accounting measure performance still, the findings are inconclusive which refers to the fact that during the post-merger era, some sample firms exhibit significant improvement while the others show a decrease [3–6]. Some studies support the positive impact on financial performance [7–9] and others support the negative impact on financial performance [10, 11]. Thus, this research gap

motivates the author to investigate the impact of M&A on Indian companies' financial performance using a set of ratios that examines the performance from the aspect of operating performance, financial performance, and shareholder return aspects.

The paper is subdivided into four sections. The literature review will be explained in section 2. In section 3, the study's objectives and hypothesis will be discussed. The data and research methodology used in the study will be discussed in section 4, and empirical evidence will be discussed in section 5. Conclusion, Implications for Managers, Limitations, and Future Scope of the study will be mentioned in Section 6.

LITERATURE REVIEW

Mergers and acquisitions are frequently utilized to restructure companies. Mergers and acquisitions are justified for several reasons, including achieving synergistic results [12, 13], gaining larger market control, and gaining access to creative capabilities, thus lowering the risks of developing a new service or product, increasing productivity using economies of scope and scale, and, in many circumstances, reshaping a company's competitive scope [14, 15]. A short-term solution to financial problems, reviving the business by bringing in new information to enhance long-term sustainability, and a short-term solution to financial challenges are some of the other reasons [16, 17].

According to the existing literature, academicians evaluated merger-related profits in two ways. First, using the event research method, scholars evaluatede the impact on stock returns of the target and acquiring firms during the announcement of a merger. Second, they examine the accounting data in the pre-M&A and post-M&A period by calculating various performance ratios and using advanced statistical techniques such as t-tests, correlations, regressions, and so on. *Table 1* shows a comprehensive evaluation of current merger performance studies that looked at the influence of M&A on firm performance in the pre and post-period.

The existing literature on M&A has shown mixed results. Although some studies found that mergers improved the profitability of the resulting firm [18, 28, 41–43] others found that mergers failed to produce positive returns. Acquisitions, likewise, tend to provide mixed results to the various stakeholders concerned. Although target company shareholders typically see positive short-term returns, acquiring company investors frequently witness share price underperformance in the months after the acquisition, resulting in small overall wealth increases for portfolio holders.

The pre and post-merger success of the merging firms dominates the M&A literature. These studies, despite their large number, are not definitive because the findings are contradictory. The M&A literature is not only full of contradictory findings, but the performance measures used in these studies also differ significantly. As a result, despite several studies, it is fair to conclude that this field of M&A operation remains a mystery, necessitating further study.

The problem addressed in this study is that existing literature on determinants of M&A performance is focused on several industries, various geographical areas, and uses different data selection methodologies. As a result, the existing literature's findings are inconsistent, and it is uncertain whether all of them are applicable to the Agri-Food sector. As a result, the study's goal is to contribute to knowledge on M&As by finding the impact on the performance of acquiring firms.

RESEARCH OBJECTIVES

The following are the objectives of this study:

a. To examine the existing literature to understand how mergers and acquisitions studies have occurred in the Indian and international markets.

b. To examine the impact of mergers and acquisitions on the operating performance, financial performance, and shareholders' wealth of the Agri-Food companies.

Hypothesis

i. H1: There is a significant growth in the literature of mergers and acquisitions studies in India.

ii. H2: There is a significant difference in operating performance of acquiring firms in the post-merger and acquisition period compared to the pre-merger and acquisition period.

Table 1

Review of Literature

S. No.	Author	Objective	Country	Findings
1	Healy et al., 1992 [18]	Post-merger performance of acquiring firms	US	Positive
2	Capron, 1999 [19]		European and the US	Positive
3	Rahman and Limmack (2004) [11]	Post-merger Operating cash flows of the acquired firm	Malaysia	Positive
4	Kumar and Rajib (2007) [7]	Post-merger Operating performance of firms post the merger	India	Positive
5	Kumar and Bansal (2008) [20]	To examine financial performance	India	Positive
6	Mantravadi and Reddy (2008) [21]	Operating Performance in different Industries	India	Positive
7	Sinha et al. (2010) [22]	Examines financial performance	India	Positive
8	Sukyee Lee, 2005 [23]	Improved market share and market power	Hong Kong	Positive
9	Alhenawi and Stilwell (2017) [24]	Create Value in the long run	USA	Positive
10	Zuhri et al. (2020) [25]	To examine the impact of M&A on Solvency and Profitability Ratio	Indonesia	Positive
11	Hajiyeva et al. (2020) [26]	Create Value for acquiring firm	BRICs nation	Positive
12	Dickerson et al. (1997) [27]	Improved Firm performance		Negative
13	Ghosh (2001) [28]	Pre- and post-acquisition operating cash flows		Negative
14	Langhe et al. (2001) [29]	Improved Firm performance		Negative
15	Sharma and Ho (2002) [30]	Improved Firm performance	Australia	Negative
16	Andre et al., (2004) [31]	To analyse the long-term performance	Canada	Negative
17	Pazarskis et al. (2006) [32]	Examine profitability performance		Negative
18	Singh and Mogla (2008) [33]	Examine profitability performance	India	Negative
19	Kuriakose, 2016 [34]	Impact on pre and post-performance	India	Negative
20	Yook (2004) [35]	Post-Acquisition Performance		Negative
21	Yeh and Hoshino (2002) [36]	Firms operating performance	Japan	Negative
22	Poddar (2019) [37]	Impact on Operating Efficiency of Acquiring firms	India	Negative
23	Mehrotra and Sahay, 2018 [38]	Review of Literature	All countries	Mixed-Positive and Negative
24	Aggarwal and Puja, 2019 [39]	Impact on the accounting-based performance	India	Mixed-Positive and Negative
25	Mantravadi (2020) [40]	To analyse the influence of M&A on operating performance in different Industries	India	Banking & Financial Services industry- Positive Pharmaceutical and Textiles Sectors – Negative

Source: compiled by the author.

iii. H3: There is a significant difference in acquiring firms' financial performance in the post-merger and acquisition period compared to the pre-merger and acquisition period.

iv. H4: There is a significant difference in shareholder wealth of acquiring firms in the post-merger and acquisition period compared to the pre-merger and acquisition period.

DATA AND RESEARCH METHODOLOGY

This study uses secondary data that has been extracted from the Scopus database and the CMIE Prowess IQ (Centre for Monitoring Indian Economy) database. For objective 1, the Scopus database has been used. Initially, the keywords namely, Mergers, Acquisitions, Firm Performance, Shareholder Performance and Value Creation

were used to extract the number of studies without limiting the country from the year 2016 to 2020. Then, in the second phase the number of studies was extracted by limiting the country to India only. The past 5 years period has been used to get the recent data.

For the second objective, the data of merger and acquisition of Indian Agri-Food companies deals from the year 2014 to 2016 has been extracted. Then, the window of three pre- year and three post-year data of these deals have been collected, thus making the total period of data the year 2011 to 2019. To make the data compatible, various filters have been used. The year of event i.e., the year of merger and acquisition has not been taken into consideration for the study because the financial reporting in this year is different from the other years. The total number of Agri-Food company's data included in this study is 59.

Ratio analysis is a popular tool for comparing performance pre and post-mergers and acquisitions. To make statistical analysis of the data easier, IBM SPSS 25 is utilised to analyse the data. The Wilcoxon signed-rank test is a non-parametric statistical hypothesis test that is used to see if two related samples, matched samples, or repeated measurements on a single sample different population have means ranks (i.e., a paired difference test). The Wilcoxon signed-rank test is a non-parametric test used to see if two dependent samples were drawn from the same population having the normal distribution. The level of significance used in this study is 5 percent. The author believes that it will be beneficial for the reader to gain more understanding about mergers and acquisitions by conducting this research.

Table 2 summarizes the formula used for the calculation of ratios.

EMPIRICAL EVIDENCE

Objective 1 states that the number of M&A studies has been increased in India. The results are explained in this section. The number of studies country-wise and the number of studies in India has been graphically presented from 2016 to 2020 (*Fig. 1*).

The United States has conducted the highest number of studies, i.e., 209, followed by the United Kingdom, which had 108 studies. India ranks 4th in the number of studies conducted from the year 2016 to 2020. The number of studies conducted in India is around 60, which is much lower than the highest two countries' studies. At the same instance, the number of studies is almost near to other countries' studies. It can be inferred that Mergers and Acquisitions in India are growing equivalently to other developed nations. The number of studies will match the United States and United Kingdom studies in the coming years.

From the above *Fig. 2*, it can be concluded that Indian studies are growing gradually in the last five years. Moreover, the number of studies decreased in 2020 as compared to 2019. The reason is that the Indian economy has been hit by COVID-19, which resulted in a complete lockdown of the whole country for three continuous months beginning from March 24, 2020, and the lockdown was first lifted on June 1, 2020. This situation is too abnormal for the whole world as no one has ever witnessed this type of pandemic, which has led to a decrease in the number of publications due to the lockdown of academic and company areas. Thus, this is the reason for a decrease in the number of studies of 2020 in India.

Hence, hypothesis 1 is accepted, which states that there is significant growth in the literature of M&A in India.

Based on operating performance, financial performance, and shareholder wealth, this paper aimed to evaluate acquiring firms' performance during the post-M&A and pre-M&A periods. The hypothesis of the study is that acquiring firm's performance has improved in the post-M&A period compared to the pre-M&A period.

Table 3 shows that the operating performance ratio, namely, the operating profit ratio and operating expense ratio, indicates that acquiring enterprises' operating performance increases significantly in the post-M&A period. The operating profit ratio in the post-M&A period has increased from 21.1 to 26.2. This increase implies a boost in performance after the consolidation of acquiring and target firms. The mean ratio of operating profit ratio in each period is positive, and the mean change is also positive. The ratio is statistically significant at a significance level of 5%, indicating that profit margins increase due to consolidation in the post-M&A period. The

Table 2

Measure of Ratio Used in the Study

Measure	Ratio	Formulas
Operating Performance	Operating Profit Margin (OPM), (%)	= EBIT/Net Sales
	Operating Expense Ratio (OER), (%)	= Total operating expenses-depreciation / Gross Revenue
Financial Performance	Gross Profit Margin (GPM), (%)	= Profit before Interest and Tax / Net Sales
	Return on Assets (ROA), (%)	= Profit before Interest and Tax / Total Assets
	Net Profit Margin (NPM), (%)	= Profit After Tax / Net Sales
	Return on Equity (ROE), (%)	= Profit After Tax / shareholders' equity
Shareholders Return	EPS (Rs)	= Net Profit / No. of equity shares
	Book Value per share (Rs)	= Value of equity (Equity Shareholders-Preference shareholders) / Average outstanding shares
	Dividend Yield, (%)	= Annual Dividend per share / Current share price

Source: [3, 5, 21, 44–46].

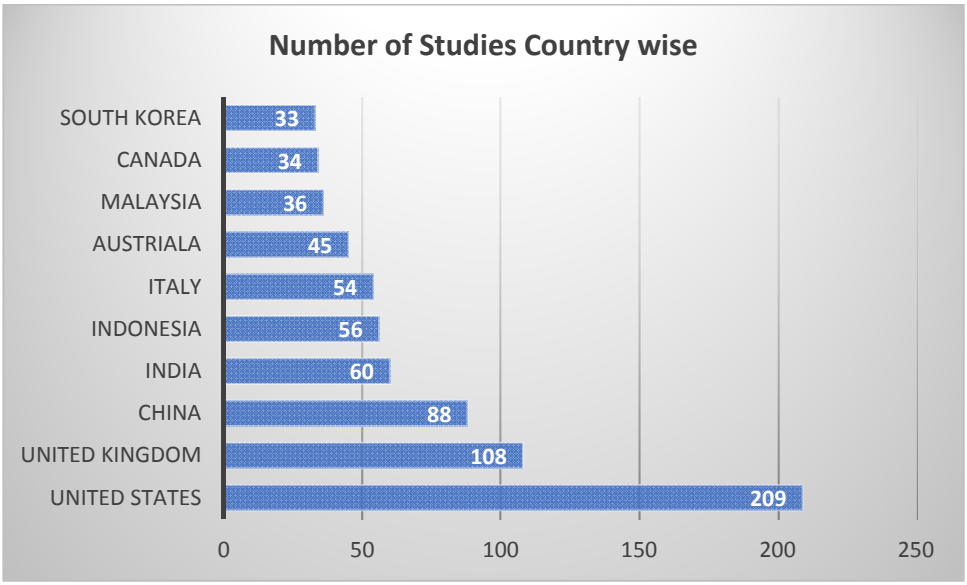

Fig. 1. **Number of Studies Country-Wise (2016–2020)**

Source: compiled by the author.

operating expense ratio has reduced in the post-M&A period from 21.2 to 19.0. The results infer that the mean ratio is positive in each period still, the mean change is negative, which indicates that expenses of acquiring firms have decreased in the post-M&A period. The t-value is not much statistically significant. Hence, hypothesis 1 is accepted.

The indicators of financial performance ratios, Return on Assets, Gross Profit Margin and Net Profit Margin, conclude that during the post-merger period, the financial performance of the acquiring firm differs significantly. The Gross Profit Margin ratio has decreased from 17.7 to 13.6 in the post-M&A period. The mean change is negative, and p-value indicates that the results are not statistically significant. The decrease indicates that Gross Profit Margin has no improvement during the post-M&A period. The Net Profit Margin increases from 15.4 to 21.5 in the post-M&A period and means change is also positive, indicating that the acquiring firm net profit margin has increased due to the consolidation of firms. The p-value shows that the results are statistically significant.

The Return on Assets and Return on Equity have also shown significant improvement in the

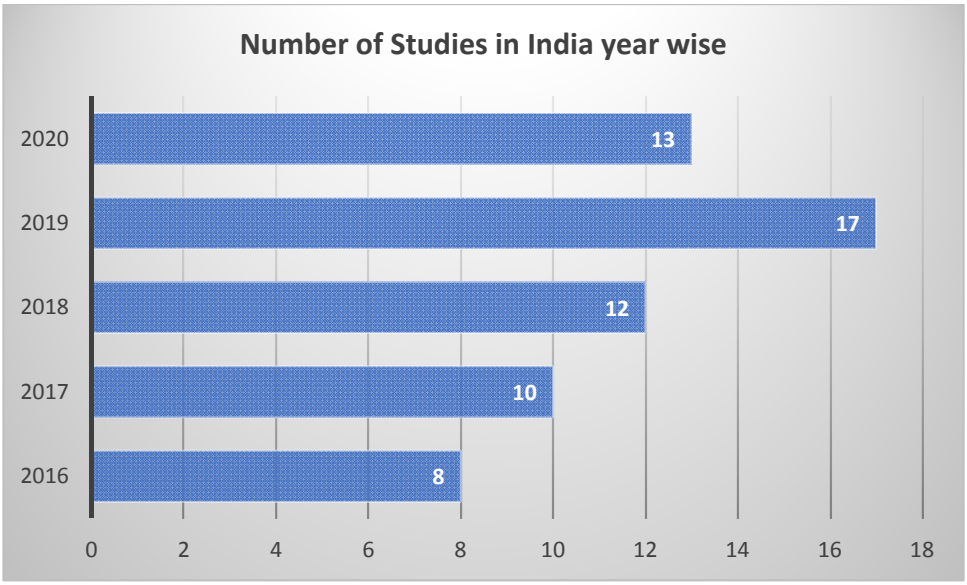

Fig. 2. **Number of Indian Studies Year-Wise (2016–2020)**

Source: compiled by the author.

Table 3

Results of Ratio Analysis

Ratios	Post Mean Ratio (–3, +3)	Pre-Mean Ratio (–3, +3)	Mean Change (–3, +3)	t-value	Significance
OPM	26.2	21.1	4.1	2.73**	0.046
OER	19.0	21.2	–2.2	2.05	0.001
GPM	13.6	17.7	–4.1	3.56	0.310
NPM	21.5	15.4	6.1	2.41**	0.011
ROA	21.6	16.4	5.2	5.16**	0.021
ROE	16.4	13.9	2.5	0.64**	0.016
EPS	20.4	17.1	3.3	1.09**	0.032
BV per share	19.2	15.8	3.4	5.10**	0.040
Dividend Yield	13	14.1	–1.1	1.05	0.229

Source: compiled by the author.

Note: ** significance at 5%.

post-M&A period and the p-value indicates that results are statistically significant. The mean ratio in pre-period and post-period is positive, and the mean change is also positive. Thus, hypothesis 2 has been accepted.

The shareholder's return measured by Earnings per share, Book Value per share and Dividend Yield has been used. The EPS has increased from 17.1 to 20.4, indicating that the mean ratio is positive in each period. The difference in the pre mean ratio and post mean ratio is positive and the p-value is statistically significant. The Book Value per share indicates that in the post-M&A period there is a positive increase in the mean value of 3.4 and the p-value indicates a statistically significant value. Whereas the Dividend Yield does not increase in the post-M&A and the p-value is statistically insignificant. Thus, it can be inferred that hypothesis 3 has been accepted.

In a nutshell, it can be inferred that there is an overall significant improvement in the performance of Indian Agri-Food companies. The merger is accountable for the improved performance. The merged firms seem to have generated higher operating, financial and shareholders profit because of improved managerial efficiency,

utilization of assets effectively and increase in return per share received by shareholders. As a result of the shift of Indian companies from non-competitive to operationally more viable firms, synergistic gains appear to have accrued to the acquired firm. To summarize, this study reaffirms or renews faith in the Indian management community's ability to use mergers and acquisitions as effective instruments of corporate growth strategy.

CONCLUSION

Mergers and acquisitions are among the most popular tactics used by businesses to achieve synergies, tax savings, and consolidation [47–49]. Furthermore, [15] have argued that M&As are also driven by economies of scale, economies of reach, higher growth paths, low concentrated industries, and higher cash flows. As a result, it is apparent that mergers and acquisitions are intended to build and offer superior value to shareholders and improve the performance of acquiring firms during the period of post-M&A.

This study examines the growth rate of M&A literature in India and analyzes the performance of acquiring firms in the post-M&A period. The paired t-test methodology has been used in the study for making a comparison between the pre-M&A period and the post-M&A period. The data from the period 2011 to 2019 has been taken into consideration by Indian companies. The three-year pre- and three-year post windows have been calculated to analyze the long-term performance. The performance has been on three aspects — Operating performance, financial performance, and shareholder return. The various accounting ratio related to these measures have been analyzed namely, Operating Profit Margin, Operating Expense Ratio, Gross Profit Margin, Net Profit Margin, Return on Assets, Return on Equity, EPS, Book Value per share and Dividend Yield.

The findings of these ratios conclude that operating performance, financial performance, and shareholder return exhibit a significant improvement in India's Agri-Food companies' performance. All three hypotheses of the study have been accepted. Mergers and acquisitions are aimed at developing and generating synergistic value [50]. Most academics consider the increase in profit margin, as well as changes in operating and financial ratios, to be crucial markers of post-merger value that have contributed to synergy. The post-merger shareholder earnings also improve in the post-merger because most government policies favour the food and agriculture industries because of their significant contribution to economic growth; for example, in terms of GDP. The results are in line with studies of other Indian industries both in case of domestic and international [8, 18, 20, 28, 39, 51–55]. It can be inferred that M&A produces results in the long term. The acquiring company pays a high premium, operational integration takes time to complete and cultural integration is another mammoth task. Synergies might not emerge quickly because of all these causes. M&A can be defined as a long-term investment that yields favourable returns and enhances a company's accounting and financial position.

This study has several managerial implications. The managers should pursue mergers and acquisitions that create a win-win outcome for both acquiring and target companies. Mergers and acquisitions by themselves are insufficient to develop strong, efficient, and competitive systems because a variety of other factors influences performance. They must be reinforced by additional measures, such as improving employee knowledge and professionalism, and ensuring consistency between the two companies in the merger or acquisition implementation strategy, bringing about more effective corporate governance measures to further elevate the institutions' competitiveness in the context of the problems of a globalized and liberalized environment. Secondly, the acquiring firm should identify the target's hidden problems and contingent liabilities and not ignore them due to infatuation with the other party.

The limitation of this study is that only publicly traded companies that completed a merger or acquisition in the India Agri companies during the research period have been included. Only those companies with three years pre and 3 years post-financial data are included. Furthermore, aside from firm and deal variables, other micro-and macroeconomic variables viz.

GDP rate, government policies, taxation rules and regulations, and exchange rate can also affect the acquiring firm's accounting output in the long run. The impact of Mergers and Acquisitions from the cross-border and stock price reaction leaves a future scope for the extension of the study.

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Excess Value Created as a Performance Metric and its Determination Utilizing the *TEVA* Measure

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ABSTRACT

The paper explores the excess value created (*EVC*) metric, which is an aggregated measure of the financial performance of a company over a multi-period measurement interval. **The relevance** of the study is due to the demand for practical solutions in the field of financial performance monitoring and incentive compensation, which makes it possible to achieve congruence between the interests of shareholders and the decisions of managers. **The aim** of the study is to build and justify a periodic financial measure that takes into account not only the current result but also the long-term consequences of management decisions. **The scientific novelty** of the study lies in the determination of the *EVC* metric via the *TEVA* indicator and providing the rationale for the new design of the performance measure. **The result** of the study is the derivation of formulas for calculating the *EVC* measure on multi-period and one-period intervals, which are free from restrictions on changes in the capital structure and the cost of capital, allow for a time-varying systematic risk of operating activities and possess the advantage of computational simplicity important for practical applications. The study **concludes** that the measurement of value created using the *EVC* indicator determined via *TEVA* makes it possible to achieve close conformity of the metric constructed to the real-world conditions with the unification of calculations in its retrospective and forecast components based on data available from historical and Pro Forma financial statements and information from the capital market.

Keywords: performance measurement; residual operating income; Total *EVA* (*TEVA*); value-based management

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INTRODUCTION

Companies increase their financial value to shareholders when they invest in strategies, projects, technologies, or products with a positive net present value. At the same time, investing in projects that are profitable ex ante does not guarantee that these investments will be profitable ex post. To achieve the goal of creating value, well-functioning mechanisms for measuring, monitoring and rewarding results are needed that stimulate management to realize the economic benefits embedded in the rationale for their decisions.

The difficulty here lies in the fact that the evaluation of the work of management should be based on the past, on actual results. On the other hand, the incentive effect of the indicator for ongoing monitoring of financial performance should be consistent with the overall goal of creating value. A periodic measure that potentially combines these two aspects is residual income — an indicator that characterizes the financial result after covering the income from alternative use of capital forgone by investors [1].

Since the late 1980s, along with the ideas and technologies of value management, the version of residual income, popularized by Stern Stewart & Co [2] under the trademark EVA™ (Economic Value Added), has become firmly established in management practice. The priority purpose of using the indicator is the current assessment of efficiency and the formation of remuneration for managers [3–6]. It should be noted that this, of course, is not the only area of active application of analytical criteria based on the concept of residual income. The issues of using *EVA* in evaluating investment projects [7], building value based management models [8] and controlling

[9] remain relevant. Focusing on the *EVA* indicator, a number of authors conduct a comparative analysis of the activities of Russian corporations from various sectors of the economy [10–12], evaluate the innovative potential of an enterprise [13], as well as the impact of investments in intellectual capital on the company's capitalization [14].

Typical for most publications in Russian periodicals is the interpretation in which the positive value of *EVA* of the period is identified with the creation (increase) of value, and the negative value with its destruction (decrease). And although the equivalence of calculating *NPV* based on expected residual incomes and expected cash flows has long been known [15] and repeatedly reproduced in the literature [16–18], this property does not make residual income maximization over a period equivalent to *NPV* maximization [1, 19–21]. Moreover, academic studies have repeatedly noted that the *EVA* indicator, and in its person the entire family of residual income indicators, has properties that cast doubt on the possibility of its direct use as a single period value creation measure. The most significant shortcomings, in the context of the task of measuring and encouraging performance, include the following.

Firstly, *EVA* is calculated on the basis of accounting data, and this, on the one hand, creates opportunities for manipulation by management [22], and on the other hand, entails the distorting effect of erroneous periodization due to accounting policy for depreciation of long-term assets adopted at the enterprise [7, 23].

Secondly, historical *EVA* does not necessarily reflect future performance, especially if the company is in transition or has made major capital investments. In the latter case, the *EVA* value cannot be an adequate indicator of the quality of managerial decisions due to the effect of deferred productivity: the values of the indicator fall due to the high base of invested capital, while the expected future return on investment is not taken into account in the calculations as a benefit [24].

Thirdly, *EVA* is a single-period metric focused on the current result, which can push management to choose the shortest and most convenient path to personal gain by maximizing the current *EVA* to the detriment of the company's long-term goals and its viability [25–27].

In a broader sense, the use of residual income for the ongoing evaluation of results and the basis for executive compensation leaves the agency problem unresolved. The manager is usually better informed about investment opportunities and their characteristics than his principal, the owner of the company. A prerequisite for a conflict of interest may be a shorter time horizon and/or higher than the principal's risk sensitivity when the agent evaluates his personal benefits at the time of making a decision: the principal seeks to maximize the expected net present value, and the agent seeks to maximize the utility function which depends on residual income through a compensation agreement linking wages to the financial performance of the company [28]. Thus, control and incentives based on the *EVA* indicator itself do not allow achieving a strict correspondence between the goals of the agent and the principal [16, 29, 30], and the decisions made by management may not be optimal with respect to the goal of maximizing financial value.

Bonus schemes based on indicators that are conceptually similar to *EVA* were used by many companies in the first half of the 20th century, but all of them eventually abandoned the idea of incentive payments in the form of a fixed share of *EVA* [31, 32]. The second wave of *EVA* popularity came in the 90s, but by 2008, at least 90% of the companies included in the S&P1500 index had excluded this metric from the arsenal of managerial effectiveness criteria, and out of 66 clients of the consulting company Stern Stewart & Co, who built in 1999 a system of material incentives based on a modified approach, called the "modern bonus plan *EVA*",[1] only six stayed committed by 2008

[1] The earned bonus in this scheme is calculated as the sum of the target bonus and a fixed share of the excess of the actual increase in EVA over the expected increase [35].

[24]. One of the main reasons for this under-the-radar phenomenon of *EVA* abandonment in actual corporate practice is two-fold. Firstly, *EVA* encourages management not to invest in strategically important long-term projects, since it is much easier to achieve *EVA* growth and bonus payments by reducing the amount of assets in the statement of financial position than by working for the future reaching the planned level of profitability in the long term [33]. Secondly, neither the value of *EVA* nor its growth over the reporting period is a reliable indicator of the levels of financial results in the future [34], and hence the value created.

Based on the understanding that the value created by management decisions includes not only the financial result of the period, but also the current value of future economic benefits, then the periodic indicator of the financial result should, by perforce, combine the retrospective and forecast components. This approach is consistent with the findings of contemporary corporate governance research,[2] which shows that companies create the most value when management is focused on achieving high long-term results, while pressure from investors and the board of directors forces managers to focus on values of indicators by the next reporting date. This is also consistent with the methodology of system management, according to which the objective function of assessing the quality of management should include characteristics of the effectiveness and efficiency of the enterprise both in the short and long term [36, 37].

J. O'Hanlon and C. Pisnell [38] introduced a new financial metric Excess Value Created (EVC) into academic circulation, which aggregates the realized value ex post and the creation of new value ex ante through the concept of unrecovered capital.[3] The retrospective and forecast components of *EVC* are calculated through residual income, which forms a single basis for a holistic analysis over a multi-period interval for evaluating performance and allows the development of financial incentive schemes based on a bonus bank, in which management receives remuneration taking into account both the value already realized in historical residual incomes and the value created by residual incomes expected in the future, thereby achieving the necessary alignment between incentive payments and actual value creation [39].

Although the work of J. O'Hanlon and K. Peasnell was recognized by the academic community as a significant advance in the theory of financial performance measurement [40], it did not attract active attention of practitioners. Perhaps this is due to the fact that the *EVC* indicator has not received multimillion-dollar marketing support from consulting companies, and also because the design and calculation of *EVC* in the perception of the manager looks much more complicated than the usual residual net income and *EVA*.

From the point of view of transferring the developments of J. O'Hanlon and K. Peasnell [38] into practice, there are also a number of significant limitations. Initially, *EVC* assumes that the company is financed only from equity, the cost of which remains constant both in the retrospective and in the prospective part of the calculation of the indicator. This assumption narrows the scope of applicability of the basic version of *EVC*. If we take a typical situation in practice, where financing is mixed and the capital structure can change as a result of the mutual imposition of investment, operational and financial decisions, then the problem of cyclic dependencies arises [46, 44] when calculating the weighted average cost of capital WACC in the forecast part of

[2] Sneader K., Williamson S.K., Koller T., Potter V., Babcock A. Corporate long-term behaviors: How CEOs and boards drive sustained value creation. McKinsey&Co and FCLTGlobal, 2021. This is a joint study by FCLTGlobal (a non-profit organization that conducts research and develops tools that encourage long-term investment) and McKinsey. Its full version is available at the URL: https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/how-executives-can-help-sustain-value-creation-for-the-long-term (accessed on 01.04.2022).

[3] This article offers, perhaps, the most complete formalized presentation of consonant ideas discussed in the scientific and professional literature, in particular, in the works [5, 41–43].

EVC, modified for companies with leverage [44], which requires iterative calculations to find the specific weights of WACC for each period and over the entire forecast horizon.. Due to a combination of factors, the correct calculation of the *EVC* indicator really becomes unnecessarily cumbersome.

In the present study, the definition of the indicator of the excess value created *EVC* through the *TEVA* indicator (Total *EVA*) is substantiated and it is shown that the new design of the *EVC* while retaining all the advantages of the original development by J. O'Hanlon and K. Peasnell, removes its inherent limiting assumptions and circumvents the computational complexity of measuring value created for companies with mixed financing.

ASSUMPTIONS AND BASIC RELATIONSHIPS

The following assumptions are accepted as initial for subsequent developments. Cash flows occur discretely at the end of each time period. The Company's assets do not include excess cash and cash equivalents and investments in financial assets. The Company implements a payout policy whereby the total cash flow from its activities (*CCF*, Capital Cash Flow[4]), namely free cash flow[5] (*FCF*) plus tax savings from interest on debt (*TS*), is paid out in full to investors:

$$CCF_t = FCF_t + TS_t, \quad (1)$$

where the index *t* denotes the period.[6]

The interest tax shield is calculated using the formula:

$$TS_t = k_t^D \, \text{int}_t, \quad (2)$$

and with regard to borrowed capital, the standard assumption in the literature is that in each period *t* the debt interest rate coincides with the cost of debt k_t^D, and, accordingly, the financial value of debt V_t^D is equal to the nominal amount of debt D_t, i.e. $V_t^D = D_t$.

Changes in time of flow and final indicators are described by the ratios:

$$int_t = k_t^D D_{t-1}, \quad (3)$$

$$OI_t = NI_t + int_t \cdot (1-T), \quad (4)$$

$$A_t = A_{t-1} + OI_t - FCF_t, \quad (5)$$

where *int* — debt service interest; *OI* — operating income; *NI* — net profit; *T* — income tax rate; *A* — net operating assets.[7] The operating assets growth equation (5) is the basic structural relation linking the statement of financial position (balance sheet) and income statement with the statement of cash flows [48, p. 212].

The TEVA indicator is based on the decomposition of the total financial result into operating and financial components using the cost of unlevered capital k^U, which characterizes the risk of operating assets, as a threshold for calculating the opportunity cost of the capital invested in these assets [49]:

$$TEVA_t \equiv OI_t + TS_t - k_t^U A_{t-1}. \quad (6)$$

Given Equation (4), *TEVA* can be expressed in terms of quantities available directly from historical and projected financial statements[8]:

$$TEVA_t = NI_t + Int_t - k_t^U A_{t-1}. \quad (7)$$

[4] The original English term Capital Cash Flow within the meaning of [46] can be translated as cash flow to invested capital. CCF is also equal to the sum of the cash flow of shareholders (CFE) and the cash flow of creditors (CFD): CCF = CFE + CFD.

[5] A popular book by McKinsey Partners [47] defines free cash flow as the cash flow from operating activities minus new capital investments.

[6] For balance sheet items (statement of financial position) and other totals, the index t — 1 means the end of period t — 1, or, equivalently, the beginning of period t.

[7] The balance sheet amount of total assets minus current non-interest bearing liabilities.

[8] The transition to TEVA as a flow metric of financial performance eliminates the prerequisites for the occurrence of distortions in the assessment and errors in the interpretation of the results, which are potentially possible when using classic indicators of residual operating income, in particular EVA [51].

The financial value at time t of operating assets, V_t^A, which determines the financial value of the company as a whole under blended financing, is equal to the sum of the book value of operating assets and expected future *TEVA*, discounted at rates k_j^U, calculated at time t for each of the future periods j[9] [50]:

$$V_t^A = A_t + \sum_{j=t+1}^{L} u_{t,j}^{-1} TEVA_j , \quad (8)$$

where L denotes the expected completion period of the activity,[10] $u_{t,j} = \prod_{s=t+1}^{j} (1+k_s^U)$ and the symbol ∏ denotes the product.[11]

Note that using *TEVA* as a forecasted attribute, it is also possible to estimate the value of the company's equity. Indeed, since the financial value of a company is equal to the sum of the financial value of its equity V_t^E and the financial value of its debt V_t^D:

$$V_t^A = V_t^E + V_t^D , \quad (9)$$

and the book value E_t of equity capital can be expressed from the main balance sheet equation as $E_t = A_t - D_t$, then under the assumptions made regarding debt financing, equation (8) is transformed into the equation

$$V_t^E = E_t + \sum_{j=t+1}^{L} u_{t,j}^{-1} TEVA_j , \quad (10)$$

showing that the financial value of equity is equal to equity on the balance sheet plus the sum of current estimated *TEVA*.

MEASURING VALUE CREATED FOR LEVERED COMPANIES

The concept of Unrecovered Capital plays a key role in measuring the value created by a company over a period of time. And if the basic design in [58] assumes the capital of shareholders, then in the case of mixed financing, two new notions must be introduced.

The first is the unrecovered financial value of operating assets at time t. Let us denote it by UV_t^A and define it as the accumulated value of the net investments in operating activities, namely, the total investments from equity and debt capital, minus payments to shareholders and creditors, increased at the alternative return rate k^U:

$$UV_t^A = UV_{t-1}^A (1+k_t^U) - CCF_t , \quad (11)$$

under the initial condition $UV_0^A = V_0^A$.

The equation for UV_t^A over a multi-period interval from the beginning of the measurement at time 0 to the end of the measurement at time t is obtained by induction:

$$UV_t^A = u_{0,t} V_0^A - \sum_{i=1}^{t} u_{i,t} CCF_i , \quad (12)$$

where $u_{i,t} = \prod_{p=i+1}^{t} (1+k_p^U)$, $u_{t,t} = 1$.

In essence, the unrecovered financial value of operating assets is the difference between the financial value imputed at time t of those assets that the company owned at the beginning of the analyzed multi-period interval,[12] and the sum of all accrued payments to investors over time t. Net payouts for a period can be negative if, during that period, the amount received by the company from issuing new shares and/or raising new debt exceeds the total payouts to investors, which consist of cash dividends, share repurchases, and debt servicing and repayment.

The second is the unrecovered book value of operating assets at time t. We denote it as UA_t and define it as follows:

[9] For ease of understanding, the expectation operators in all formulas are omitted.

[10] As a rule, L = Г

[11] If we assume that the company's business portfolio and its systematic risk will not change in the future, then the calculation of the product will be simplified to exponentiation.

[12] For a public company, the natural measure of the financial value of operating assets at the beginning of the performance interval will be the sum of its market capitalization and net debt. If we talk about a closed company or a division of a larger enterprise, then an internal valuation is required, which can be performed, as an option, with the involvement of an external business appraiser.

$$UA_t = u_{0,t} A_0 - \sum_{i=1}^{t} u_{i,t} CCF_i . \qquad (13)$$

Equations (12) and (13) coincide, except for the initial condition. In the latter case $UA_0 = A_0$, where A_0 — is the book value of operating assets at the beginning of the multi-period measurement interval. UA_t can be interpreted as the amount of resources transferred to the company by capital providers in all previous periods cumulated to time *t* at the rate of alternative return.

Using equations (1), (5) and (13) and the definition of *TEVA* (6), the relationship at time *t* between the book value of the assets, the unrecovered book value of the assets and the past realized residual incomes can be established.

Indeed,

$$A_1 - UA_1 = A_1 - A_0(1+k_1^U) + CCF_1 =$$

$$= A_0 + OI_1 - FCF_1 - A_0 - k_1^U A_0 + (FCF_1 + TS_1) =$$

$$= OI_1 + TS_1 - k_1^U A_0 = TEVA_1 .$$

$$A_2 - UA_2 = A_2 - UA_1(1+k_2^U) + CCF_2 =$$

$$= A_1 + OI_2 - FCF_2 +$$

$$+ (-A_1 + TEVA_1)(1+k_2^U) + (FCF_2 + TS_2) =$$

$$= OI_2 - k_2^U A_1 + TEVA_1(1+k_2^U) + TS_2 =$$

$$= TEVA_1(1+k_2^U) + TEVA_2 .$$

Continuing, by induction we obtain:

$$A_t - UA_t = \sum_{i=1}^{t} u_{i,t} TEVA_i . \qquad (14)$$

Equation (14) is a retrospective reflection of equation (8), linking the financial value of assets, their book value and expected future residual operating incomes.

We define the excess value created over a multi-period measurement interval as the excess of the financial value of operating assets over the unrecovered financial value of operating assets at the end of this interval:

$$EVC_t = V_t^A - UV_t^A . \qquad (15)$$

EVC — is a monetary measure at time *t* of the total return on funds invested in the company in excess of the return on alternative investment with the same level of risk, and it represents the total return for all investors, both equity and debt, including both the income already received in the past from the beginning of the measurement interval and income expected in the future.

Since the capital invested in the operating assets of a levered company is a combination of debt and equity, it is possible, according to A. Schueler and S. Krotter [44, p. 273], to divide the unrecovered value of operating assets into the unrecovered value of equity (UV_t^E) and the unrecovered value of debt (UV_t^D), so that $UV_t^A = UV_t^E + UV_t^D$, and calculate UV_t through pre-calculated UV_t^E and UV_t^D. On the one hand, this approach is interesting from a theoretical point of view, as it makes it possible to see that the accumulation of the initial financial value of operating assets and payments to investors cannot be carried out at the standard *WACC* rate, and it is necessary to calculate a modified weighted average rate with weights for each retrospective period, based on the values of UV_t^A, UV_t^E and UV_t^D. On the other hand, it noticeably complicates both the design and calculation of UV_t^A, and this gives a significant advantage to equation (14) in practical applications.

In our assumption about the equality of the financial value of the creditors' investments and the book value of the debt, we have: $V_t^D = D_t = UV_t^D$. Then

$$EVC_t = V_t^A - UV_t^A = V_t^E + V_t^D - \\ - (UV_t^E - UV_t^D) = V_t^E - UV_t^E . \qquad (16)$$

Here we can draw a useful intermediate conclusion. Under the standard assumption in the literature that the net present value of financial decisions is zero, the excess value created by a company with mixed financing can be equivalently calculated either at the level of the company as a whole, i.e. from the standpoint of the entire capital of investors, both equity and debt, or at the level of equity only. When applied consistently and in

concert, both approaches should produce the same result. If we proceed from a more realistic assumption about the possible divergence of the market value and the nominal amount of the debt, and this is a typical situation for bonds, then

$$EVC_t = V_t^A - UV_t^A = V_t^E - UV_t^E + (V_t^D - UV_t^D). \quad (17)$$

The excess value created for shareholders will differ from the excess value created by the company as a whole (for all investors) by the excess value created for the creditor, which is the integral effect of his participation in financing the company over a multi-period time interval.

Further, adding and subtracting $A_t - UA_t$ on the right side of (15) after rearranging the terms, we have:

$$EVC_t = (V_t^A - A_t) + (A_t - UA_t) - (UV_t^A - UA_t).$$

Taking into account (8) for $V_t^A - A_t$, (14) for $A_t - UA_t$, (12) for UV_t^A and (13) for UA_t, we obtain an equation expressing the *EVC* indicator in terms of historical and projected *TEVA*:

$$EVC_t = \sum_{i=1}^{t} u_{i,t} TEVA_i + \sum_{j=t+1}^{L} u_{t,j}^{-1} TEVA_j - u_{0,t}(V_0^A - A_0). \quad (18)$$

Thus, the aggregate measure of financial performance — the excess value created over a multi-period time interval from the start of measurement at time 0 to time t — consists of three components. The first is the sum of all TEVAs that have arisen in the past, cumulated to time t. It is equal to the excess at time t of the book value of the company's assets (the total book value of equity and debt) over the amount of investments made in the company during the measurement interval, cumulated to time t at the rate of alternative return. The second is the sum of the future *TEVA* discounted to time t that will occur in periods following period t. It represents the contribution to the *EVC* of financial results expected in the future. The third is the difference between the financial value and the book value of operating assets at time 0, cumulated to time t. This value is included in the *EVC* calculation with a "–" sign, and can be interpreted as an adjustment due to the fact that the return at the level of the alternative should have been provided on investments measured by their financial value and not by the amount on the company's financial statement.

EXPECTATIONS AND ACTUAL RESULTS

If the financial value of the company's assets exceeds their book value, then equation (8) implies that the present value of expected *TEVAs* is positive, or equivalently, expected future *TEVAs* are positive on average. In this case, the fact that *TEVA* is positive for the reporting period does not necessarily mean that the company is successful and is coping with the task of at least maintaining the financial value of operating assets (the value of investors' capital) at the level reached earlier, not to mention its growth. This implies the well-known concept of constructing financial incentive schemes for managers, based on the accrual of bonuses, provided that the residual income value exceeds the target level imputed by already existing expectations regarding future financial results [5, Ch. 8]. Let us show further how this idea can be formalized using the indicators constructed above.

In practice, the value of realized TEVA, as well as TEVA expected in the future, may differ from their values expected (planned) earlier. Let the index s denote the beginning of the control multi-period measurement in the time interval from 0 to t. We denote by $TEVA_{i|s}$ the value of *TEVA* expected in period i ($I = s + 1, s + 2, \ldots, L$) based on the information available at time s. For estimates that are retrospective with respect to the current moment t, financial success is characterized by $TEVA_i^s$ value equal to the excess of the actual $TEVA_i$ period i over $TEVA_{i|s}$, expected in this period at time s:

$$TEVA_i^s \equiv TEVA_i - TEVA_{i|s}. \quad (19)$$

If the expectations were met exactly, then $TEVA_i$, realized in period i, will be equal to

$TEVA_{i|s}$, forecasted for this period based on the information available at time *s*, and $TEVA_i^s = 0$. Deviation from the expected value gives the excess *TEVA*, which can be either positive or negative.

For future periods $j = t + 1, t + 2, \ldots, L$ the measure of success will be the difference between the revised forecast values $TEVA_{j|t}$, based on information at time *t*, and the forecast values $TEVA_{j|s}$, as they were at time *s*:

$$TEVA_j^s \equiv TEVA_{j|t} - TEVA_{j|s}. \qquad (20)$$

Let us represent (8) in the form

$$V_s^A - A_s = \sum_{i=s+1}^{t} u_{s,i}^{-1} TEVA_{i|s} + \sum_{j=t+1}^{L} u_{s,j}^{-1} TEVA_{j|s}$$

and multiply both sides of this equality by $u_{s,t}$:

$$u_{s,t}(V_s^A - A_s) = \sum_{i=s+1}^{t} u_{i,t} TEVA_{i|s} + \sum_{j=t+1}^{L} u_{t,j}^{-1} TEVA_{j|s}. \qquad (21)$$

Then, substituting (21) into equation (18) for the interval from time *s* to time *t*, and taking into account (14) and (15), we obtain:

$$EVC_t^s = \sum_{i=s+1}^{t} u_{i,t} TEVA_i^s + \sum_{j=t+1}^{L} u_{t,j}^{-1} TEVA_j^s. \qquad (22)$$

Thus, the excess value created EVC_t^s over the multi-period reference interval from time *s* to time *t* can be defined solely in terms of *TEVA*, excluding the initial difference between the financial value and the book value of the invested capital. It consists of the sum of the excess *TEVA* already realized, accrued up to the date of the control calculation (time *t*), and the sum of the discounted excess *TEVA* arising from the revision of forecasts based on the information that became available at time *t*. If the management of the company achieves positive values of excess *TEVA*, then this means that the required results imputed by the starting position $V_s^A - A_s > 0$ were exceed. Accordingly, *EVC* will be positive, and there is a basis for bonus payouts.

In a situation where financial performance monitoring includes a period-by-period calculation of *EVC*, the duration of the control interval is one period from *t* — 1 to *t*, so that

$$EVC_t^{t-1} = TEVA_t^{t-1} + \sum_{j=t+1}^{L} u_{t,j}^{-1} TEVA_j^{t-1}. \qquad (23)$$

Formula (23) has an intuitive interpretation. The excess value created includes the deviation of the actual *TEVA* of completed period *t* from that budgeted at the start of the period, plus the deviation of the present value of future *TEVA* forecast at time *t* from the present value of future *TEVA* as forecast at time *t* — 1. If the result of the period is equal to the planned one and no events have occurred that entail the need to revise the forecasts and budget, then $EVC_t^{t-1} = 0$ and the management receives a reward for achieving the target result. If the value EVC_t^{t-1} is non-zero, then the reasons for the deviation should be analyzed. It may also be necessary to make adjustments to the forecasting assumptions made and to the process of building the financial plan.

Note that $TEVA_t^{t-1}$ on the right side of (23) is equal to the difference between the actual and planned operating profit of period *t*. Indeed, since the book value of operating assets at the beginning of the period does not depend in any way on new information at the end of the period and $A_{t-1|t} = A_{t-1|t-1}$, then

$$TEVA_t^{t-1} = (OI_{t|t} - A_{t-1|t} k_t^U) -$$
$$- (OI_{t|t-1} - A_{t-1|t-1} k_t^U) = OI_{t|t} - OI_{t|t-1}.$$

In addition to the above, there are two more aspects of the meaningful interpretation of the metric EVC_t^{t-1}. Firstly, it can be represented as

$$EVC_t^{t-1} = EVC_{t|t}^s - EVC_{t|t-1}^s, \qquad (24)$$

i.e. as the difference between the amount of excess value created over a multi-period measurement interval from time *s*, calculated based on the information available at time *t*:

$$EVC^{s}_{t|t} = \sum_{i=s+1}^{t} u_{i,t} TEVA_{i|t} + \sum_{j=t+1}^{L} u^{-1}_{t,j} TEVA_{j|t} - \quad (25)$$
$$- u_{s,t}(V^{A}_{s} - A_{s}),$$

and the same value calculated on the basis of the information available at time $t-1$:

$$EVC^{s}_{t|t-1} = \sum_{i=s+1}^{t} u_{i,t} TEVA_{i|t-1} + \sum_{j=t+1}^{L} u^{-1}_{t,j} TEVA_{j|t-1} - \quad (26)$$
$$- u_{s,t}(V^{A}_{s} - A_{s}).$$

From (24) it follows that the increase or decrease in *EVC* relative to its level in the previous period does not necessarily mean the creation or destruction of value, the improvement or deterioration of performance. A quantitative measure of financial success for the reporting period is the excess of the actual excess value created during this period over the value that it was expected at the end of the period at its beginning.

Secondly, EVC^{t-1}_{t} it can be represented as:

$$EVC^{t-1}_{t} = EVC^{s}_{t|t} - (1 + k^{U}_{t}) EVC^{s}_{t-1|t-1}. \quad (27)$$

This is easy to verify: after substituting $EVC^{s}_{t|t}$ из (25), from (25), taking into account the fact that

$$EVC^{s}_{t-1|t-1}(1 + k^{U}_{t}) = \sum_{i=s+1}^{t} u_{i,t} TEVA_{i|t-1} +$$
$$+ \sum_{j=t+1}^{L} u^{-1}_{t,j} TEVA_{j|t-1} - u_{s,t}(V^{A}_{s} - A_{s}),$$

(27) is immediately converted to (23).

Equation (27) says that the net value created for period *t* is equal to the difference between the excess value created at the end of period *t* and the imputed value, which is the amount of excess value created at the beginning of period *t*, cumulated to the end of the period at the rate of alternative return.

ADVANTAGES OF THE PROPOSED APPROACH

The initial design of the *EVC* indicator, presented in [38], is based on the assumption that the company is financed exclusively by the equity capital, the cost of which remains unchanged over the entire multi-period performance measurement interval. The authors intentionally exclude leverage effects from the analysis [38, p. 230], and this makes their constructions refined and the formulas computationally simple, but at the same time significantly limits the scope of their practical application.

In a subsequent publication, A. Schueler and S. Krotter [44] analyze how the EVC indicator and its components should be determined for the company as a whole when financing not only from its own, but also from borrowed funds, and redefine EVC through EVA. The scenario of mixed financing occurs in reality much more often, however, the initial assumptions regarding the capital structure, cost of capital and operational risk in the constructions of A. Schueler and S. Krotter remain quite rigid. In addition to risk-free debt, they assume that the company's financial policy is to constantly adjust the amount of debt used following changes in the value of operating assets in order to maintain financial leverage and the cost of capital at a fixed level,[13] and also that the systematic risk of the company's activities and, accordingly, the rate k^{U} remain unchanged over the entire multi-period performance measurement interval. But even with these highly simplifying assumptions, A. Schueler and S. Krotter conclude that for companies with mixed financing, EVC cannot be based entirely on *EVA* calculated using the standard *WACC*. Historical *EVA* in the retrospective part of *EVC* must be recalculated and then cumulated to the date of calculation of the indicator using a modified weighted average cost of capital, which for each retrospective period is based on weighting factors determined through the values of unrecovered equity and unrecovered debt capital at the beginning of the period

[13] It should be noted that the authors themselves [44, p. 272] explain their choice in favor of focusing on the target capital structure rather by the popularity among practitioners of the assumption of a constant WACC [52, p. 10–12], and not the realism of such a financial policy option.

[44, p. 273]. At the same time, the future *EVA* of the *EVC* forecast portion is still calculated and discounted using the standard *WACC*, in which the weights for the costs of capital components are based on market values of equity and debt. This dichotomy breaks the symmetry and elegance of the results [38] where an identically defined cost of capital rate is used to calculate both unrecovered capital and residual income.

If, while bringing the model closer to reality, we admit the possibility of arbitrary changes in the company's capital structure, then the need to calculate the cost of equity and *WACC* rates[14] are consistent with the forecasts when calculating the *EVC* defined through EVA, as done in [44], leads to multiple cyclic dependencies between the variables of the financial model [53; 54, p. 388–395; 55] and the need to iteratively solve systems of equations for each period over the entire forecast horizon from t to L. Although this problem can be solved using the computational capabilities of modern spreadsheets [56, 57], the modification of the excess value created indicator for levered companies proposed by A. Schueler and S. Krotter, turns out to be excessively cumbersome for periodic calculations and difficult to understand at the level of operational management.

If *TEVA* is used as an *EVC* attribute instead of the traditional *EVA*, then all the noted limitations and difficulties are completely removed. Equations (18), (22) and (23) do not imply any assumptions about the financial policy and capital structure of the company, they do not have cyclical relationships between variables. The definition of the *EVC* indicator proposed in this study, while maintaining the symmetry and computational simplicity of the original construction of J. O'Hanlon and K. Peasnell [38], makes it possible to correctly include the effects of mutual imposition of the consequences of investment, operational and financial decisions into the assessment of operational performance, as well as take into account the change in time of the systematic risk of the company's activities.

Another important advantage of defining *EVC* in terms of *TEVA* is that *TEVA* avoids the design flaw and its consequences inherent in traditional definitions of residual operating income, including *EVA* [50]. The use of *WACC* in the latter as an alternative rate of return for calculating the opportunity cost of funds invested in operating assets creates prerequisites for the occurrence of distortions in measurements and errors in the interpretation of financial indicators. The reason is that *WACC* is a threshold return for a combination of investment and financing decisions, not for return on investment in operating activities, and is also often calculated with simplifying assumptions about the weights and costs of capital components which leads to a discrepancy between the correct *WACC* value and the one actually applied [51].

It should also be noted that the information required for calculations using the presented formulas does not go beyond the perimeter of standard sources that form the basis for management analytics. Net income, interest on debt and book value of operating assets for calculating *EVC* values through *TEVA* are available directly from retrospective and projected financial statements. Rates k^U can be calculated according to a standard scheme using the *CAPM* model [47, 54, 58, 59].

CONCLUSIONS

To achieve a high degree of alignment between the interests of shareholders and the decisions of managers, the financial reward of the latter must be based on the financial value created for shareholders. The use of residual income and *EVA* in particular as performance indicators and the basis for generating incentive payments, does not provide an effective solution to this problem. As a single-period indicator, *EVA* does not

[14] Failure to comply with the consistency conditions leads to the so-called "error of incorrect calculation of the discount rate" [17], which can lead to significant errors in the interpretation of financial results and management recommendations arising from them [51].

take into account the long-term financial consequences, which, as a rule, are the most significant component of financial value, created or destroyed by decisions made by the company's management.

As a metric to overcome the focus of *EVA* on the short term to the detriment of the long-term success of the company, the indicator of excess value created *EVC* is proposed — a financial metric of performance over a multi-period interval, consisting of two components: accumulated residual income realized from the beginning of the measurement to the point in time for which the calculation is made, and the present value of the expected residual income in the future. The combination of retrospective and prospective analysis expands the conventional view of the assessment of financial performance and makes the new metric relevant for management practice focused on creating financial value for shareholders, however, the transfer of this tool from the idealized world of academic research into the field of practical application immediately pulls along the problem of nonconformity of simplifying assumptions with real world conditions.

The construction and use of a consistent financial model with built-in dynamic adjustments to the structure and cost of the company's capital conditional upon the overlapping effects of investment, operating and financial decisions makes the *EVC* indicator computationally cumbersome and, moreover, requires filling in information that is outside the scope of daily monitoring of operations' effectiveness.

The definition of the aggregate financial metric *EVC* for a multi-period and single-period measurement interval, based on the *TEVA* indicator, justified in this study, makes it possible to achieve a constructive unification in the retrospective and prospective components of *EVC*, and also, by simplifying calculations, remove all restrictions on changes in the structure and cost of the company's capital in case of mixed financing. The proposed approach provides a framework for building a holistic system that includes capital budgeting decisions, post-audit of investment projects, evaluation of results and financial incentives, in which management is rewarded taking into account both the value already realized in the historical residual income and the value created by the residual income that is expected in future, thus achieving the required alignment between incentive payments and the actual creation of financial value for shareholders.

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The Evolving Role of National Central Banks

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ABSTRACT

The article is devoted to the study of modern trends in the development of functions and instruments of central banks (CB). The article **aims** to identify new CB approaches to crisis management and the used tools' analysis and to study the transformation of CB activities and their current role. The authors use general scientific and special research **methods**, including comparative legal analysis and the method of systematization. The article focuses on the current international discussion on the evolving role of CB, provides an overview of experts' opinions on issues related to assessing how CB activities influenced the formation and development of the 2007 global financial crisis. The spread of the latest crisis caused by the COVID-19 pandemic was different from the spread of the 2007 crisis when financial markets were first hit and then stress spread to the real economy through reduced confidence and tightening credit conditions for businesses and households. The authors note that the pandemic crisis developed differently: first, the real economy was affected, which was accompanied by a fall in GDP, and then conditions in the financial sector worsened. The authors systematized the CB measures in response to the pandemic and analyzed them by groups of countries: the CB measures of the advanced economies and countries with emerging markets were broadly similar. Based on a comparative analysis of the monetary instruments, the authors **conclude** that the advanced economies CBs have extremely limited opportunities to use interest rates to manage the crisis, while the emerging markets CBs still have some space for their regulation. The paper also analyses other CB instruments used during the crisis caused by the pandemic. The authors note that the measures implemented by CBs reflect their increased role in modern economic systems and the change in the long-known traditional functions. This research may be useful to state bodies in the implementation and coordination of the policy in the field of regulation of CB activities.

Keywords: central banks; functions of central banks; banking system; financial crisis; crisis caused by the COVID-19 pandemic; central banks instruments

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INTRODUCTION

Currently, all spheres of human activity are rapidly changing, and the activities of central banks have also changed significantly. After the financial and economic crisis of 2007–2009 in many countries, in addition to price stability, the direct responsibility of the central banks included the obligation to maintain financial stability. The expansion of the functions of the central banks became noticeable in its activities to restore national economies after unexpected crisis phenomena. Realizing the traditional function of a lender of last resort in a crisis, the central banks in the last decade have significantly expanded the lists of programs for emergency placement of liquidity, acquired assets and potential partners. This was reflected in a sharp increase in their balance sheet accounts. Thus, if in 2007 the assets of the central banks of the United States, the European Union, Great Britain and Japan, respectively, amounted to from 6 to 20% of nominal GDP, then at the end of 2020 the balance sheet of the Federal Reserve System (FRS) was 34% of the national nominal GDP, the European Central Bank (ECB) — 59%, Bank of England — 40%, Bank of Japan — 127% [1].

By allocating emergency liquidity to participants in certain segments of the capital market and/or setting requirements for banks that provide certain loan products, the central banks become the regulator of macro-social and economic processes that previously belonged to the exclusive powers of the government.

Changes in the activities of the central banks, which were initially formed in the course of overcoming the consequences of the global financial crisis of 2007–2009, were even more clearly manifested in the measures that the central banks of most countries implemented in response to the crisis caused by the COVID-19 pandemic.

The empirical basis of this article was data from several databases. First of all, this is the database of the International Monetary Fund (IMF) "Policy Tracker", which contains data on measures implemented and continuing to operate in different countries in 4 areas: fiscal policy; monetary policy, macro-prudential policy; monetary policy. Only those monetary policy measures that were introduced in the sample countries in 2020 were selected from this database. The second source is the database of the Bank for International Settlements (BIS) [2], which contains a description and assessment of the actions taken by the central banks in 39 countries. Central banks' press releases and individual private databases also served as other sources of information.

The study aims to identify new approaches of the central banks to managing crises caused by systemic shocks and the tools used. The transformation of the functions of the central banks and their role in economic systems is analyzed. Comparison of the experience of anti-crisis management of the central banks of advanced economies and emerging market countries made it possible not only to identify the most effective approaches that had the greatest efficiency, to highlight common features in anti-crisis strategy and tactics but also to trace the evolution of the traditional functions of the central banks.

DISCUSSION ON THE ROLE AND ACTIVITIES OF CENTRAL BANKS

In the 1990s, it was believed that the main instruments by which the central banks could "softly" and flexibly manage national banking systems were short-term refinancing operations of commercial banks and open market operations, limited to the purchase/sale of government securities on the secondary market. These operations allowed the central banks, under normal conditions, to carry out monetary regulation by economic methods, and to provide timely liquid support to individual financial institutions to ensure the stability of their activities. In other words, the so-called standard approach prevailed in monetary theory, containing the following central bank recommendations for conducting monetary policy:

- central banks should focus on achieving price stability, as maintaining a low and stable inflation rate helps to maintain aggregate output at an efficient level;
- central banks should, as the main instrument of monetary policy, regulate the value of the policy (key) short-term interest rate;[1]
- central banks, acting as a lender of last resort, can prevent the development of a systemic banking crisis;
- the implementation of the function of the lender of last resort should be based on the principles of Baijot;[2]
- the banking system is stable if individual credit institutions are financially stable;

control over compliance by credit institutions with regulatory requirements and supervision over their activities should be carried out by a body separate from the central bank.

[1] The documents of the Basel Committee on Banking Supervision use the concept of "policy interest rate". In the documents of the ECB and the Bank of Russia — the concept of "key interest rate". In this work, these concepts are used as synonyms, namely "policy (key) interest rate", and hereinafter — the policy interest rate.

[2] Bagehot's principles (Walter Bagehot, 1893), which essentially determined the rules for the Central Bank to act as a lender of last resort before the global financial crisis, stated: 1) the Central Bank can lend only to solvent banks; 2) loans should be allocated against liquid collateral; 3) rates on emergency loans of the Central Bank should be higher than the market average. In the context of counteracting the consequences of the global financial crisis, these principles have been radically revised. To restore the functioning of national banking systems, it was recognized that the Central Bank should: a) allocate emergency liquidity to temporarily insolvent financial institutions; b) in conditions of systemic stress, loans can be provided with illiquid collateral or without collateral; c) rates on emergency loans should be below market rates. Re-thinking the lender of last resort. BIS Papers. 2014. No. 79. 140 p. URL: https://www.bis.org/publ/bppdf/bispap79.pdf (accessed on 20.03.2022).

In numerous publications, for example [3, 4], it was proved that in order to achieve price stability (target inflation levels), the central bank must have political independence from the government, not credit budget expenditures, not participate in the monetization of the budget deficit or public debt, and to finance own expenses not to resort to budget financing.

However, the development of the global financial crisis of 2007–2009 showed the "inadequacy" of the pre-crisis regime of financial stability and set the task of developing new monetary rules. In order to stop the spread of stressful situations, the central banks implemented various sets of measures, which later became known as "unconventional" monetary policy. Thus, the central banks began to regulate many areas of economic activity that were previously the responsibility of the fiscal and social policy. Central banks have become "judges of probity, arbiters of capital markets, rescuers of banks, backstops to governments and overarching umpires of the financial system".[3]

In scientific sources, for example [5, 6], the point of view has become widespread that one of the root causes of the global financial crisis was the "failures" of financial regulation, in connection with which the following important conclusions were made:

- it is necessary to introduce supranational regulation of the activities of globally significant financial institutions;
- traditional micro-prudential financial regulation does not allow to identify the strengthening of systemic risk factors, cross-border and network risks;
- separation of financial regulation and supervision is inefficient;
- the construction of financial market regulation by the branches of financial intermediation generates serious failures and regulatory arbitrage;
- there are important shortcomings in the infrastructure of the financial market that need to be eliminated;
- it is necessary to revise the rules for implementing the function of the lender of last resort of the central banks, adapting them to the new conditions of complex financial systems;
- the use of a single instrument of monetary policy — a short-term policy interest rate — is not enough to achieve the goals of monetary policy;
- the performance of the central bank only as a lender of last resort in relation to commercial banks does not prevent a systemic banking crisis.

In almost all countries, in response to the crisis of the 2010s institutional transformations and legal reforms were carried out to regulate the activities of the central banks, giving them new powers and tools. The empowerment of national central banks with new powers and tools meant their entry into the "new normal". It also provoked a resumption of the previous discussion about an acceptable degree of independence and autonomy of the central banks, the compatibility of monetary policy objectives, financial stability policies, and crisis management policies.

According to historical data, the main drivers of reforms in the status and powers of the central banks were:

- economic recession or financial crisis;
- external pressures such as IMF loan condition;
- changes in the ideology of state policy, political structure and institutional environment;
- the need to maintain favorable economic conditions, for example, positive economic growth rates in conditions where economic entities have limited access to market sources of financing.

The crisis of 2007–2009 showed that the focus on price stability is too narrow to maintain financial stability. To overcome the narrowness of the approach, it is necessary:

- to take into account the situation in the financial sector as a whole to ensure the effectiveness of macroeconomic policy;

[3] Challenges for central banks: wider powers, greater restraints. Ernst & Yang, 2013. p. 8. URL: https://www.omfif.org/wp-content/uploads/2020/02/OMFIF-EY-Central-Banking-Report.pdf (accessed on 15.06.2021).

- to coordinate monetary and fiscal policy, since the translation of the effects of the policy interest rate on the real sector of the economy is undergoing changes in the current economic conditions;
- to consider the contradictions in the dependencies between stable inflation rates, full employment and financial stability;
- to assess the extent to which monetary policy is limited in its ability to manage crises;
- to develop a new model for the central banks' efficient business.

A rather extensive flow of scientific literature is devoted to the analysis of the evolution of the functions of the central banks in changing macro conditions. It is possible to identify sources affecting certain areas of the central bank activities [7], as well as for the period of 2010–2020 in the flow of literature, several waves of increased attention to changes in the activities of the central banks can be distinguished. During the first wave (2010–2012), the attention of experts was focused on issues related to assessing how the activities of the central banks influenced the formation and development of the global financial crisis and how the activities of the central banks should be transformed in order to eliminate the likelihood of systemic crises in the future [8]. During the second wave (2013–2016), the problems of making the central banks responsible for maintaining macro-financial stability were actively discussed [9]. In 2018–2019, during the discussions, the following issues were raised: has the independence of the central banks become excessive in the context of the expansion of their powers and the tools used? What could be the new institutional mechanisms of interaction between the central banks and the ministries of finance? What should be the responses of the central banks to the increased demands of society for their activities [10]? The problem of effective financial regulation remained relevant: new international standards contributed to the increase in the stability of national financial systems, but not to a sufficient extent [11].

In response to the issues raised during the discussion and criticism of the current situation of expanding the functions, powers and tools used by the central banks, experts from the BIS and the IMF substantiated the need to protect the independence of the central banks in order to increase the efficiency of their activities and maintain financial stability. The IMF proposes to update the Monetary and Financial Policies Transparency Code.[4]

Comparison of the experience of anti-crisis management of the central banks of advanced economies and emerging market countries made it possible not only to identify the most effective approaches that had the greatest efficiency, to highlight common features in anti-crisis strategy and tactics but also to trace the evolution of the traditional functions of the central banks.

ANALYSIS OF THE ACTIVITIES OF THE CENTRAL BANKS DURING THE CRISIS OF 2020

The crisis caused by the COVID-19 pandemic has affected the economies of many countries, simultaneously affecting aggregate demand, aggregate supply and financial conditions. If during the spread of the global financial crisis of 2007–2009 the deterioration in the general financial condition led to a reduction in real economic activity, during the crisis of 2020 the sequence was different: a sharp closure of territories, enterprises, certain types of activities, i.e. the reduction in real economic activity led to a deterioration in the overall financial conditions. While it has been recognized that fiscal action is better suited to counter the COVID-19 crisis, monetary policy has played a key role in responding

[4] Staff Proposal to Update the Monetary and Financial Policies Transparency Code. IMF Policy Paper. 2019, May. 48 p. URL: https://www.imf.org/-/media/Files/Publications/PP/2019/PPEA2019011.ashx (accessed on 15.06.2021).

quickly to the sudden and sharp contraction in economic activity and market freezes. The current situation required the central banks to implement a set of various measures, including those that were used to counteract the global financial crisis [2].

Due to financial regulatory reforms implemented in many countries after the global financial crisis, bank capitalization was much higher than on the eve of the previous crisis.[5] This allowed national regulators to implement a variety of support packages, worrying less about the potential insolvency of credit institutions and the possible need for their emergency recapitalization.

In general, central banks around the world have responded quickly and on a massive scale to the COVID-19 crisis, expanding both existing financial sector support programs and launching new ones, often working in conjunction with fiscal authorities to provide additional support to individual sectors of the economy. Although individual measures implemented by the central banks reflect the characteristics of their economy, institutions and the degree of development of the financial market, they also had a number of common features: a) the speed and scale of the anti-crisis measures of the Central Bank of the Russian Federation; advanced and emerging market economies overlapped in many ways; b) the central banks of both groups of countries used a wider range of instruments than when overcoming the crisis of 2007–2009.

Let us compare the monetary measures to manage the COVID-19 crisis that were urgently implemented by the central banks of five developed countries (US, UK, Germany, Canada, Japan) and five emerging markets (Brazil, Russia, India, China and South Africa). Considering the general goals of the measures introduced by the central banks of these two groups of countries (stabilizing the situation in the financial markets, preventing the development of a new systemic financial crisis and limiting the reduction in real activity), they used both general (*Table*) and specific national instruments and a set of measures.

Interest rates. Table 1 shows that the central banks of the advanced economies included in the sample actively used traditional tools of monetary regulation, including the reduction of the policy interest rate: the Fed lowered the policy interest rate from 1.625 to 1.125%, the Bank of England — from 0.75 to 0.10%; The Bank of Canada — from 1.75 to 0.25% [12], but unlike the Bank of Japan and the ECB, kept them positive [13]. The central banks of the BRICS countries, in addition to lowering policy interest rates,[6] used other traditional instruments to a much lesser extent than the central banks of advanced economies. If in advanced economies policy (key) rates approached zero or became even more negative, i.e. since the national central banks have practically no room left to regulate financial conditions through changes in the values of short-term interest rates, in the BRICS countries, even at the height of the crisis, the nominal values of policy interest rates remained positive. At the same time, while emerging market central banks had room to cut nominal policy interest rates further, they were not prepared to cut them to negative levels.

In addition to regulating policy interest rates, the central banks of emerging markets began to use in their public communications an "unconventional" instrument of the central banks of developed countries — "instructions on future changes in interest rates" to stabilize the expectations of the market participants [14].

In general, the central banks of both groups of countries, in managing the COVID-19 crisis, to a lesser extent than in counteracting the

[5] According to BIS calculations, capital exceeded Tier 1 capital adequacy by about $ 5 trillion. Valencia F., Varghese R., Yao Weijia, Yépez J.F. Handle with Care: Regulatory Easing in Times of COVID-19. IMF Working Paper. 2021. No. 49, p. 3. URL: https://www.rba.gov.au/publications/bulletin/2020/dec/the-response-by-central-banks-in-advanced-economies-to-covid-19.html (accessed on 20.03.2022).

[6] The Central Bank of Brazil reduced it by 225 bps up to 2%; the Central Bank of Russia — by 200 bps up to 4.25%; The Reserve Bank of India cut the repo rate by 115 bps to 4%, and the reverse REPO rate by 155 bps up to 3.35%; The People's Bank of China reduced rates on targeted loans, 7- and 14-day REPOs by 30 bps, and on the 1-year medium-term lending program (MLF) by 30 bps; the South African Reserve Bank — by 25 bps up to 3.25%. URL: https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#B (accessed on 20.03.2022).

Table

Monetary instruments used by Central Banks during the crisis caused by the COVID-19 pandemic

Instruments	Advanced economies					BRICS countries				
	USA	UK	G	C	J	B	R	I	RPC	RSA
Lowering the policy (key) interest rate*	+	+		+		+	+	+	+	+
Lending operations / liquidity provision										
Liquidity provision	+	+	+	+	+	+		+	+	+
Target lending	+	+	+		+	+			+	+
Asset purchase programs										
Government bonds	+	+	+	+	+			+		
Commercial bills	+	+	+	+	+					
Corporate bonds	+	+	+	+	+					
Other private assets			+							
Required reserve ratio										
Decreased reserve requirement	+					+		+	+	

Note: G — Germany; C — Canada; J — Japan; B — Brazil; R — Russia; I — India.

* Except for the eurozone (–0.5%) and Japan (–0.1%), where policy interest rates were already negative.

Source: [2].

consequences of the global financial crisis, used the regulation of policy interest rates and tried to focus on market expectations, more clearly informing about their possible future dynamics.

Refinancing of commercial banks and other business entities. Both advanced and emerging market central banks have provided additional liquidity to financial institutions, with the exception of Russia, whose banking system was running a significant structural liquidity surplus at the start of the COVID-19 crisis. Many of the central banks included in the sample have expanded the scope and scope of established lending programs to financial institutions and introduced new emergency lending programs, amended Lombard lists of accepted collateral and lists of possible participants, based on the experience gained in the process of countering the spread of the global financial crisis.

Thus, the Central Bank of Brazil opened a lending program for financial institutions, accepting corporate bonds and pools of loans as collateral. The program of new time deposits with special guarantees (DPGE)[7] has become a special way of supporting banks. A number of central banks in emerging markets make extensive use of directed lending programs. For example, the Reserve Bank of India introduced the TLTRO-2.0[8] (Targeted Long-Term Repo Operations) program, according to which financing was provided on an auction basis for a period of 3 years at a policy repo rate, the attracted financing was to be directed to investments in investment-grade bonds, commercial bills, non-convertible liabilities of non-banking financial corporations. The People's Bank of China, among other measures,

[7] Preserving the regular operation of the financial system and the Brazilian economy. URL: https://www.imf.org/en/News/Articles/2020/10/05/mcs100520-brazil-staff-concluding-statement-of-the-2020-article-iv-mission (accessed on 15.06.2021).

[8] Reserve Bank Announces Targeted Long-Term Repo Operations 2.0 (TLTRO 2.0). 2020. Apr 17. URL: https://www.rbi.org.in/CommonPerson/english/Scripts/PressReleases.aspx? Id=3207 (accessed on 15.06.2021).

expanded its bank lending program to resume lending and rediscount commercial bills of medical and consumer goods manufacturers, micro, small and medium-sized enterprises and enterprises in the agricultural sector, providing for lower interest rates.[9] Both central banks provided liquidity support to local governments through repo operations and increased limits on local government issuance of bonds.

In general, central banks around the world have responded quickly and on a massive scale to the COVID-19 crisis, expanding both existing financial sector support programs and launching new ones, often working in conjunction with fiscal authorities to provide additional support to individual sectors of the economy.

Similarly, a number of central banks in developed countries have introduced targeted lending programs [15]. Thus, the Central Bank of Japan provided loans to financial institutions to stimulate corporate financing, temporarily increased the purchase rate of exchange-traded funds (ETFs) and public real estate investment trusts (J-REIT), as well as the purchase of commercial bills and corporate bonds. In the US, the Fed simultaneously launched several directed lending programs, including a commercial bill financing program[10] to stimulate bond issuance by companies and municipalities; a program for lending to primary dealers who have accepted a wide range of investment-grade securities as collateral; asset-backed securities term lending program (student loans, car loans, credit card loans, small business administration guaranteed loans, etc.) aimed at supporting the issuance of such instruments,[11] etc.

Government funding. Although the current operating standards of the central banks prohibit them from directly supporting national governments and/or buying government securities in the primary market, the laws of various countries contain provisions that allow such transactions in emergency cases. Thus, the Bank of England, as during the global financial crisis, announced a possible direct advance on the account (overdraft) of the Treasury, if necessary. A special place among the central banks' support measures was occupied by financial support operations for local governments, carried out mainly through asset purchase programs. Providing direct financial support to central and local authorities, certain sectors of the economy, or groups of households, thus, the central banks of both advanced economies and countries with emerging markets replaced budget spending programs with their own measures, i.e. carried out quasi-fiscal operations.

Asset purchase programs. Central banks have put in place various asset purchase programs to keep the markets liquid and keep them running smoothly. Program volumes were very large, in some cases unlimited, and the rate of increase in purchases exceeded those during the global financial crisis. In April 2020 alone, the 4 largest central banks bought assets worth almost $ 1.5 trillion, or 6 times more than at the peak of the global financial crisis [16]. In advanced economies, asset purchase programs have played a key role, while in emerging market economies their role has been more limited. In advanced economies, only 40% of asset purchase programs were new, while in emerging markets, the proportion of new programs exceeded 90%. One of the common characteristics was that asset purchase programs mostly included long-term instruments (over 70% of

[9] PBOC increases re-lending, re-discount quota by 500 billion yuan to support small businesses. 2020, 27 Feb. URL.: https://news.cgtn.com/news/2020–02–27/PBOC-increases-re-lending-re-discount-quota-by-500-billion-yuan-OqpvLCqbh6/index.html (accessed on 20.03.2022).

[10] Commercial Paper Funding Facility: Program Terms and Conditions. 2020. No. 30. URL: https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20201130a1.pdf (accessed on 20.03.2022).

[11] Term Asset-Backed Securities Loan Facility (TALF). 2020, July 28. URL.: https://www.federalreserve.gov/newsevents/pressreleases/files/monetary20200728a6.pdf (accessed on 20.03.2022).

activities). In advanced economies, existing programs have mostly expanded in scope, but less in frequency and type of assets acquired. Private asset purchase programs accounted for about half. In developed countries, the central banks have activated such programs to directly support the non-financial sector. Most of the programs included promissory notes or corporate bonds. Other asset types included covered bonds, stocks, asset-backed securities, and mortgages [12].

Mandatory reservation. Only the United States among the advanced economies has made changes to its reserve policy. In emerging markets, reserve policy changes have been more frequent. In most cases, this was a reduction in the required reserve ratio, i.e. filling the financial market with additional liquidity. For example, the reduction by the Central Bank of Brazil of the required reserves for term deposits from 25% to 17% contributed to the injection of 68 billion reais ($ 12 billion) into the banking system. China lowered its required reserve ratio by 200 bps for banks implementing inclusive financial policies and rural banks. Finally, some central banks have announced measures to change the composition of commercial bank assets that can be counted as reserves. For example, the Central Bank of Argentina allowed the use of its own debt instruments in this capacity, the Central Bank of the Philippines — loans guaranteed by SMEs, the Central Bank of Malaysia — government bonds.

Various central bank responses to the COVID-19 crisis have put an end to the distinction between "traditional" and "unconventional" monetary policy. The use of indicators of the likely change in interest rates in the future, the purchase of assets and various lending programs have become common tools of monetary policy and crisis management. But even after the central banks of both groups of countries curtails emergency measures, their balance sheets will remain significantly larger than on the eve of the crisis for a long time, and the central banks themselves are subject to more risk factors. By acquiring, for example, financial instruments such as corporate bonds, commercial paper, pools of credit, or by providing long-term unsecured loans, central banks take on corresponding additional risks (credit risk, currency risk and interest rate risk).

Due to the expansion of the tools used, the motives for the actions of the central banks varied and changed over time. Many central banks have focused on stabilizing markets. This helped justify quick and large purchases of government bonds and intervention in private markets in ways that had not previously been used. Another clear difference between the anti-crisis measures of the central banks during COVID-19 and the previous crisis is that the central banks of emerging markets, using "non-traditional" tools that were applied in the past by the central banks of advanced economies, did not provoke the development of negative market reactions. A group of emerging market central banks that used foreign exchange intervention accumulated more in official reserves than they spent.

In an effort to help the economy recover, many central banks have scaled up their operations, reflected in a significant increase in their balance sheets. In addition to monetary regulation measures, the central banks applied macroprudential regulation measures. Thus, the central banks of developed countries allowed financial institutions to release a conservative capital buffer and introduced a ban on the payment of dividends. Central banks in advanced economies have significantly relaxed prudential requirements for credit institutions and the rules for assessing assets, including those denominated in foreign currency, in order to maintain their formal solvency and ability to continue lending to the real sector of the economy.

CURRENT CHANGES IN THE FUNCTIONS OF CENTRAL BANKS

Since the late 1980s, the following definition of the functionality of the central bank has become generally accepted: 1) a single emission center; 2) the regulator of the economy by monetary methods; 3) lender of last resort for banks; 4) state bank; 5) the organizer of the national payment system.

The presented narrow approach showed its failure during the global financial crisis of 2007. Moreover, during the financial reforms of the 2010s, the functions and powers of the central banks were expanded and transformed considering the complexity and dynamics of financial markets, as well as the digitalization of financial intermediation. The crisis of 2020 made additional adjustments to the tools and functionality of the central banks. Let us outline the main directions of these changes.

Historically, the state regulation of money circulation and money issues is the first most important function of the majority of the central banks. But at present, the need to preserve this function for the central banks is increasingly being questioned both by supporters of the rejection of the monetary monopoly of the central bank and a return to private money[12] and by those who prove the possibility of a transition to a single world currency or several currencies in common circulation [17, 18]. The reduction in the use of cash, the development of financial technologies, and the experiments of the central banks to create digital national currencies suggest that in the future the function of the central banks as an "issuing center" can be supplemented by the function of "controller of the national currency" if central banks will be responsible and keep records of distribution digital currencies between users. As follows from the projects of a number of the central banks for the issuance of national digital currencies, the central banks will keep records of their direct circulation or delegate this authority to systemically important banks.

The second traditional function of the central banks is monetary regulation or the implementation of the state monetary policy. Using the instruments of monetary regulation and manipulating their reserves, the central banks, through their balance sheet operations, influence the money supply or the value of interest rates in the economy. At the same time, as follows from the practice of the central bank in the course of relieving the negative consequences of the crises of recent years, the central banks began to extend their regulation to market segments that are not directly responsible (for example, the real estate market) and introduce new tools that replace budget spending programs. Thus, the central banks, together (and in some cases instead) with the ministries of finance, become the conductors of the state financial policy.

The toolkit of monetary regulation intersects with another classic function of the central banks — the function of the lender of last resort, which implies liquidity support for significant participants (or segments) of the financial market if other mechanisms for replenishing liquidity temporarily do not work. Depending on the structure and depth of the national financial market, the function of a lender of last resort began to extend to non-bank financial intermediaries, backbone producers, and even local governments. In countries where there are high currency risks for exporting producers, the central banks, providing them with financial assistance, began to perform the function of a "hedger of last resort" [19].

The central banks have become more active in influencing financial market participants, giving "voice signals to the market". This happens not only in connection with a change in the policy interest rate. As practice shows, the central banks can perform the function of supporting the last resort, using the so-called "announcement effect", when in order to normalize the situation in any market segment or restore confidence in a certain type of market participants of the central banks, it is enough to announce about the introduction of a specific program.

In fulfilling the new functions, the central banks directly stimulated the total spending of economic entities by purchasing various classes of stock instruments, thereby financing the relevant non-banking segments of the financial market and supporting overall economic activity. Thus, the central banks began to perform the function of a "market maker of last resort" [20].

[12] For example, in the early summer of 2021, El Salvador made a legislative decision to equate private money in the form of digital program code with other fiat currencies and allowed their use as an official means of payment.

In recent years, the central banks have begun to pay increased attention to the development of the nationwide financial literacy of the population, i.e. perform an educational function. It was recognized that financial literacy is one of the three key elements (along with protecting consumers of financial services and increasing the availability of these services) for expanding the financial opportunities of citizens and maintaining financial stability in general. Many countries, including Russia, are currently implementing national programs for the financial education of the population. In Russia, this function is included in the current legislation on the Central Bank, and relevant programs are being implemented.

The indicated processes of the evolution of the functions of the central banks radically change their role and place, on the one hand, in the system of public administration, and on the other hand, make their activities more complex, or, figuratively speaking, "the art of the possible".

CONCLUSIONS

The standard approach to doing business in the midst of the global financial crisis that existed before the 2007 crisis was not effective enough. It did not take into account the peculiarities of the evolution of modern financial systems and markets, the role of non-bank financial intermediaries, the relationship between various types of financial institutions, as well as cross-border links between national financial systems, etc. The response of the world community to the failures identified by the crisis was large-scale reforms of financial regulation and the expansion of the powers and responsibilities of the central banks. As a result, the decisions of the central banks began to go beyond the purely monetary sphere and affect the distribution of resources between sectors of the economy and influence the level of income differentiation of the population.

At the very beginning of the 2020 global crisis caused by the pandemic, the central banks quickly and on a large scale introduced various measures designed to stop the negative consequences of an unexpected and sharp contraction in economic activity. In addition to maintaining the proper level of liquidity in the national financial system, the central banks paid great attention to the mechanisms of interaction with the ministries of finance (treasury), new channels for financing business, and supporting the population. To do this, the central banks used programs and measures that operate under normal conditions; introduced the tools used during the global financial crisis; developed and applied new tools that change the prevailing ideas about what central banks should and can do, and about their role in the modern economy.

Central banks around the world responded quickly and on a massive scale to the economic crisis caused by the pandemic, often in concert with fiscal authorities. In advanced economies, they served a dual purpose: at the beginning of the pandemic, monetary policy measures were aimed at stabilizing financial markets and preventing the likelihood of the pandemic escalating into a new financial crisis; as liquidity in the domestic and corporate sectors began to deteriorate, the central banks' priority became to contain the contraction in real activity by providing credit to the private sector on attractive terms, despite the increase in credit risk. Emerging market central banks' responses reflected a number of specific factors facing their economies. In the early 2020s, most of these countries were at the bottom of the business cycle, when aggregate demand was generally below potential. In the context of large capital outflows and devaluation of national currencies, the central banks in these countries pursued a monetary policy focused on domestic goals, namely, to support aggregate demand.

In the process of managing the current crisis, the central banks of many countries have significantly expanded the scope of their function as a lender of last resort, providing emergency financing not only to banks, financial institutions and certain segments of the financial markets but also to industries and groups of enterprises that are important for the national economy. By providing direct financial support to central and local governments,

individual sectors of the economy, or groups of households, the central banks of both advanced economies and emerging market countries, thereby replaced budget spending programs with their own measures, i.e. carried out quasi-fiscal operations. The use of new tools and the revitalization of the activities of the central banks make it possible to formulate their modern functions in a new way: the regulator of the national money circulation; conductor of state financial policy; hedger of last resort; market maker of last resort; state banker; educator (development of financial literacy).

In conclusion, we note that in the process of managing recent crises, central banks have been actively expanding their tools and functions, including by increasing their balance sheet assets and liabilities. This fact cannot be unequivocally assessed, since its consequences are still difficult to assess in terms of improving economic activity in the long term and further impact on inflation. At the same time, the change in the functions and development of the operations of the central banks is an evolutionary process and should correspond to the dynamics of the economic development of countries.

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Model of Financial Incentives for Innovation Activity in Industrial Sector: Development and Forecasting of Efficiency

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ABSTRACT

The article presents the key provisions of the developed model of financial incentives for innovation activity for companies in the industrial sector. **The subject** of the study is economic relations formed in the process of financial incentives for innovation activity of industrial companies. **The aim** of the study is to present the authors' model of financial incentives for innovation activity in the industrial sector, as well as to evaluate its effectiveness using forecasting methods. **The relevance** of the study is due to the existence in modern conditions of significant obstacles to financial incentives for innovation in the industrial sector: the lack of equity capital of companies, sufficiently high costs for the implementation of innovation projects, the existence of financial risk of loss of solvency by the company, as well as a lack of budget financing of innovation and state material support. **The novelty** of the research consists in the development of a model of financial incentives for innovation, which could be used in practice by companies operating in the industrial sector in order to increase production potential through the implementation of innovation and R&D projects. The authors apply the following **methods**: statistical analysis, correlation and regression analysis, forecasting, scenario analysis and construction of the trend of the GDP of the Russian Federation. **Results**: the authors define the structure of the modern model of financial incentives for innovation activity for industrial companies, evaluate its effectiveness using the interdependencies between the GDP of the Russian Federation and key parameters reflecting the increase in innovation activities of Russian entrepreneurship. Statistical data for forecasting the GDP of the Russian Federation were collected for the period 2010–2021. **The authors conclude** that the most effective scenario for the Russian innovation economy is the practical use of the developed model of financial incentives for innovation activity in highly active and medium-active companies.

Keywords: financial incentive model; innovations; innovation activity; industrial sector; forecasting changes in the GDP of the Russian Federation; digitalization of the business environment; forms of financing; R&D

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INTRODUCTION

In modern conditions, innovation activity is a key tool for the development of the national economy and scientific and technological achievements. Speaking about companies in industrial sectors, the author notes that their activity in the implementation of innovation activities becomes a prerequisite for increasing and maintaining the competitiveness of a particular country in the international community in the long term. It should be noted that in the context of digitalization of the business environment and globalization taking place around the world, the role of innovation is increasing over time, so the authors believe that there is a need to stimulate the activity of industrial sectors to produce and sell innovations through the development of a financial model that includes the possible practical application of modern achievements of the digital economy.

Despite the fact that attempts have been made in Russia to develop areas of innovation activity among companies in industrial sectors, with the international comparison of the global innovation index, there are issues in stimulating business to the practical implementation of innovation projects. Thus, according to the results of 2020, the value of the above parameter is 35.6% for Russia, slightly higher in the ranking of countries are Latvia (41.1%), Slovenia (42.9%), while Germany should be singled out among European countries with index in the amount of 56.6%, as well as the leader of this rating — Switzerland (the global innovation index reached 66.1%).[1]

As a result of an independent study, the authors identified significant obstacles to the development of innovation activities of industries: a lack of equity in companies, rather high costs for the implementation of innovation projects, the presence of financial risk of losing the company's solvency, as well as the lack of budget financing of innovations and state material support within the framework of ongoing national projects and development strategies [1]. Given the above results of the author's research, it was concluded that the key reason for Russia's lagging behind other countries in the development of the innovation activity of companies in industrial sectors is the financial restrictions of business, which do not allow to significantly increase the innovation activity of the domestic economy.

The relevance of the chosen research topic lies in the fact that in order to stimulate companies in the industrial sectors to produce and implement innovations in the market, special attention should be paid to financial support measures within the framework of public policy. For example, this is evidenced by the experience of European countries, which have focused on the implementation of projects for the production of innovations by companies, including financial support for research and development (hereinafter referred to as R&D), as well as on the commercialization of the result. At the same time, according to the authors, it is necessary to develop a financial model that will increase the innovation activity of companies in industrial sectors and the country as a whole by overcoming significant problems that negatively affect the economic potential of Russian entrepreneurship.

For the successful development of innovation areas in industrial sectors, the importance of a smooth transition of companies to digitalization processes, the role of which is growing in modern realities, should be noted. This state of affairs will lead to the fact that an increase in the innovation activity of business and, accordingly, economic growth, reflected in the value of the gross domestic product (hereinafter referred to as GDP), will be achieved. However, in recent years there has been a very low level of innovation activity of companies in industrial sectors. In 2018 this figure was 15.6%, in 2019 it slightly decreased to 15.1%, and in 2020

[1] Global Innovation Index 2020 Rankings. URL: https://www.globalinnovationindex.org/gii-2020-report# (accessed on 08.11.2021).

there is a slight increase of 1.1%.[2] At the same time, the author emphasizes the existence of a rather urgent problem related to financial incentives for companies in industrial sectors to implement innovation projects.

The topic of creating and implementing in practice a financial model for stimulating innovation in industries has been the subject of many scientific papers. The definition of the term "innovation" is given in the works of various Russian and foreign authors: N. Davidson, V.V. Karacharovsky, K.I. Kurpayanidi, N.I. Lapin, E.E. Rastvortsev, B. Twiss, J. Tidd, B.S. Utegulova, Yu.V. Yakovets [2–7].

The characteristics of the features of financial support for industrial enterprises in the development of innovation areas are presented in the studies of N.M. Abdikeev, A.A. Aliev, Yu.S. Bogachev, K.V. Ekimova, S.P. Kolchin, E.L. Moreva, V.A. Slepov, E.B. Tyutyukina [8–10].

Although in the available academic literature one can find a variety of studies on the topic of stimulating innovation activity in industries, the algorithms already developed and the activities presented do not lead to the very high efficiency of the process under study in their practical use in domestic business. In addition, it should be noted the importance of digitalization conditions for creating a model of financial incentives for innovation activities of companies operating in industrial sectors.

This article aims to present a model of financial incentives for innovation in industries, as well as to evaluate its effectiveness using forecasting methods.

The scientific novelty and practical significance of the work lie in the presentation of the developed model of financial incentives for innovation in industries, which could be used in practice by companies operating in industries in order to increase production potential through the implementation of innovation and R&D projects.

DEVELOPMENT OF A MODEL OF FINANCIAL INCENTIVES FOR INNOVATION ACTIVITIES IN INDUSTRIES

The development of innovation activity in industries is interconnected with the rate of economic growth of the country. Equally, a sufficiently high level of scientific and technological development, as well as the formed innovation potential of industrial enterprises, according to the author, will contribute to the transformation of domestic production, change in the established conservative model of Russian business, the introduction of breakthrough innovations, taking into account the activation of digital processes in the business environment.

In addition, the authors of this article believe that in order to significantly increase innovation activity in industries, a number of conditions must be met, which are as follows. Firstly, it is necessary to achieve a sustainable increase in the innovation activity of companies operating in industrial sectors, since from 2018 to 2020 the value of this parameter is extremely small, and the growth rate is unstable. Secondly, the role of innovative facilities infrastructure in the financial incentives for innovation activities is important, but in modern conditions, their functioning in the Russian economy is faced with strategic, marketing, information, and system-wide problems. Thirdly, budget financing of innovation projects implemented in the industrial business should be more than 50%, while this condition is actually observed, based on statistical data: 66.7% of the funds invested in projects are state financial support from the budget.[3] Fourthly, the state policy must be effective, in this case, it is necessary to develop ways of stimulating companies operating in industrial sectors in terms of the active implementation of R&D in practice. According to the authors, an effective state policy is a set of consistent steps aimed at financial incentives for companies to

[2] Science and Innovation. URL: https://rosstat.gov.ru/folder/14477 (accessed on 08.11.2021).

[3] Science. Technology. Innovation. 2019. URL: https://www.hse.ru/primarydata/niio2019 (accessed on 09.11.2021).

implement innovation projects in practice. However, in accordance with the dynamics of the actual level of innovation activity of companies in the context of industries, which was mentioned above, the authors cannot note the effectiveness and consistency of the state policy pursued.

In addition, when developing a model of financial incentives for innovation in industries, the authors also take into account the identified obstacles that are of great importance in modern conditions: the lack of equity in companies, and the rather high costs of implementing innovation projects, the presence of financial risk of loss of solvency of the enterprise, as well as the lack of budgetary financing of innovations and state material support [1].

At the same time, under the model of financial incentives for areas of innovation in industries, the authors understand a functional system that includes several separate but interconnected areas (financial, integration and industry) that make it possible to identify the possibility of achieving an economic effect from the introduction of innovation projects into practice. Therefore, the purpose of creating a model of financial incentives is to develop such a mechanism, which is based on the relationship between financial, integration, and industry directions (*Table 1*).

In addition to the relationship between financial, integration and industry areas, the model of financial incentives for innovation activities in industries should take into account the property of complexity, due to the above-mentioned conditions for a significant increase in innovation activity. Under the complex model of financial incentives for innovation activities in industries, the author understands a functional system that includes areas (financial, integration and industry), practice-oriented tools, namely: commercial, budgetary, partnership, competitive, regulatory and cooperative, which contribute to the activation of innovation processes in the Russian business environment in the context of the adoption of an effective, consistent policy of state regulation (*Fig. 1*).

The above structure of the developed model of financial incentives for innovation in industries is due to several goals. Firstly, companies operating in industrial sectors will be able to increase investment potential through the interaction of the three components of the model: directions, consistent, effective government policies, and forms of financing. Secondly, the growth of investment potential can become a prerequisite for the active import of digital technologies that allow the transformation of domestic production. Thirdly, in order to expand the markets for innovative products, foreign financing should be attracted, which will be carried out through the practical application of the developed model. Fourthly, the volume of ongoing operations to finance innovation projects will increase to a certain extent due to the expansion of forms of financing.

Currently, it is necessary to reflect the essence of each significant element in the structure of the developed model of financial incentives for innovation in industries. There are four forms of financing of innovation projects: budgetary, loan, investment, and financing within the framework of a public-private partnership project (hereinafter referred to as PPP). Definitely, the forms of financing innovations can be different, but the authors of the article proceed from the fact that during 2018–2020 the share of budget financing did not exceed 17%, and the funds for innovative facilities infrastructure and foreign funds are rather small in the costs of companies operating in industrial sectors. At the same time, the share of own financing of innovation projects exceeds 60% [11]. The insufficiently active use of regulatory spheres to stimulate innovation should be noted, which also had a negative impact on the current situation.

Taking into account the fact that the financial support of innovation projects in the industry should be sufficient in terms of volume, the study of the author

Table 1

Characteristics of directions as the basis for creating a model of financial incentives for innovation activities in the industrial sector

Direction	Definition	Types of direction
Financial	A method, reflecting the process of financial support and use of capital aimed at creating a new idea or participating in an innovation project	1. Commercial: own financing of an innovation project by a company or attracted financing from innovative facilities infrastructure, financial and credit organizations, and institutional investors. 2. Budgetary: financing of an innovation project from the state budget
Integration	A method of bringing together the efforts of several entities to achieve a common long-term goal	1. Partnership: efforts are combined between technologically related business units. 2. Competitively oriented: efforts are combined between entities whose activities are homogeneous in terms of industry
Industry	A method reflecting industry and market differences between companies operating in industrial sectors, considered in state regulation policy	1. Regulatory: involves the introduction of target-oriented documents that take into account industry and market differences between companies operating in industrial sectors. 2. Cooperative: involves joining forces between companies operating in industrial sectors and development funds, and research centers in order to implement joint innovation projects.

Source: developed by the authors.

of the article [1] revealed the absence of own sources of financing. According to the author, it is necessary to consider the presence of a conservative model in Russian entrepreneurship, which does not currently allow highly efficient development of innovation activity and significantly increases the innovation activity of companies operating in industrial sectors. Consequently, the structure of the developed model of financial incentives for innovation in industries, taking into account the property of complexity, includes not only private financing, which also implies PPP projects, but also budgetary, investment (project financing by investment companies, investment banks and venture funds, whose role is quite significant in stimulating innovation projects [12]), and debt financing (project financing by commercial banks).

Separately, it is worth dwelling on the financing of innovation projects within the framework of PPP. The fact is that the use of this form of financing can help not only to eliminate the problem of insufficient equity capital in companies operating in industrial sectors but also to develop partnerships that can increase the innovation activity of Russian entrepreneurship. At the same time, in addition to the material advantages of PPP, according to the author, attention should also be paid to another positive side of the interaction between business and the state: there is the possibility of developing a digital platform that will lead to the achievement of institutional goals of increasing the innovation and digital activity of domestic companies through the formation of a strategic alliance between private and public sectors.

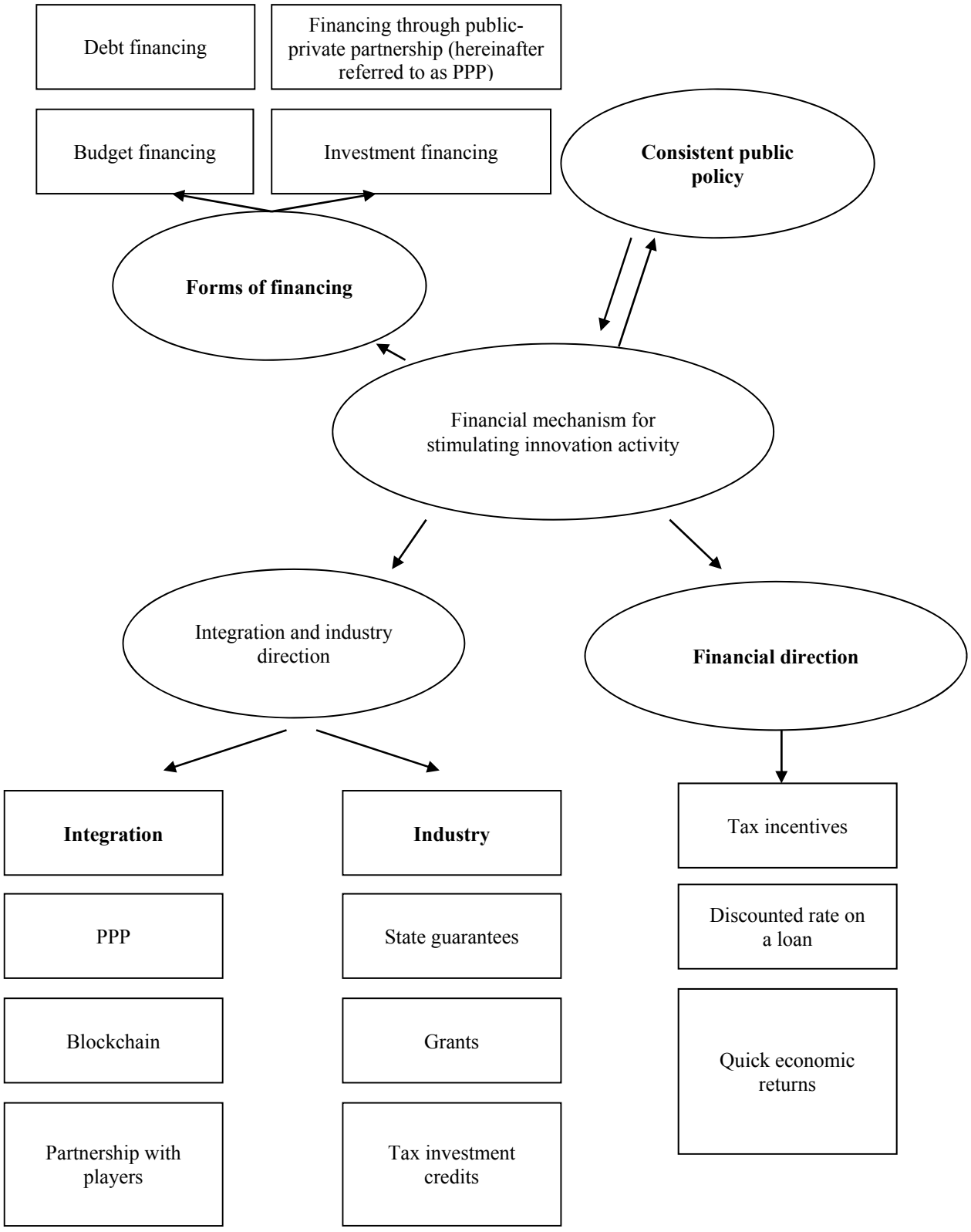

Fig. 1. **The structure of the developed model of financial incentives for innovation activities in the industrial sector**

Source: developed by the authors.

The next element of the structure of the developed model of financial incentives for areas of innovation is an effective, consistent policy of the state. From the point of view of the current state of affairs, the authors of the article propose a set of principles that will improve the efficiency of state policy through the prism of stimulating innovation projects in industries:

1. Interaction of key players in the developed model of financial incentives for innovation projects. Here it is worth talking not only about the functionality of the proposed system but also about its integrity, therefore, in the context of the implementation of a consistent state policy, it is necessary to maintain interaction between the participants in the model, namely: venture funds, commercial and investment banks, investment companies, companies operating in industrial sectors, public sector.

2. The principle of marketability of the developed model. The fact is that while maintaining constant interaction between all participants, financing of innovation projects will be carried out only in market conditions, considering existing competition.

3. The principle of regulation. On the one hand, the public sector ensures control over the actions of all participants in the model being developed and the transparency of the current legislation in the framework of operations to finance innovation projects. On the other hand, key players are obliged to comply with the main provisions of the legal framework created in Russia.

4. Information support. Each participant of the developed model must have sufficient and reliable information about the innovation project. For example, before investing existing capital, an investor needs to know the stages of the innovation cycle in the industrial sector, the purpose of the project, the net present value, or the internal rate of return. At the same time, a fairly quick exchange of such information can take place within the digital platform, and the public sector guarantees the absence of distorted statistical data on a single innovation portal.

The last element of the structure of the developed model of financial incentives for innovation activity is the directions: financial, industry, and integration. The financial direction includes tax incentives, a preferential interest rate on a loan, and a quick economic return on an innovation project being implemented. More details should be said about the last instrument of the financial direction. Any market as a system includes two enlarged product groups: traditional and innovative. At the same time, the receipt of economic returns from the ongoing innovation project can be seen through the positive value of net present value and internal rate of return, as well as a very low payback period for financial investments. The authors of the article believe that the greater the value of the parameters of the net present value and the internal rate of return, the higher the probability of choosing this particular innovation project, since its attractiveness for the investor will be very high. However, for a company operating in the industrial sector, the demand for new products plays a special role: a sought-after innovative product will increase the monetary volume of sales, which can become the basis for economic returns from the innovation project being implemented. In addition, within the framework of market relations, special preference in financing is given to breakthrough innovations and methods that increase the company's production potential [13]. Therefore, their fairly rapid generation will allow for a very short period of time to receive income, taking into account the spread of an innovative approach or method to other related industries.

To ensure high efficiency in the activities of companies operating in industrial sectors, it is necessary to conduct R&D. Although certain problems arise in the implementation of R&D on an ongoing basis in Russian entrepreneurship [14], tax incentives and preferential interest rates on tax investment loans can contribute to their elimination. In this case, the approach presented by the author will stimulate various areas of

innovation in industries, considering the recommendations presented. At the same time, on the one hand, the relevance of solving the problems associated with stimulating R&D in the industry is certainly visible. On the other hand, tax methods can also be used in public policy as a tool that creates favorable conditions for the development of innovation activity [15]. Therefore, according to the author of the article, further attention should be paid to such measures as tax incentives for companies operating in industrial sectors and conducting R&D in domestic conditions, and preferential interest rates on tax investment loans.

The very low efficiency of R&D in industrial sectors is also due to the fact that the state is simultaneously the initiator of such R&D, the customer, and the contractor [16, p. 63–64]. In this regard, in the structure of the developed model of financial incentives for the areas of innovation activity of industries, sectoral areas are identified, including grant support, state guarantees, and the provision of tax investment loans. Here it should be noted the importance of cooperation between companies operating in industrial sectors and research centers, which will stimulate the implementation of R&D programs..

FORECASTING THE EFFICIENCY OF THE DEVELOPED MODEL OF FINANCIAL INCENTIVES FOR INNOVATIONS IN THE INDUSTRY

After developing a model of financial incentives for innovation in industries, it is necessary to analyze its effectiveness through the prism of the Russian economy. Under the effectiveness of the model of financial incentives for innovation in industries, the authors of the article understand the presence of a positive mutual influence on the innovation activities of companies and the gross domestic product of the Russian Federation (hereinafter referred to as the GDP of the Russian Federation), since this parameter is a key macroeconomic indicator in the system of national accounts (hereinafter referred to as the SNA). At the same time, the higher the value of financial investments in innovation projects, the higher the GDP of the Russian Federation. Its growth is explained by the following aspects. Firstly, the integral growth of the GDP depends on tax revenues to the state budget, which will be higher with an increase in the innovation activity of companies in industrial sectors. Secondly, the indirect growth of the GDP of the Russian Federation depends on the increase in demand for innovative products sold. Thirdly, a direct increase in the GDP of the Russian Federation will be achieved through the active implementation of innovation projects within the framework of using the model of financial incentives for innovation activity in the industry created by the authors. Considering the above facts, the analysis of efficiency should be carried out by predicting changes in the GDP of the Russian Federation using the apparatus of correlation regression and scenario analysis of the selected indicator.

To predict changes in the GDP of the Russian Federation, the authors of the article take into account the division of all companies operating in industrial sectors into three groups, carried out earlier in [17], due to the difference in their functioning in the conditions of innovation activity: highly active, medium active and low active. In accordance with this, the authors propose two significant scenarios for increasing innovation activity in industries. The first scenario is base, it is typical for all selected groups of companies in modern conditions, when active financial incentives for Russian entrepreneurship, considering the flow of digital processes, are not sufficiently available. The second scenario is stimulating, it has three sub-scenarios, each of which is determined by the peculiarities of dividing industrial companies into highly active, medium active and low active (*Table 2*). At the same time, the stimulating scenario indicates the implementation of a model of financial incentives for innovation in industries, taking into account digital processes.

According to the selected scenarios, the authors of this article predicted the change

Table 2

Characteristics of scenarios for forecasting changes in the GDP of the Russian Federation, taking into account the classification of companies by the level of innovation activity

Scenario	Type	Scenario prerequisites	Group of industries by the level of innovation activity	Expected result and effect from innovation funding, %
1	Base	The development of a financial mechanism to stimulate the innovation activities of industrial corporations in the context of the digitalization of the economy is not carried out	All groups	0
2	Stimulating	Financial mechanism for stimulating the innovation activity of industrial corporations in the context of the digitalization of the economy is being implemented	Low active	From 0 to 0.7
3	Stimulating		Medium active	From 0.7 to 1.4
4	Stimulating		Highly active	From 1.4 to 2.1

Source: developed by the authors.

in the GDP of the Russian Federation in the time period 2022–2030 taking into account actually available statistical data for 2010–2021. A variety of factors influence the dynamics of the selected macroeconomic indicator [18]. Therefore, it is necessary to consider those factor variables that reveal the essence of ongoing innovation projects in industrial sectors. To build a correlation-regression model for predicting changes in the GDP of the Russian Federation, they can be divided into three groups: scenario, base and control. Scenario factors include only one variable — the level of innovation activity of companies operating in industrial sectors. As the main factors, the author of the article selected such parameters as the costs of innovation infrastructure facilities for technological innovations in the industry, the volume of foreign financing of innovation projects in the industry, the average number of employees of companies functioning in industrial sectors and implementing technological innovation projects, the number of industrial companies that have invested their own funds in R&D programs. Control factors are additional variables that can be used to account for the effectiveness of the model of financial incentives for innovation projects in the industry. Among them, the following indicators can be distinguished: the index of industrial production, the share of innovative products in the total volume of shipped products in industrial production, and the size of developed technologies in industrial production (*Table 3*).

In accordance with the theory of probability and mathematical statistics, to evaluate the regression model, it is necessary to construct an equation that is a mathematical formula applied to independent variables in order to model the GDP of the Russian Federation with high accuracy. The general form of the regression equation is represented by formula (1):

Table 3

Characteristics of the result-effective and factor variables in forecasting changes in the GDP of the Russian Federation in the framework of correlation and regression modeling

Applied econometric package variable	Variable characteristic	Variable used in the regression model	Strength of the relationship between the factor and result-effective variables
Result-effective variable			
GDP (Gross domestic product)	Financial incentives for innovation activity	Logarithm of the GDP of the Russian Federation	1.00
Factor variable			
IA (Innovation activity)	Scenario	Assessment of the level of innovation activity of companies in industrial sectors	0.53
FII (Facilities infrastructure for innovation)	Base	Logarithm of the cost of innovative facilities infrastructure for technological innovation in industry	0.59
FFI (Foreign financing of innovation)	Base	Logarithm of the volume of foreign financing of industrial innovation projects	–0.15
EFI (Employees functioning in innovations)	Base	Logarithm of the average number of employees of companies functioning in industrial sectors and implementing technological innovation projects	0.79
RD (Research and development)	Base	Logarithm of the number of industrial companies that have invested their funds in R&D programs	0.81
IP (Index of production)	Control	Index of industrial production	0.37
IGWS (Innovative goods, works, services)	Control	The share of innovative goods, works, and services in the total volume of shipped industrial products	0.72
SPT (Size of production technologies)	Control	Logarithm of the size of developed technologies in industrial production	0.82

Source: developed by the authors.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_n X_n + \varepsilon, \quad (1)$$

where β_0, β_1, β_2, β_3, β_n — are coefficients of correlation-regression modeling of independent variables; Y — the dependent variable; X_1, X_2, X_3, X_n — independent variables; ε — a variable reflecting the probability of a random error.

Taking into account the fact that all factor variables have different dimensions, correlation-regression modeling should be based on the logarithm of some of the presented indicators [19] (*Table 3*). In this case, the model can be described by the equation given in formula (2):

$$\begin{aligned} LN(GDP)_t = {} & \beta_0 + \beta_1 LN(FII)_t + \beta_2 LN(FFI)_t + \\ & + \beta_3 LN(EFI)_t + \beta_4 LN(RD)_t + \beta_5 IA_t + \beta_6 IP_t + \\ & + \beta_7 IGWS_t + \beta_8 LN(SPT)_t + \varepsilon_t, \end{aligned} \quad (2)$$

where β_0, β_1, β_2, β_3, β_4, β_5, β_6, β_7, β_8 — coefficients of correlation-regression modeling of changes in the GDP of the Russian Federation.

Now we should move on to direct analysis of the parameters using a correlation model that allows us to see the strength of the relationship between the selected parameters (*Table 3*).

Comparing the values of the parameters obtained in the course of the study in the correlation model with the Chaddock scale[4] (*Table 4*), one can see a fairly high strength of the relationship between the GDP of the Russian Federation and the volume of mastered technology in industrial production. In addition, there is a high strength of the relationship between the GDP of the Russian Federation and other factor variables: the number of industrial companies that have invested their own funds in R&D programs, the average number of employees of companies functioning in industrial sectors and the implementation of technological innovation projects, the share of innovative goods, works, services in general volume of shipped industrial products.

Equally, a significant relationship between the GDP of the Russian Federation as an indicator of the effectiveness of the developed model of financial incentives for innovation projects in industry and the parameters characterizing the implementation of R&D and the introduction of technological innovations indicates that in the future we can expect an increase in the share of innovative goods in the total volume of shipped products. In addition, there is a weak relationship between the GDP of the Russian Federation and the volume of foreign financing of innovation projects in the industry. At the same time, it should be noted that the share of foreign investments in the innovation activities of companies is very low (in the structure, the indicator did not reach 1%)

Table 4

Cheddock scale, designed to determine the strength of the relationship between the analyzed parameters

Value of the multiple correlation coefficient (*R*)	Evaluation of the strength in a relationship
0.1–0.3	Weak
0.3–0.5	Moderate
0.5–0.7	Noticeable
0.7–0.9	Strong
0.9–0.99	Very strong

Source: compiled by the authors on the basis of [20, p. 71].

[4] To assess the correlation coefficients or determine the statistical dependencies of quantitative indicators, the Chaddock scale is widely used when building multifactor regression models. The Chaddock scale is popular in economic, sociological, medical and marketing research. It was introduced in 1925 by the American scientist Robert Chaddock. This scale became the first tool for analyzing the strength of the relationship between indicators.

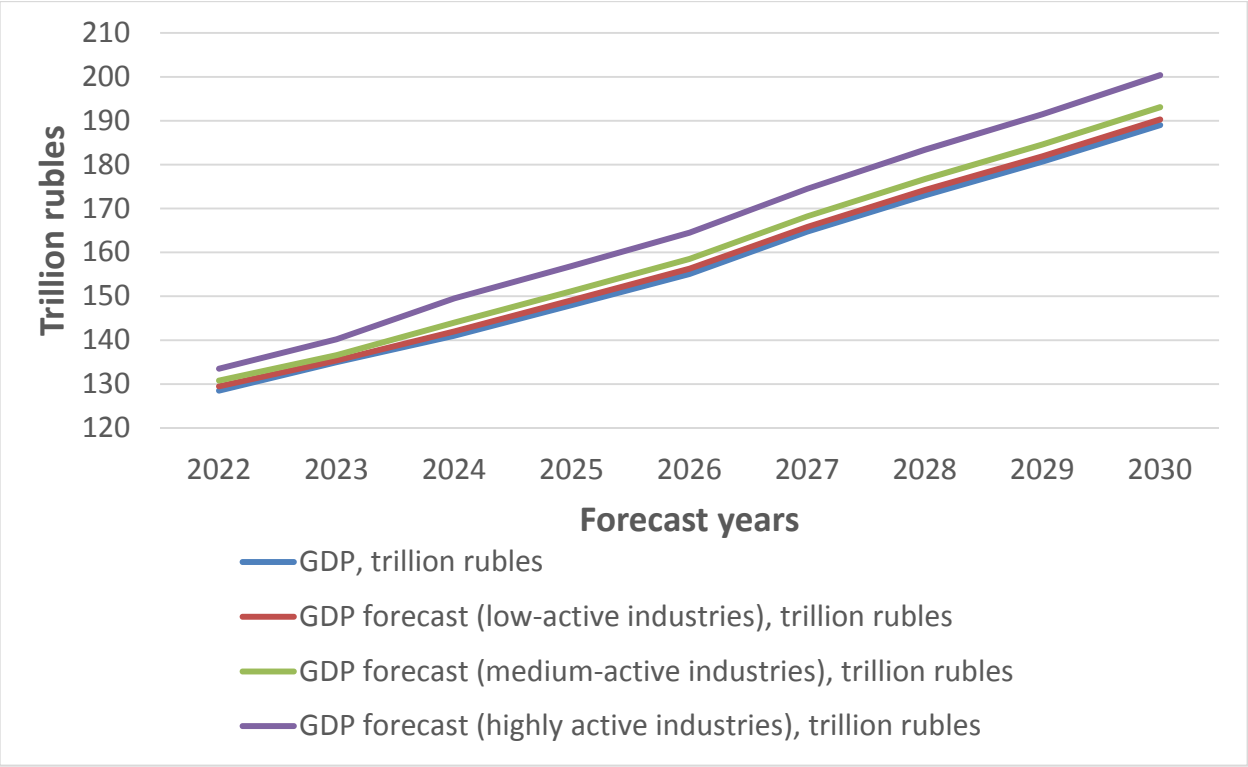

Fig. 2. **Forecasting changes in the GDP of the Russian Federation as an indicator of the effectiveness of the developed model of financial incentives for innovation projects**

Source: developed by the authors.

[11]. A significant outflow of capital abroad, which started in 2014 with the introduction of international sanctions, is one of the reasons for the weak relationship between the two indicators under consideration. It is necessary to emphasize the fact that there is a noticeable relationship between the GDP of the Russian Federation and the costs of innovation facilities infrastructure for technological innovation in the industry. This indicates the key role of venture funds in the framework of the developed model of financial incentives for innovation in the industry.

To predict changes in the GDP of the Russian Federation, the author of this article takes into account the selected scenarios for stimulating innovation activity in industries, as well as the division of all companies into three groups according to the level of innovation activity (*Fig. 2*).

In accordance with the presented forecast of changes in the GDP of the Russian Federation, the implementation of the developed model of financial incentives for innovation projects in highly active and medium-sized companies should be considered the most effective scenario for the development of the domestic innovation economy.

CONCLUSIONS

Summing up, it can be noted that at the present stage of the innovation development of the domestic economy, the activities of companies operating in industrial sectors are extremely important for the development of production and technical potential. Undoubtedly, it is impossible to stimulate innovation projects in the industry without an effective financial model, due to which companies would have enough resources to implement various areas of innovation.

The identified problems associated with insufficient financing of innovation projects, as well as very low growth in the level of innovation activity in industrial production, led to a lack of efficiency of state policy, which is also a prerequisite for developing a financial incentive model for innovation activities. It should

include such significant components as forms of financing, principles of effective, consistent state policy, as well as areas that allow stimulating innovation activity in industrial production: financial, industry and integration.

In order to understand how effective the developed model of financial incentives for innovation is for companies operating in industrial sectors, the author predicted the change in the GDP of the Russian Federation as a fundamental indicator of the development of the domestic economy. Based on the research results, it was established that the developed model of financial incentives for the innovation activity of industrial companies will contribute to the transformation of the national economy towards an innovation-oriented one, taking into account the active participation of key players: commercial and investment banks, investment companies, venture funds and the public sector. The results of the study can form the basis of the modern development of the Russian innovation economy.

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Factors of Formation of Financial Behavior Types of Economic Entities

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ABSTRACT

The research is focused on determining the factors influencing the formation of the types of financial behavior of economic entities. Determining the types of economic entities' financial behavior is necessary for implementing state economic policy measures. **The subject of the study** is the types of financial behavior reflecting the propensity of an economic entity to perform economic operations. Entities may exhibit active, adaptive, and reactive financial behaviors. **The purpose of the work** is to determine the key factors that influence the formation of types of financial behavior of economic entities. The study suggests that the formation of financial behavior types is caused by the influence of human, social and financial capital. The formation of financial behavior types is influenced by the basic characteristics associated with age, perception of the external environment, etc. The significance of certain factors is assessed using **statistical analysis**. The combination of these factors has a different impact on the formation of the type of financial behavior of an economic entity, but they can be significant under certain external conditions related to the economic situation. Because of the significance of individual factors, all economic entities form 'yadernye' (core) groups demonstrating a certain type of financial behavior, as well as groups of entities that change the type of financial behavior depending on the influence of the external environment. The change in financial behavior types is associated with a change in the strength of the impact of various factors that need to be considered in the dynamics. Entities with an active type of financial behavior, whose actions transform the external environment and stimulate other categories of entities to commit economic actions, are of significant interest for the analysis. The latter is especially actual for the financial market when entities with a reactive type of behavior under the influence of the information background commit rash actions leading them to financial losses. Based on the available sociological data, the study examines the main factors that lead to the formation of an active type of financial behavior. **As a result of** the construction of the econometric model, the authors **conclude** that the amount of available funds, the age of the respondent, the level of professional competence have a significant impact on the formation of an active type of financial behavior.

Keywords: financial behavior; economic policy; risk; government regulation; human capital; social capital; behavioral expertise; volatility; cash flows

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INTRODUCTION

This study reveals a methodological approach to determining the factors influencing the formation of types of financial behavior of economic entities.[1] Economic entities in their activities can demonstrate active, adaptive and reactive types of financial behavior [1]. Demonstration by a group of entities of one type of financial behavior leads to the formation of a dominant type of financial behavior at the macro level, which has a significant impact on the sustainability of economic development (for example, in the distribution of cash flows). [2]. Changes in the types of financial behavior lead to an increase in the volatility of economic processes, which is expressed in the commission of spontaneous economic transactions by entities. The latter is particularly significant in the financial market, when business entities, under the influence of changes in the information background, take actions that lead to losses. Conducting non-optimal operations may be associated with chaotic actions of entities which do not have sufficient experience and knowledge to conduct operations in the financial market. Massive deposits of investors in the Finiko[2] financial institution is an example of such a situation.

To reduce possible losses, the Bank of Russia is currently developing the practice of conducting "behavioral expertise", which involves the development and application of a methodology for classifying economic entities depending on their propensity to take hasty actions.[3] The Bank of Russia conducts "behavioral expertise" to identify investors who do not fully understand how financial instruments work to protect them from future losses. In addition, the Bank of Russia may face other urgent tasks to identify entities prone to "speculative operations" that can lead to the realization of systemic risks in the financial market. Successful expansion of the practice of applying "behavioral expertise" requires the simultaneous development of the theory of behavior of economic entities.

Behavior is the propensity of the entity to perform certain actions.[4] The propensity to perform actions reflects the attitude of the entity to the possibility of performing a certain action, considering the state of the external environment. Entities with an active type of financial behavior analyze emerging opportunities and take active actions aimed at changing the external environment. An example of such a situation is the purchase by Reddit users of the shares of the unprofitable company GameStop. The actions of users, and further support from Elon Musk, led to a change in the dynamics of the share price.[5] Thus, it is the actions of entities with an active type of financial behavior that can enhance the ongoing changes in the external environment.

Entities with an adaptive type of financial behavior, observing changes in the external environment, perform adaptive actions aimed at preserving their capital and income. An example of the formation of an adaptive type of behavior is a positive decision on the participation of a number of Russian banks in a pilot project to test the digital ruble.[6] Banks assessed the prospects for introducing a digital ruble and decided to adapt to the proposed innovation at an early stage.

[1] Economic entities are understood as both individuals and legal entities. For legal entities, the formation of a financial type of behavior depends on the top management of the organization, whose policy determines the business operations performed. Each legal entity is headed by people with certain professional experience and accumulated knowledge. That is why the actions of legal entities are "behavioral", which makes it possible to apply behavioral concepts to analyze their activities.

[2] URL: https://quote.rbc.ru/news/article/6054a79a9a7947f9a3755aca (accessed on 15.03.2022).

[3] The results of the behavioral due diligence, for example, were published in 2021 in a document of the Bank of Russia ("Report on the results of the behavioral expertise testing of unqualified investors".

[4] This study highlights economic actions in the field of finance. At the same time, this approach can be applied to the analysis of other activities.

[5] Meme investors against Wall Street. LLC Journal Company. URL: https://ko.ru/articles/mem-investory-protiv-uoll-strit/ (accessed on 10.03.2021).

[6] The first pilot group to test the digital ruble. URL: https://www.cbr.ru/press/event/?id=11000 (accessed on 13.02.2022).

Entities with a reactive type of financial behavior in most cases do not take active actions or take them out of time. An example of a reactive institution is KfW Bankengruppe,[7] which made a payment to Lehman Brothers on the day of its bankruptcy. which made a payment to Lehman Brothers on the day it went bankrupt. The sequence of actions of entities with active, adaptive and reactive types of behavior plays a significant role in understanding the dynamics of economic development and can be expressed in the emergence of large-scale behavioral cycles that are an integral part of the economic cycle [1].

In turn, at present there is no answer to the question of the factors and causes leading to the emergence of a certain type of financial behavior of entities in economic systems [3]. Obviously, the type of financial behavior is the result of external and internal factors affecting the entity at a particular point in time. In this regard, it is necessary to classify factors to assess the current type of financial behavior of an economic entity. The identification of significant factors will make it possible to predict the further actions of the entities, which is important from the point of view of maintaining their level of financial stability.

The second question is the assessment of the possibility of one and the same entity to predominantly demonstrate a certain type of financial behavior. It is necessary to answer the question: is the type of financial behavior of the entity a constant value or is it constantly changing under the influence of external factors? The study shows that the type of financial behavior of business entities can change over a certain period of time. However, the periods of manifestation of a certain type of financial behavior can be quite long (calculated in years, and even decades). As a result, the study suggests the existence of 'yadernye' (core) groups that consistently exhibit a certain type of financial behavior. In turn, some entities periodically change their type of financial behavior depending on the situation. In connection with the change in the type of financial behavior, there is a redistribution of the number between the main groups of entities, there is a change in the structure of the capital accumulated by them. The composition of the 'yadernye' (core) groups of economic entities determines the direction of economic development. The latter is connected, among other things, with the possibility of lobbying certain economic decisions and stimulating their adoption [4]. To determine the 'yadernye' (core) groups it is necessary to develop an original approach that makes it possible to statistically evaluate the factors influencing the formation of the types of financial behavior of economic entities.

The presented study includes several main sections. Initially, a classification of the main factors influencing the formation of types of financial behavior is proposed. In the future, an empirical analysis of the significance of certain factors is carried out on the basis of the available sociological databases. Ultimately, the main provisions on the mechanism for the redistribution of entities between different types of financial behavior, and approaches to the definition of 'yadernye' (core) groups of economic entities, are revealed.

LITERATURE REVIEW

The type of behavior reflects the propensity of the entity to perform certain actions. The type of behavior differs from the concepts of "expectation" and "actual action". The implementation of a set of business transactions (actions) is the result of a formed type of financial behavior of the entity, which depends on the expectations regarding each individual transaction. Understanding the essence of behavior solves one of the questions of economic science about how the expectations of entities are transformed into actions. The key difference between behavior and expectations is that

[7] Uproar Over German Bank's Payout to Lehman. URL: https://www.nytimes.com/2008/09/19/business/worldbusiness/19kfw.html (accessed on 13.02.2022).

expectations are formed in relation to a specific event.

It is necessary to consider the type of financial behavior, representing a certain list of actions that an entity can perform in the financial sector. Jakob Fugger is an example of an entity who, throughout his life, took active actions aimed solely at making a profit. It is obvious that Jakob Fugger had expectations about each proposed operation. Expectations were constantly changing, but in general he always showed the dominant active type of behavior.

By itself, the type of financial behavior does not reflect the fact of action. The performance of an action can be limited by psychological barriers, the system of state regulation, a significant level of information asymmetry [5], etc. The difference in the direction of the action arises when analyzing possible alternatives. Some actors initiate actions, some support the actions being taken, and some remain on the sidelines. The propensity to choose actions of a certain direction allows us to classify the types of financial behavior of entities into active, adaptive and reactive.

Entities with an active type of financial behavior are prone to actions aimed at changing the external environment. An example of an entity demonstrating an active type of behavior is PJSC Sberbank, which is creating its own digital ecosystem.[8] Another example illustrating the existence of an entity with an active type of financial behavior is the story of George Soros, who "ruined the Bank of England".[9] In practice, an entity with an active type of financial behavior cannot always, like George Soros, change the external environment, but he can anticipate changes and take active actions. Probably, such an entity is also adaptive to some extent, since in economic interaction there is always a leader and a follower entity [4]. However, his actions would not be so destructive if they were not supported by other players who adapt to the situation.

Entities with an adaptive type of financial behavior observe changes in the external environment caused by the actions of entities with an active type of financial behavior. Changes can be expressed in increased volatility of cash flows, which leads to price fluctuations, changes in the information background. Entities with an adaptive type of financial behavior try to perform actions that correspond to the trend set by entities with an active type of financial behavior and are aimed at increasing (or maintaining) their own income. Such entities usually do not have sufficient funds to change the parameters of the external environment (or access to the most relevant information), but reinforce the trends laid down by the actions of entities with an active type of financial behavior. Thus, the entities with an adaptive type of financial behavior increased pressure on the pound sterling caused by the actions of D. Soros, in connection with which the Bank of England had to devalue the pound sterling. In the event that entities with an adaptive type of financial behavior would not have supported the actions of D. Soros, such significant consequences for the economic development of England might not have arisen. At the same time, the entities with a reactive type of financial behavior suffered the greatest losses, which did not take any action, and whose savings were transferred to entities with an active-adaptive type of financial behavior.

Entities with a reactive type of financial behavior, theoretically do not take actions related to a change in the external environment. In practice, some of them may randomly perform certain actions, striving to become adaptive, but this only leads them to large economic losses. For example, in a situation of currency fluctuations,

[8] Sber digital ecosystem. URL: https://www.sberbank.com/ru/eco (accessed on 13.02.2022).

[9] George, you are a cowboy. Why do they hate and fear the billionaire Soros? Lenta.ru. URL: https://lenta.ru/articles/2017/09/04/everybodyhatesgeorge/ (accessed on 10.03.2021). Soros took active steps to devalue the pound.

entities with a reactive type of financial behavior realize the changes taking place too late and most often buy currency during periods of maximum exchange rate. As a result, they lose their savings, which are transferred to entities with an active-adaptive type of financial behavior. Entities with a reactive type of financial behavior are perhaps the largest group, and therefore it is their actions that are mainly identified through the analysis of macro indicators (for example, when changing the dynamics of cash flows). Entities with an active type of financial behavior constitute the smallest group.

The Bank of Russia is faced with the task of identifying entities with an active type of financial behavior to reduce the probabilities of possible illegal financial speculations.

A natural question arises: what determines the propensity of the entity to commit certain actions? It is advisable to apply various interdisciplinary approaches depending on the dominant factors that are significant at a certain point in time. In particular, the resource theory proceeds from the fact that the actions of entities depend on the amount of accumulated resources [6]. Based on the analysis of the literature, five main groups of factors can be distinguished that determine the formation of the type of financial behavior of economic entities: human capital, social capital [7], financial capital, main characteristics and parameters of external environment (*Table 1*).

For legal entities, human, social capital and key characteristics can be determined considering the accumulated management capital of the organization. In particular, the quality of social ties of a legal entity affects the possibility of "rescue" during a crisis. An example of such a situation is the story of General Motors during the 2008 global financial crisis.[10]

Human and social capital are among the resources analyzed using the tools of sociology and psychology. For legal entities, it is also possible to analyze the social ties of top managers, which provide an opportunity for the exchange of information and resources. It is advisable to analyze the volume of financial capital using economic tools that allow analyzing, among other things, the balance sheets of organizations, the level of wages, etc. The main characteristics and parameters of the external environment include various characteristics, some of which change over time. Constant characteristics include time, place of birth, age. These parameters are less variable and depend on natural features. Other parameters (for example, the dollar exchange rate) are highly volatile. They largely determine the propensity of entities to commit actions.

Each of the three types of capital, as noted above, is a resource. The accumulation of capital increases the likelihood of falling into the category of entities with an active type of financial behavior (Table 2). Human capital includes characteristics related to the level of education, previous experience. In fact, it reflects the level of accumulated knowledge, skills and abilities. There are a number of basic psychological characteristics associated with effective financial behavior, among which are such characteristics as: personal qualities [8], the ability for long-term planning [9], the ability to make quick decisions in a situation of uncertainty, activity and readiness for reasonable risk, striving for success [10]. The main characteristics are associated with the characteristics of the entity, and the remaining parameters are formed under the influence of experience.

Social capital is considered from the standpoint of the amount of resources

[10] General Motors as a barometer for the US economy. URL: https://m.lenta.ru/articles/2013/12/13/gmagain (accessed on 13.02.2022).

Table 1

Systematization of parameters influencing the formation of dominant types of financial behavior of economic entities

Group	Characteristic
Human capital	Human capital is determined by the achieved level of education, acquired professional experience. Accumulated knowledge determines the propensity of the entity to perform actions
Social capital	Social capital is determined by the quantity and quality of contacts between business entities
Financial capital	Financial capital determines the general level of wealth of an economic entity and the amount of free funds that it can quickly use
Basic parameters	Basic parameters exist regardless of the entity's actions. These parameters include place of birth, age, etc.
Parameters of the external environment	Parameters of the external environment generally do not depend on the individual actions of the economic entity. These include, for example, information about the global crisis, the dynamics of the COVID-19 pandemic, etc.

Source: compiled by the authors.

that can be obtained through the existing system of relations [11]. The assessment of social capital is carried out by analyzing the number of social contacts, their quality, and the possibility of providing additional information. The size of social capital determines the possibilities of knowledge transfer [12].

Financial capital reflects the amount of free cash (the size of the budget constraint) that can be mobilized if necessary for business operations. Basic characteristics include an assessment of the main elements related to age, place of birth. Also, the basic characteristics involve considering psychological characteristics, including gambling and the level of optimism of the economic entity.

The indicators listed above reflect the main aspects that lead to the formation of a certain type of financial behavior. Each of these factors determines the propensity of the entity to perform the action. To check the significance of the influence of these parameters on the entity's propensity to perform an action, it is advisable to conduct an empirical analysis. Particular attention should be paid to determining the factors influencing the formation of an active type of financial behavior. Interest in entities with an active type of financial behavior is associated with their significant role in terms of influencing the external environment. The actions of entities with an active type of financial behavior leas to fluctuations in the economy, and mainly in financial markets. Financial markets are their object of interest due to the possibility of quick profit. When making business transactions, they change the information background, stimulating entities with an adaptive and reactive type of financial behavior to make business transactions. As a result, they make a profit through the "aggressive" redistribution of

Table 2

Systematization of factors and issues that allow determining the type of financial behavior of an economic entity

Group	Characteristic	Description
Human capital	Level of education	The lack of knowledge will not allow the entity to take active actions leading to additional income. Increasing the level of education will help to demonstrate an active type of financial behavior. Raising the level of financial literacy can have a significant impact [13]
	Previous experience	Previous experience determines the amount of accumulated skills, knowledge, etc.
	Reasonable risk appetite	Assesses the entity's attitude to uncertainty, which is largely related to previous experience of being in a particular situation. Unlike gambling, it is determined by the specific situation, the circumstances of the case and the knowledge of the probability of an unfavorable outcome. Gambling is not related to the objective understanding of the situation. This is the main feature of the entity
	Long-term planning ability	If the entity cannot plan long-term, then it will not take active actions. It must understand long-term trends in the economy and be able to delay the satisfaction of needs. The planning horizon is important. It should be noted that entities with an adaptive type of financial behavior probably do not adapt, but reflect depending on the specific situation
Social capital	The number of social contacts	Social capital reflects the presence of a large number of contacts, ways of obtaining information, and the ability to build relationships [14]
	The quality of social contacts	When analyzing social capital, one can consider the network of social capital. Entities with an active type of financial behavior have positive social capital. The presence of negative social capital contributes to the manifestation of a reactive type of financial behavior
	Access to information	If there is no access to information, then the entity will not be able to receive objective data, and therefore, to perform optimal actions
Financial capital	Availability of funds/size of the budget constraint	If an entity does not have funds, then even if desired, it will not be able to carry out business operations. An entity with an active type of financial behavior has sufficient funds
	The amount of free cash	In addition to a significant amount of material wealth, the entity must have a sufficient amount of free cash, which it can dispose of in the event of a change in the external environment [15]
Main characteristic	Age	With age, a person becomes less active, and therefore he can change his type of financial behavior from active to reactive. That is why it is necessary to take into account age characteristics when analyzing the financial behavior of the entities [16].
	Gender	The conducted studies demonstrate an increased propensity of males to take risks, which suggests the influence of this characteristic on a person's propensity to act
	Gambling	In addition to understanding the situation, an individual may have a desire to get more money, to beat other entities. The characteristic is associated with the search for thrills, is basic and depends on the psychological characteristics of the individual
	Level of optimism	Although actors operate during the boom and bust phases of the business cycle, those who engage in active financial behavior still hope to reap some benefit. The level of optimism and trust in a financial instrument determines the propensity of the entity to perform business transactions [17]

Source: compiled by the authors.

funds from entities with a reactive type of financial behavior, which can lead to systemic risks. In this regard, the Bank of Russia is faced with the task of identifying entities with an active type of financial behavior to reduce the probabilities of possible illegal financial speculations.

EMPIRICAL ASSESSMENT OF DOMINANT TYPES OF FINANCIAL BEHAVIOR OF ECONOMIC ENTITIES

Data description

Currently, there is no database that makes it possible to unambiguously assess the formation of a certain type of financial behavior of an economic entity. To do this, it is advisable to conduct a separate sociological study. At the same time, it is possible to use the accumulated sociological databases and, in particular, the Russian Longitudinal Monitoring Survey of the Higher School of Economics (RLMS HSE).[11] This study presents the analysis carried out using data generated in the specified sociological database in 2018. The information available in this database does not allow assessing the factors that form the type of behavior of a legal entity. An assessment of the types of behavior of legal entities is possible on the basis of financial indicators and requires additional analysis in terms of compiling the necessary list of them.

Dependent variable

The content of the dependent variable was formulated based on ideas about the qualitative features (phenomenology) of an entity with an active type of financial behavior. In our understanding, this is a person with influence and capital, enterprising and content with life. When conducting an econometric assessment, four categories of indicators were used to determine the dependent variable, allowing the entity to be classified as an entity with an active type of financial behavior:

Question 1: "Imagine a ladder of 9 steps, those who are completely deprived of rights are on the bottom step and those who have great power are on the top step. Which of the nine steps are you personally on today?" The values range from 1 to 9. This question considers the entity's assessment of his ability to receive information and freedom of action. Entities who believe they have power are more likely to display an active type of financial behavior.

Question 2: "Imagine a ladder of 9 steps, the poor are on the bottom, first step, and the rich are on the highest, ninth step. Which of the nine steps are you personally on today?" The values range from 1 to 9. This question considers the degree to which the entities assess their financial capabilities. If the entity highly appreciates financial opportunities, then in this case he will be more inclined to demonstrate an active type of financial behavior.

Question 3: "Have you ever tried to organize your own enterprise, start your own business?". The values for this indicator are presented as a binary variable (0 — did not try, 1 — tried). If the respondent tried to start his own business, he demonstrated the desire to influence the state of the external environment. Accordingly, in the past, he was inclined to demonstrate an active type of financial behavior.

Question 4: "How satisfied are you with your life in general at present?" The values of this indicator range from 1 to 5, where 5 is the maximum satisfaction. This question assesses the degree of satisfaction, which determines the desire of the entity to take actions aimed at changing his well-being.

Considering the fact that the indicators presented above have different dimensions, the obtained values were converted into percentages (using the calculation of proportions). Subsequently, each of the obtained values was weighed with a weight

[11] Russian Longitudinal Monitoring Survey of the Higher School of Economics and Demoscope LLC with the participation of the Population Center of the University of North Carolina at Chapel Hill and the Institute of Sociology of the Federal Research Sociological Center of the Russian Academy of Sciences. URL: http://www.cpc.unc.edu/projects/rlms and http://www.hse.ru/rlms (accessed on 25.02.2021).

Table 3

Distribution of entities by type of financial behavior

	Quantity	Distribution, %
Entities with a reactive type of financial behavior	10,659	87.65
Entities with an adaptive type of financial behavior	1,240	10.2
Entities with an active type of financial behavior	262	2.15

Source: compiled by the authors.

equal to 0.25. As a result, a general index was obtained in the range from 0 to 100. The theoretical premises stated earlier are confirmed. The smallest number of respondents demonstrate an active type of financial behavior. The largest number of respondents demonstrate a reactive type of financial behavior. Accordingly, to classify economic entities in the sample, the values of standard deviations were calculated, and the average values:

1) if the value of the aggregate index was from 72.6 inclusive, then such a respondent was classified as an entity with an active type of financial behavior;

2) if the value of the aggregate index was from 53.3 inclusive to 72.6, then such an economic entity was classified as an entity with an adaptive type of financial behavior;

3) if the value of the aggregate index was up to 53.3, then such an economic entity was classified as an entity with a reactive type of financial behavior.

As a result of the calculations, the dominant group turned out to be entities with a reactive type of financial behavior (*Table 3*).

To the least extent, there are entities with an active type of financial behavior, which corresponds to the previously stated theoretical provisions. It should be noted that in practice, determining the type of financial behavior of an economic entity requires a separate sociological study, which includes a set of target questions. Actors with influence and money have enough resources, and financial and social capital to act.

The proposed approach to the calculation of the aggregated index makes it possible to assess how the entity assesses its current capabilities, considering the influence of past factors, and guidelines for the future. The entities with an active type of financial behavior, whose actions change the external environment are of considerable interest for analysis. It seems appropriate, on the basis of the available sociological data, to determine the factors influencing the formation of an active type of financial behavior.

Determination of factors influencing the formation of an active type of financial behavior

When determining the factors influencing the formation of an active type of financial behavior, it is advisable to use the previously described theoretical approach. At the same time, it is necessary to consider the basic characteristics that affect the ability of the entity to perform certain actions (*Table 4*).

The above indicators reflect the main factors that determine the possibility of forming an active type of financial behavior. The indicator that takes into account the age of the respondent is of considerable interest. The following hypotheses can be put forward here:

Table 4

Variables used in determining significant factors that influence the formation of active financial behavior by entities

Variable	Characteristic	Average value
Human capital		
Level of education	This variable represents the level of education, where 1 is the lowest level (primary and junior high school) and 14 is the highest level (Ph.D.). When forming the variable, the specialist degree corresponds to the master's degree, the postgraduate diploma corresponds to a candidate of sciences degree	5.99
Evaluation of personal professional qualities	Results of evaluating the answer to the question: "Imagine a ladder of professional excellence", consisting of 9 steps, where step 1 is the level of a beginner student, 9 is the level of "high professional class". Which of them would you classify yourself as? Thus, 9 is the maximum personal assessment of professional qualities, and 1 is the minimum	5.48
Social capital		
Knowledge of a foreign language	This variable uses an indicator of knowledge of a foreign language (knowledge of the national languages of the republics that were part of the USSR was not considered). 1 — know, 0 — do not know. If a person speaks a foreign language, then most likely he will have a large social capital	0.2
Internet use	This variable considers the ability to obtain information. The variable was obtained as a result of the analysis of the answer to the question: "Have you used the Internet during the last 12 months for work?", where 1 — yes, 0 — no	0.43
Financial capital		
Opportunity to improve living conditions	This variable uses the answer to the question: "Do you or your family have the opportunity, if you wish, to improve your living conditions — buy a room, apartment, house?", 1 — yes, 0 — no. If yes, then most likely the respondent has a sufficient amount of free financial capital	0.092
Bank card	This variable uses the answer to the question: "Do you have a bank card?", where 1 — yes, 0 — no. The variable reflects the level of financial activity of the respondent	0.73
Main characteristics		
Age 18–29	This binary variable takes the value 1 if the age is within the specified range, 0 — otherwise	0.11
Age 30–49	This binary variable takes the value 1 if the age is within the specified range, 0 — otherwise	0.28
Age 50–69	This binary variable takes the value 1 if the age is within the specified range, 0 — otherwise	0.28
Age 70+	This binary variable takes the value 1 if the age is within the specified range, 0 — otherwise	0.12
Gender	Male — 1, female — 0	0.43
Level of optimism	This variable considers the level of optimism that the respondent demonstrates. The variable uses the answer to the question: "Do you think in 12 months you and your family will live better or worse than today?". If according to the respondent, his life will improve, then 1 point is given, if it worsens — 0. The answer "nothing will change" is considered as positive	0.84

Источник / Source: составлено авторами / compiled by the authors.

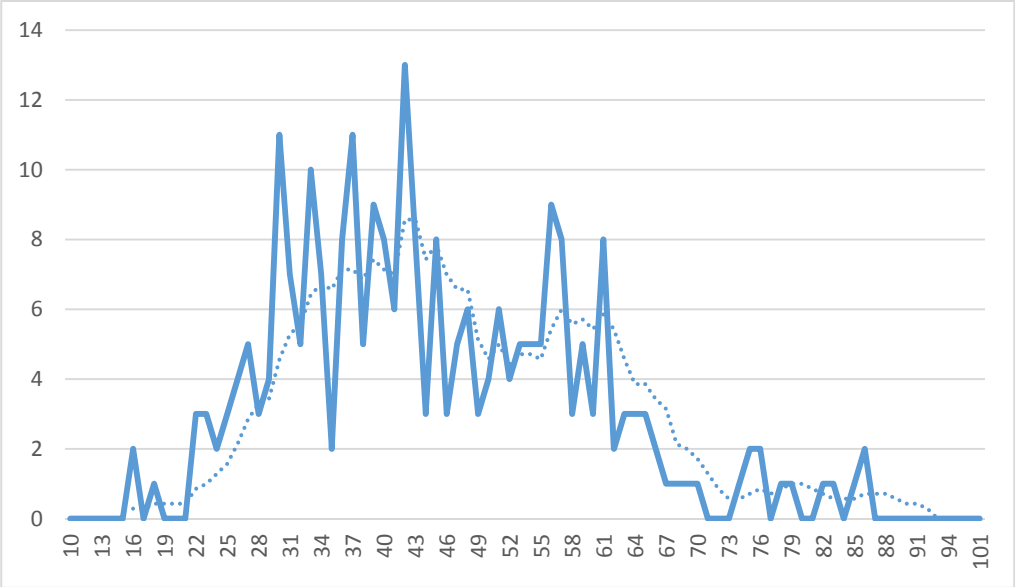

Fig. 1. **Distribution of entities by types of financial behavior depending on age**

Source: compiled by the authors.

Hypothesis 1. *With age, the entity will tend to demonstrate more adaptive and reactive types of financial behavior.*

The availability of financial capital leads to the formation of an active type of financial behavior.

This hypothesis is due to the fact that the activity of the entity will tend to decrease due to objective biological indicators. In turn, an increase in age will lead to an increase in the level of influence and disposable income, allowing for active actions. Thus, although younger entities are prone to an active type of financial behavior, they do not have the ability to perform the desired actions.

If we look at the distribution of entities depending on age, it is obvious that a significant number of entities with an active type of financial behavior falls into the range from 30 to 43 years. A certain jump in activity growth is also observed among respondents aged 55 to 64, after which the level of activity begins to decline. At the same time, with age, the entities show a tendency to reduce the likelihood of demonstrating an active type of financial behavior.

An analysis of the age composition of entities by types of financial behavior allows us to distinguish two main categories of entities with an active type of financial behavior: young entities who are prone to an active type of financial behavior but do not have sufficient resources to significantly influence the external environment, and mature entities who do not have a psychological propensity to commit active actions but possess the necessary amount of money. These two groups can be observed based on the analysis of the data presented in *Fig. 1*.

Hypothesis 2. *The size of available financial capital determines the inclination of entities to act actively.*

If the entity has financial capital, then it is likely to be more prone to active actions. Entities that do not have funds do not have the opportunity to take active actions. Most likely, they will demonstrate a reactive (or adaptive) type of financial behavior.

Econometric evaluation and analysis of the results

To test these hypotheses, it is advisable to build a binary regression. First, a regression

Table 5

Results of econometric analysis

Variable	Results for a model with all variables	Results for a model with significant variables	Average marginal effects
Level of education	0.0028156		
Assessment of personal professional qualities	0.0427418**	0.0519207***	0.0034982***
Knowledge of a foreign language	0.2824059***	0.2874272***	0.0193659***
Internet use	0.3865077***	0.4059782***	0.0273534***
Opportunity to improve living conditions	0.6731121***	0.6714557***	0.0452404***
Bank card	0.1421961		
Age 18–29	0.1442795		
Age 30–49	0.4402503*	0.2905798***	0.0195783***
Age 50–69	0.3981508	0.2519933**	0.0169785**
Age 70+	0.4456968		
Gender	0.3221758***	0.3196907***	0.0215397***
Level of optimism	0.4825447***	0.475602***	0.0320445***
Remains	–3.65131***	–3.414439***	
Number of observations	5,401	5,410	5,410
Regression significance (Prob > chi2)	0.0000	0.0000	

Source: constructed by the authors.

Note: the asterisks reflect the p-value: *** p < 0.01, **p < 0.05, *p < 0.1.

with all variables will be built, after which a regression with significant variables will be built (*Table 5*).

The resulting regressions were significant. The value under the ROC curve was 0.79. The indicator of the qualifying table also turned out to be quite high (96.52%). Correlation analysis showed no high correlation between explanatory variables. Thus, the results can be considered reliable.

The conducted regression analysis partially confirmed the hypotheses put forward in the study. The availability of financial capital leads to the formation of an active type of financial behavior. This hypothesis was confirmed by analyzing the answer to the question about the opportunity of acquiring property.

A rather interesting result was obtained for age indicators. Respondents aged 30 to 70 tend to demonstrate an active type of financial behavior, which is combined with the assumption that in order to form an active type of financial behavior, it is

necessary to accumulate the necessary amount of capital. In turn, respondents aged 30 to 49 show great prospects for the formation of an active type of financial behavior than respondents aged 50 to 69. This fact confirms the assumption that the performance of active actions is also determined by the personal characteristics of the entities, and not solely by the accumulated volume of influence and money [18].

Information about the knowledge of a foreign language, and the use of the Internet, also turned out to be significant parameters. An entity prone to the formation of an active type of financial behavior will probably try to actively interact with other entities, including through the use of modern digital means of interaction [19]. Moreover, he will have the opportunity to acquire additional knowledge. Accordingly, he will demonstrate an active type of financial behavior.

Thus, the conducted econometric analysis demonstrates the significance of individual parameters for the formation of an active type of financial behavior of entities. In turn, the set of these parameters may vary depending on the time period. In this logic, the answer to the question of the possibility of forming a sustainable type of financial behavior of an economic entity is not given.

Methodological approach to the definition of the type of financial behavior of an economic entity

Econometric analysis has shown that certain factors lead to the formation of the type of financial behavior of an economic entity. The concept of types of financial behavior of economic entities is an intermediate link between the formed expectations of an economic entity and the actions performed by it. Econometric assessment makes it possible to determine the values that allow us to compare the degree of influence of each factor on the formation of the type of financial behavior. A natural question arises

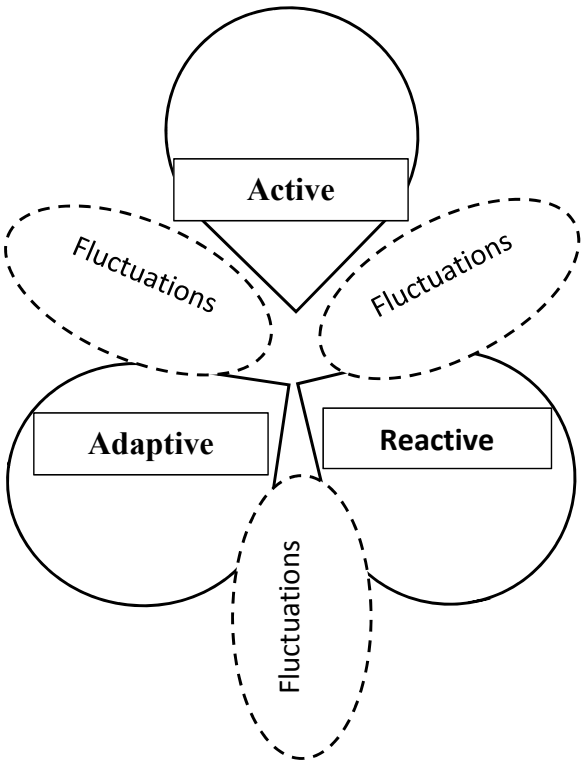

Fig. 2. **'Yadernye' (core) groups and entities with a variable type of financial behavior**

Source: compiled by the authors.

about the classification of economic entities within the types of financial behavior. It is possible to talk about the existence of certain 'yadernye' (core) groups, i.e. categories of entities that will constantly demonstrate the formed type of financial behavior. Naturally, among the indicated categories of entities, there are groups that can every now and then change their type of financial behavior (*Fig. 2*). The formation of 'yadernye' (core) groups is determined by the stability of factors related to human, social, and financial capital. If these factors are stable, then the entity is likely to exhibit a certain type of financial behavior over an extended period of time. Examples of such legal entities among banks in Russia are PJSC Sberbank, VTB Bank (PJSC), etc. Thus, the 'yadernye' (core) group is a constant, it differs not only in the type of financial behavior but also in the frequency and duration of demonstration of such behavior.

In particular, the strength of the potential impact of an entity with an active type of

financial behavior on foreign markets is determined by the amount of available free capital. If an entity with an active type of financial behavior has a significant amount of funds, then it can influence the markets (for example, D. Soros, Jakob Fugger). If the entity has a shortage of funds, then it will always demonstrate a reactive type of financial behavior. Such an entity will, first of all, think about meeting the basic needs of life. It will not be able to take active and adaptive actions. Fluctuating groups between 'yadernye' (core) groups arise from the predominance of variable factors in terms of the three types of capital. Entities change their type of financial behavior under the influence of the external environment. To assess the potential impact of types of financial behavior at the macro level, it is necessary to consider the factors of distribution of funds between groups of entities, and the distribution of entities by number.

In the process of life, entities can change their type of financial behavior under the influence of experience and life circumstances. In particular, even if the entity demonstrates an adaptive type of financial behavior, its income will decrease by the time of retirement. This fact was confirmed in the analysis of the influence of age characteristics on the formation of an active type of financial behavior. With age, the entity's ability to receive information decreases, and the level of available financial capital. In this case, the entity, most likely, will first demonstrate an adaptive type of financial behavior, and then move on to the formation of a 'yadernye' (core) reactive type.

Another important aspect is that within each type of financial behavior there are certain subgroups. In particular, entities with a reactive type of financial behavior may not take any action, regardless of changes in the external environment. In turn, some entities with a reactive type of financial behavior will take belated action, which will lead to significant losses for them. As a result, the volume of investments of entities with a reactive type of financial behavior will create "fuel" for the enrichment of entities with an active type of financial behavior and some entities with an adaptive one. It should be noted that changes in the level of income of entities occur during periods of crisis [20]. During periods of economic growth, all categories of entities, regardless of the type of financial behavior, will receive additional income. Problems will be observed during periods of crises, which are critical both in terms of changing the structure of the economy and in terms of fluctuations in the propensity of entities to conduct business transactions.

CONCLUSIONS

The research showed that the formation of the type of financial behavior of an economic entity is influenced by various factors related to psychological characteristics, the level of education, professional experience, etc. During their life, economic entities can demonstrate a very specific type of financial behavior, thereby creating 'yadernye' (core) groups, the share of which in the structure of entities remains approximately at the same level. Some economic entities will move between groups depending on specific points in time. The transition between groups occurs due to changes in the amount of accumulated human, social and financial capital.

The analysis carried out confirms the need for targeted sociological research aimed at determining the types of financial behavior of economic entities. It is necessary to conduct further research in this area to determine the methodology for calculating the coefficient that allows for assessing the propensity of the entity to form a certain type of financial behavior. Such a technique should allow analyzing the existing type of behavior of both individuals and legal entities. To do this, it is advisable to use the methodological approaches outlined in this research.

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V. V. Maslennikov — developed the conceptual framework for research, formalized the types of behavior of economic entities and the mechanism for determining "yadernye (core)" groups and entities with a variable type of economic behavior.
A. V. Larionov — prepared the literature review, performed the econometric analysis, developed the concept of the influence of human, social and financial capital on the formation of behavior types of economic entities.
M. A. Gagarina — selected specific variables for econometric analysis, described the process of behavior formation from the perspective of psychology, disclosed the concept of social capital quality.

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The Relationship Between Satisfaction, Trust and Loyalty in Electronic Banking

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ABSTRACT

Nowadays, the increase of competition has made organizations constantly strive to increase their productivity and reduce their costs. The rapid growth of systems based on electronic technology led to a significant change in banking services. Information technology has made it possible for electronic channels to perform many banking services that were traditionally performed over the counter. Albanian banks are making efforts to provide high-quality products and services to satisfy their customers as well as to increase customers' trust and loyalty to banks. The purpose of this study is based on the current state of e-banking in Albania to measure the impact that trust and loyalty have on the satisfaction of e-banking customers. The study is based on primary data collected by the administration of 400 questionnaires in Gjirokastra region. The data were analyzed using regression analysis and analysis of variance components, which resulted in both variables included in the model to be statistically significant, but among the above two factors the most important turned out to be trust, because according to the model if trust improves by one degree then satisfaction is expected to increase by 0.39 degrees. Albanian banks need to consider this effect of trust and loyalty on e-banking customer satisfaction, striving to increase them.

Keywords: satisfaction; trust; loyalty; electronic banking; Albanian banks; bank transactions; home banking; ATM; POS terminal

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INTRODUCTION

Nowadays, the increase of competition has made organizations constantly strive to increase their productivity and reduce their costs. The rapid growth of systems based on electronic technology, especially those related to the use of the Internet and personal computers, led to a significant change in the exchange of products and services in general as well as banking services in particular. Shankar and Jebarajakirthy [1] claim that e-banking is a competitive activity that aims to intensify competition in a way that attracts customers and increases revenue flow by expanding the range of banking services. Therefore, the acceptance of electronic banking by customers is one of the essential factors in the success of the overall activities of commercial banks. Moreover, electronic banking is an essential factor for the development of the electronic society [2] that is necessary for the processes of digitalization of the economy that are taking place in the world. On the other hand, as explained by Ling et al., the rapid development of computer technology is considered as a trading tool that attracts more customers to conduct banking transactions [3].

The current variant of web-based electronic banking is the latest of several generations of systems: ATMs were the first known machines to provide electronic access to retail bank customers. Phone banking then appeared where users call their bank computer system with their regular phone and use the phone keypad to perform banking transactions. PC banking surpassed telephone banking by allowing users to interact with their bank via a computer with a dial-up modem connection to the telephone network. Telephone and PC banking require maintenance costs associated with maintaining and updating various modems and avoiding complex installation procedures.

Instead of traditional banking practices, e-banking products and services are advancing more and more, as well as growing in the variety by providing information at an early stage to secure transactional activities [4]. The banking industry has rapidly developed the use of e-banking as an efficient and workable tool to create more and more customer value [5]. Electronic banking is one of the most popular services offered by commercial banks with a positive impact on the performance of banks [6].

The definition of e-banking varies among researchers in part due to the fact that it refers to several types of services through which bank customers can request information and perform banking services. E-Banking service is defined as the exchange of information between customers and providers using technological methods without face-to-face interaction [7]. Shannak [8, p. 242] describes e-banking as "The automated delivery of new and traditional banking products and services addressed to customers through electronic channels, interactive communication".

From the above definitions, we understand that "e-banking" is a very generic term and we need to be clear when talking about it. E-banking can be divided into two streams: electronic monetary products, mainly in the form of cards, and electronic product delivery channels.

The use of e-banking has brought many benefits which include: no restrictions and barriers, services are provided at a minimal cost, it has transformed traditional practices in the banking sector; the only way to stay connected with customers in any country and at any time is through internet applications, it results in high performance in the banking industry through fast delivery of customer information and service security; Customers prefer to use e-banking because it saves time, enables the use of new products or services with low transaction fees and encourages turnover management which is one of the most important dimensions of e-banking service quality [5, 9, 10]. Banks use online banking because it is attractive to customers as it helps reduce costs, control transactions, waiting time, etc. [11].

The services that Banks offer through e-banking and especially Internet Banking as part of it, are classified into four types:

- *Informative.* The bank uses the Internet to introduce its products and services. Through this service, the bank not only informs the client about its existence but also offers an electronic brochure for its services.
- *Communicative.* This type of system allows the connection between the customer and the banking system. The customer sends e-mails for further questions and receives answers from the bank for the questions he has addressed regarding the bank's products and services.
- *User interactive.* The customer is informed about the products that the bank offers by clicking on any product that he is interested in, for which he also receives relevant information. This type of service has many advantages as it offers value to the customer. If the customer is interested in a deposit or loan, he can calculate the interest rates online and can also apply online for the product he wants.
- *Transactional.* This type of system allows the client to conduct banking transactions. The customer can make money transfers, apply for credit or credit cards, pay bills. So it performs all the typical operations of a bank counter.

So we can say that the services offered through electronic banking include:

- *Information:* on the financial products and services that the bank offers; debit / credit cards, credit interest, exchange rates, etc.
- *Balance sheet check:* checking the account balance; checking the status of debit or credit cards as well as detailed checking on the bank accounts of the customers.
- *Transfer of funds:* transfers within or outside the country, payment by cards, loan repayment or direct debits.
- *Loan:* loan application, approval, request for credit limit increase and credit transfer.
- *Other:* financial advice, incident report, personal finance administration and other financial products.

LITERATURE REVIEW

Increased competition in the banking environment, as well as the importance of customer satisfaction, have pushed banks to place more and more emphasis on relationships with their customers. To survive and thrive in such a competitive industry, each bank is not only required to increase the quality of its service but also to meet the needs of customers to increase their trust and loyalty [12]. Customer satisfaction, trust and loyalty are important indicators and numerous studies have identified the benefits they bring to e-banking.

Customer satisfaction

Customer satisfaction has been and continues to be a vital pillar of business success [13]. A satisfied customer is an asset, a real diamond for any

organization and creates a competitive advantage over other companies [14]. It is defined as the way an individual feels about the satisfaction or dissatisfaction that stems from comparisons made between what he or she expects from consuming or using a product and the actual outcome of the product [15, 16].

A satisfied customer will repeat the performance of the service and convey positive messages about it to others. In contrast, a dissatisfied customer is more likely to switch to an alternative product / service the next time he / she recognizes the same need. Not only that but his / her dissatisfaction will be reflected in giving negative messages which can have a seriously detrimental effect on the business. Therefore, it is important for banks to ensure customer satisfaction for their products / services).

A number of studies point to a relationship between customer satisfaction and E-Banking services. In their study, Asiyanbi and Ishola [17] demonstrated that the level of customer satisfaction in the banking sector increases when using E-Banking services. Other studies have shown that satisfaction is one of the essential elements that affects customer trust in online banking [18, 19]. Studying electronic banking, it has been noticed that customer satisfaction leads to increased trust in banking services. Following a trust investigation, banking researchers found that satisfaction is one of the most critical factors contributing to increased trust in banking cyberspace.

According to Forsythe [20], in addition to the different approaches used to examine customer satisfaction, cyclical surveys can also be used to measure customer satisfaction. Another way that can be used to provide an assessment of customer satisfaction is by examining the degree of customer loss [21].

Trust

Trust is one of the factors analyzed by scientists and business analysts. Keskar and Pandey [22] summarized 51 articles exploring studies published between 2002–2016, which found that trust was widely studied as an important factor influencing the adoption and use of e-banking.

There are many benefits provided by e-banking, but despite this fact, researchers agree that one of the essential factors in the adoption of online banking is trust [23, 24]. Lack of trust in banks is a common determinant of bank governance, so the factors that shape trust are a major concern for bank regulators [25]. Moreover, trust has a positive impact on customer-bank relationships in the long run [26]. In recent years many studies have looked at the relationship between trust and intent to use e-banking. In fact, many scientists argue that trust has a direct positive impact on the consumer's intention to use e-banking [27]. Moreover, trust is a determining factor, leading to further use of online banking. Since trust is an important issue in determining the success of e-banking, it is important to determine what leads to a higher level of trust [28].

In this study, we will examine the impact of trust and how this together with loyalty affect e-banking customer satisfaction and how it will help banks build a long-term relationship with their customers.

Loyalty

Loyalty is considered as one of the keys in achieving company success and sustainability in time [29]. It affects the importance of the interaction between re-patronage and the relative attitude of a person [21]. Although customer satisfaction plays a crucial role in business management, it does not guarantee effective business success on its own. However, it does help increase a company's financial position [15]. However, it is more costly to attract new customers than to retain predominant customers [16]. Meanwhile, loyal customers can entice more customers to buy from the company. Customer loyalty is not simply gained, but developed by making good decisions and through resources [30].

Numerous studies have been conducted to identify the benefits that customer loyalty brings to an organization. Most of this research has focused on the financial benefits of customer retention, including known initial cost and attraction of new customers; increase the number of purchases; positive opinion; increasing the value of purchases; and customer understanding.

Dufwenberg [31], found that building good customer relationships is essential in increasing customer loyalty. On the other hand customer loyalty is a function of customer satisfaction [32, 21]. Basically, loyalty represents a form of behavior while satisfaction is an attitude. The success of the

company along with the profits it makes are driven largely by customer satisfaction and loyalty which can be said to be the main focus of most companies [33]. Finally, a significant increase in customer satisfaction will cause a large increase in customer loyalty [34].

PURPOSE AND STUDY OBJECTIVE

Problem formulation

Although a positive trend has been observed in Albania regarding the use of e-banking and the Internet as a new alternative for the provision of banking products and services, although in the Albanian market there are banks that have the support of strong foreign banking groups, this service is not yet developed, resulting in the country with the lowest use of electronic services and products in the region. In Albania, cash is still the predominant means of payment in all areas. It is difficult to build an effective electronic payment system without having complete trust in banks and without having loyal and satisfied customers.

The purpose of this study is based on the current state of e-banking in Albania to measure the impact that trust and loyalty have on the satisfaction of e-banking customers.

In view of the above purpose, the **main objective** of the paper is:

Measuring the impact that trust and loyalty have on e-banking customer satisfaction (with a focus on the Gjirokastra region).

HYPOTHESIS AND METHODOLOGY

Since the impact of factors related to satisfaction, such as customer trust and loyalty to banks in terms of using e-banking in Albania and the relationship between them, has remained largely unstudied, this study is natural. A quantitative treatment was applied to test the conceptual framework. The applied instrument for the study (questionnaire) and the research variables are discussed below.

The decision to use electronic banking is a function of several variables (measured by 7 Likert scales) and personal characteristics. Variables will include e-banking customer satisfaction, trust and loyalty.

To address the research problems and to achieve the main objective, this study will prove the following hypothesis:

Study Hypothesis: Satisfaction is not related to trust and loyalty

To achieve the purpose and objective of the study, a questionnaire was conducted in all three districts of Gjirokastra region. Based on the statistical methods and classical econometric models (linear multifactorial regression) the survey data was processed and the findings and confirmations or not of the hypotheses were extracted.

Sample selection

The empirical analysis is a process that begins with data collection, first, with the determination of a valid sample for the study. The minimum number of observations needed to be considered in this study was calculated according to the formula proposed by Tabachnick and Fidel [35]. This formula takes into account the number of independent variables for calculating the sample size valid for the study. ($N >= 50 + 8m$, where N is the minimum number of sampling observations and m = number of independent [35, p. 123].

A total of 400 questionnaires were randomly distributed through the physical copy to customers using electronic banking services in the Gjirokastra region. The distribution of questionnaires by districts of Gjirokastra region was done in proportion to the population according to the 2011 Census data. The distribution of questionnaires and their validity by districts is presented in *Table 1*.

Data collection

The district banks were visited by us to maximize participation. Participation was voluntary and out of a total of 400 questionnaires distributed, 350 were usable (n = 350). Thus the response rate is 350/400 = 87.5%. Data management is realized in two phases. The first phase consists of cleaning and dumping data in the Eviews program and the second phase — analyzing the data. The data entry in the program is performed based on the data encoding, according to the respective variables.

Data analysis methods

Our study has a three-dimensional character: descriptive, exploratory and causal. The basic method of work is that of analysis and synthesis. Primary data is used for the realization of this work.

Table 1

Customer participation by districts

District	Population	Percentage to total, %	Number of questionnaires	Valid questionnaires	Invalid questionnaires
1. Gjirokastra	37.099	51.40	206	186	20
2. Tepelena	19.606	27.16	108	91	17
3. Përmet	15.471	21.44	86	73	13
Total	72.176	100	400	350	50

Source: compiled by the author.

The literature review is an essential part of the paper. Studies and academic research of Albanian and foreign authors, published in scientific journals in Albania and abroad, the texts of authors, mainly foreign, are the basis of this part of the research. Data collection and analysis by the Bank of Albania served for a more detailed analysis. To measure and evaluate the impact of trust and loyalty on customer satisfaction of Gjirokastra region, a questionnaire was conducted in all three districts of Gjirokastra region. Based on statistical methods and econometric models, the survey data were processed and the findings and confirmations or not of the hypotheses were extracted.

Classical econometric models (linear multifactorial regression), multifactorial analysis of variance (ANOVA), component method of variance, etc.) were used.

The variables we received are of a mainly ordinary nature (ie the interviewees can be ranked according to the values of the variable from 1–7), but also of the nominal scale (gender, area, education, employment, marital status) and the scale in form ratio (age, income, number of years with the bank, number of transactions per month).

Limitations of the paper

There are some limitations to conducting this study in relation to data collection and analysis which are provided below:

First: In the study, it was assumed that respondents have the same level of internet use skills.

Second: One of the limitations of analysis or modeling is the nature of the variables; generally the variables used are measured on an ordinary scale, which violates one of the assumptions of the classical model that variables should be measured on an interval scale; this implies to some extent the relevant findings, so these should be taken as approximations and accepted with reservations.

Third: All the results of the questionnaire are based on the subjective answers of the respondents, who may or may not have been realistic in their answers.

Despite these limitations, this study may serve as a starting point for further studies.

In the future, research can be done by considering a larger number of bank customers trying to understand their level of satisfaction based on the factors cited. At least, after a few years, if the level of satisfaction is measured, then it will serve to identify if any structural progress has occurred among e-banking customers in Albania.

E-BANKING IN ALBANIA

The first bank to offer e-banking products is the American Bank of Albania in 2002, with the introduction of ABAflex. After a slow start, we can say that currently, e-banking has entered a development phase. Today the development of infrastructure has encouraged almost all banks operating in Albania to take on the challenges of providing these services and to diversify the products and services offered by them. Electronic banking products are offered by almost all banks, which have already entered a new phase of this process which consists in their further refinement in terms of technology and the variety of services offered to the clientele. Electronic banking products / services are a facility offered to customers by banks for various services. These products / services consist of the provision by banks for their customers of debit and credit cards, ATMs and POS, internet banking, mobile and SMS banking, etc.

Table 2

Performance of number and value of Home Banking transactions in years

Home Banking Transactions	Number of transactions	% of growth	Value of transactions (million ALL)	% of growth
2015	1404052	–	282756	–
2016	1791989	27.63	343583	24.51
2017	2263607	26.32	550096	60.11
2018	2911837	28.64	885777	61.02
2019	3623642	24.45	960060	8.39
2020	4119802	13.69	1044936	8.84

Source: Bank of Albania (Reports from banks according to the "Methodology for reporting payment instruments").

Home banking

The initiation of credit transfers in electronic form is realized through "home banking" services, which are offered in 11 out of 12 banks operating in the country. These services are finding increasingly widespread use in the Albanian market, being used not only for basic account information services but also for making online payments. In 2020, there is an increase of 13.69% of the volume of "home banking" payments and a slight increase of 8.84% of the value of these transactions, compared to a year ago. The measures taken by the Bank of Albania, as well as the policies of the banks, in the context of promoting alternative payment methods, are estimated to contribute to the increase in the use of "home banking". These measures are reflected in the increase of remotely accessible accounts by about 32.6%, and in the increase of the latter to the total customer accounts by 19.8% (*Table 2*).

Bank cards

Quite common in developed economies are bank cards which is the electronic payment instrument, issued by a bank licensed to conduct banking transactions with predefined functions. Bank cards are electronic payment instruments that have found use in Albania, despite the fact that their use rate is still low compared to the indicators of other countries in the region [36]. In Albania, physical money (cash) is still the predominant means of payment in all areas.

In the Republic of Albania, at the end of 2020, all banks operating in the market are licensed as card issuers, while 7 of them are also licensed as card acceptors. In 2020, there is an increase of 5.62% in debit card issuance and a decrease of 4.38% in credit cards. The performance of the number of cards in circulation in years, according to the card function, is reflected in the following *Table 3*.

The following table presents the number of cards by function and their annual growth rates *Table 4*.

Use of ATM and POS electronic devices

The use of ATMs and electronic devices at points of sale (POS) has played an important role in conducting electronic transactions.

POS (Point of Sale)

The infrastructure provided by these banks has resulted in an increase in the number of POS (Point of Sale) (an increase of 8.50% compared to 2019). Despite the positive trend of increasing the number of POS terminals, reflected in the POS ratio per 1,000,000 inhabitants (which in 2020 results in the figure of 4,268), their concentration continues to be quite high in the region of Tirana, at 88.5%. Virtual POSs, through which online card payments can be made for e-commerce purposes, have also increased significantly. The banking system has provided such services since 2013, but the expansion of their use by traders who want to trade electronically has been at a very moderate pace. Meanwhile, in 2020 there was an increase of 44 virtual POS.

ATM (Automated Teller Machine)

At the end of 2020, the number of ATM (Automated Teller Machine) terminals has increased to 738, compared to 707 terminals that resulted in 2019. Despite the fact that ATMs are mainly used for cash withdrawals, during 2020 we have an expansion of ATM functions that enable deposits and transfers (*Table 5*).

Table 3

Number of cards by function in years

Number of cards by functions	31 December 2015	31 December 2016	31 December 2017	31 December 2018	31 December 2019	31 December 2020
Cards with cash function	940 278	999 313	1 064 725	1 128 026	1 206 410	1 264 220
Card with payment function	907 405	957 548	1 010 431	1 060 337	1 139 334	1 192 140
Of which:						
1 – Debit card	826 280	871 611	914 119	954 902	1 025 559	1 083 243
2 – Credit card	81 125	85 937	96 312	105 435	113 775	108 897
Cards with electronic money function	32 873	41 765	54 294	67 689	67 076	72 080
Total number of cards in circulation	940 278	999 313	1 064 725	1 128 026	1 206 410	1 264 220
Of which:						
– Cards with more than one function	936 327	999 313	1 064 725	1 128 026	1 206 410	1 264 220

Source: Bank of Albania (Reports from banks according to the "Methodology for reporting payment instruments").

Table 4

Number of cards by function and their annual growth rates

Years	Debit card	% of growth	Credit card	% of growth	Total cards with payment function
2015	826 280	–	81 125	–	907 405
2016	871 611	5.49	85 937	5.93	957 548
2017	914 119	4.88	96 312	12.07	1 010 431
2018	954 902	4.46	105 435	9.47	1 060 337
2019	1 025 559	7.40	113 775	7.91	1 139 334
2020	1 083 243	5.62	108 897	–4.29	1 192 140

Source: Bank of Albania (Reports from banks according to the "Methodology for reporting payment instruments").

DATA ANALYSIS AND FINDINGS

To measure the impact that customer satisfaction, trust and loyalty have on e-banking, classical econometric models (linear multifactorial regression) and the method of variance components were used. *Table 6* presents the information of sample composition by personal factors.

Other participants are: 1.43% (n = 5) of the age group under 18 years, 19.43% (n = 68) of the age group 36–45 years, 18.29% (n = 64) of the age group 46–55 years and 8.00% (n = 28) of the age group over 56 years. In terms of marital status, the majority of customers 55.71% (n = 195) were identified as married, 37.71% (n = 132) were identified as single, 2.29% (n = 8) were widowed and 4.29% (n = 15) are identified respectively divorced. Regarding the level of education, statistics show that the majority of customers considered or 60.29% (n = 211) are customers with higher education, 27.43% (n = 96) customers with secondary education, 8.57% (n = 30) customers with postgraduate education and only 3.71% (n = 13) bank customers with lower education. According to statistics, the majority of bank customers considered 82% (n = 287) are customers of urban areas and only 18% (n = 63) customers of rural areas.

Sample according to other factors

Other factors considered in the analysis include employment status, monthly income, number

Table 5

Progress of the number of ATMs and POS in years and annual growth rates

Years	POS equipment (at points of sale)	% of growth	ATM	% of growth
2015	6.689	–	826	–
2016	7.111	6.31	800	–3.15
2017	7.294	2.57	747	–6.62
2018	8.726	19.63	723	–3.21
2019	11.195	28.29	707	–2.21
2020	12.147	8.50	738	4.38

Source: Bank of Albania (Reports from banks according to the "Methodology for reporting payment instruments").

of years with the current bank and number of transactions per month. *Table 7* presents detailed information of the sample composition according to the other factors mentioned above.

According to statistics, in terms of employment status 11.14% (n = 39) customers were students, 38.29% (n = 134) were employed in the public sector, 28.00% (n = 98) were employed in the private sector, 11.14% (n = 39) were self-employed, 8.00% (n = 28) were unemployed and 3.43% (n = 12) were others.

According to statistics, 37.71% (n = 132) customers of the bank had monthly income up to 30,000 ALL, 46.86% (n = 164) customers had a monthly income of 30,001–50,000 ALL, 13.43% (n = 47) customers had monthly income 50,001–100,000 ALL and only 2.00% (n = 7) customers had a monthly income over 100,000 ALL.

Regarding the number of years with the current bank, 13.14% (n = 46) customers had up to one year with the current bank, 25.43% (n = 89) customers had 1–3 years with the bank, 24.86% (n = 87) customers had 3–5 years with the bank, 19.43% (n = 68) customers had 5–10 years with the bank and 17.14% (n = 60) customers had over 10 years with the current bank.

Most of the bank's customers 54.28% (n = 190) customers performed 2–5 transactions per month, 24.86% (n = 87) customers performed only 1 transaction per month, 16.57% (n = 58) customers performed 6–10 transactions per month and 4.29% (n = 15) customers performed over 10 transactions per month.

Table 6

Sample by personal factors

	Frequency	Percent
A. PERSONAL FACTORS		
1. Gender	**350**	**100.00**
a) Female	186	53.14
b) Male	164	46.86
2. Age	**350**	**100.00**
a) below 18 years old	5	1.43
b) 18–25 years old	88	25.14
c) 26–35 years old	97	27.71
d) 36–45 years old	68	19.43
e) 46–55 years old	64	18.29
f) More than 56 years old	28	8.00
3. Marital status	**350**	**100.00**
a) Married	195	55.71
b) Single	132	37.71
c) Widowed	8	2.29
d) Divorced	15	4.29
4. Education level	**350**	**100.00**
a) Low education	13	3.71
b) Secondary Education	96	27.43
c) University education	211	60.29
d) Postgraduate education	30	8.57
5. Area of residence	**350**	**100.00**
a) Urban areas	287	82.00
b) Rural areas	63	18.00

Source: compiled by the author.

Regression Analysis

Hypothesis 1: Satisfaction is not related to trust and loyalty

The model derived from the above multivariate analysis (*Table 8*)

is presented as follows:

$$SATISFACTION = 1.622169 + 0.388420\ TRUST + + 0.326022\ LOYALTY + \varepsilon.$$

In this model the Durbin — Watson test turns out to be 1.842602, a value within the allowable range (1.5–2.5) and shows that the assumption regarding autocorrelation has not been violated. Meanwhile, the variation of the dependent variable is explained 55% of the independent variables taken in the model, because the adjusted coefficient of determination is $R\ 2 = 55\%$, while 45% of the variation of the variable "satisfaction" is explained by other random variables not included in the model.

Furthermore, from the data in the table above it appears that the model is statistically significant at the 95% confidence level ($F = 213.6291$; Prob $F = 0.000000 < < 0.05$). If we analyze the importance of each of the independent variables included in the model (trust and loyalty), they turn out to be statistically significant, so their effect on satisfaction is significant (valid).

This is confirmed by the test values *t* and the probability p values that for each variable result respectively tbesimi = 9.326493, *p* (*t*) confidence = = 0.0000 < 0.05; loyalty = 7.485194, *p* (*t*) loyalty = 0.0000 < < 0.05. It is also noted that among the above two factors the most important turns out to be trust, because if trust improves by one degree then satisfaction is expected to increase by 0.39 degrees.

Consequently, we can say that the above implication is rejected with a probability of at least 95%.

Analysis of variance components for the main variables

Analysis of variance components for satisfaction

Analysis *Table 9* divides the satisfaction variance into 4 components, one for each factor. The purpose of such an analysis is usually to estimate the amount of variability contributed by each of the factors, called variance components. In this case, the most contributing factor to the variance is the quality of service. Its contribution represents 38.0996% of the total satisfaction variation.

Table 7

Sample by other factors

	Frequency	Percent
B. OTHER FACTORS		
1. Employment status	**350**	**100.00**
a) Student	39	11.14
b) In the public sector	134	38.29
c) In the private sector	98	28.00
d) Self-employed	39	11.14
e) Unemployed	28	8.00
f) Others	12	3.43
2. Monthly income (ALL)	**350**	**100.00**
a) Up to 30.000	132	37.71
b) 30.001–50.000	164	46.86
c) 50.001–100.000	47	13.43
d) Over 100.001	7	2.00
3. Number of years with current bank	**350**	**100.00**
a) Up to 1 year	46	13.14
b) 1–3 years	89	25.43
c) 3–5 years	87	24.86
d) 5–10 years	68	19.43
e) Over 10 years	60	17.14
4. Number of transactions per month	**350**	**100.00**
a) 1	87	24.86
b) 2–5	190	54.28
c) 6–10	58	16.57
d) Over 10	15	4.29

Source: compiled by the author.

Analysis of variance components for loyalty

Analysis *Table 10* divides the loyalty variance into 4 components, one for each factor. The purpose of such an analysis is usually to estimate the amount of variability contributed by each of the factors, called variance components. In this case, the most contributing factor to variance is price. Its contribution represents 47.6809% of the total loyalty variation.

Analysis of variance components for trust

Analysis *Table 11* divides the variance of confidence into 4 components, one for each

Table 8

Summary of the model for satisfaction according to the smallest squares method

Dependent variable: SATISFACTION				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	1.622169	0.190437	8.518147	0.0000
TRUST	0.388420	0.041647	9.326493	0.0000***
LOYALTY	0.326022	0.043556	7.485194	0.0000***
R-squared	0.552543	Mean dependent var		5.444126
Adjusted R-squared	0.549956	S.D. dependent var		1.149355
S.E. of regression	0.771048	Akaike info criterion		2.326427
Sum squared resid	205.7022	Schwarz criterion		2.359565
Log likelihood	–402.9614	F-statistic		213.6291
Durbin-Watson stat	1.842602	Prob(F-statistic)		0.000000

Source: compiled by the author.

Note: *,**,*** indicates that the results are significant at the 10,5 and 1 percent respectively.

Table 9

Analysis of variance components for satisfaction

Source	The sum of the squares	Df	The average square	Components of variance	Percent
TOTAL (corrected)	461.205	349			
Quality of service	315.545	156	2.02272	0.506119	38.10
Quality of E-service	144.604	172	0.840723	0.470478	35.42
Image	1.05544	3	0.351815	0.351815	26.48
Price	0.0	1	0.0	0.0	0.00
ERROR	1.08002E-12	17	6.35309E-14	6.35309E-14	0.00

Source: compiled by the author.

Table 10

Analysis of variance components for loyalty

Source	The sum of the squares	Df	The average square	Components of variance	Percent
TOTAL (corrected)	566.934	349			
Quality of service	403.742	156	2.58809	0.717691	43.80
Quality of E-service	161.181	172	0.937097	0.139557	8.52
Image	0.53125	3	0.177083	0.0	0.00
Price	1.48026	1	1.48026	0.78125	47.68
ERROR	1.02318E-12	17	6.01871E-14	6.01871E-14	0.00

Source: compiled by the author.

factor. The purpose of such an analysis is usually to estimate the amount of variability contributed by each of the factors, called variance components. In this case, the most contributing factor to the variance is the quality of service. Its contribution represents 40.5229% of the total trust variation.

CONCLUSIONS

The purpose of this study is to show the impact of trust and loyalty on customer satisfaction with banks in terms of using e-banking. Customer satisfaction has been and continues to be a vital pillar of business success [29]. A satisfied customer

Table 11

Analysis of variance components for trust

Source	The sum of the squares	Df	The average square	Components of variance	Percent
TOTAL (corrected)	**622.399**	**349**			
Quality of service	433.678	156	2.77998	0.726567	40.52
Quality of E-service	187.666	172	1.09108	0.714597	39.86
Image	1.05544	3	0.351815	0.351815	19.62
Price	0.0	1	0.0	0.0	0.00
ERROR	3.41061E-13	17	2.00624E-14	2.00624E-14	0.00

Source: compiled by the author.

is an asset, a real diamond for any organization and creates a competitive advantage over other companies [14].

The multivariable analysis was used in this study in purpose to determine the link between satisfaction, trust and loyalty. The findings showed that both variables included in the model were statistically significant, but among the above two factors, the most important turned out to be trust, because according to the model if trust improves by one degree then satisfaction is expected to increase by 0.39 degrees. This finding is in accordance with the findings of previous similar studies. Anderson and Sullivan [37], have found a positive correlation between customer satisfaction and loyalty. Also, Caruana [38], argued that loyalty can be achieved through satisfaction. Other studies have also analysed the relationship between trust and loyalty. According to the study of Mohammed et al. [39], the relationship between trust and customer loyalty is important, suggesting that a higher level of trust leads to increased customer loyalty to the bank. Such a study can be undertaken in Albania to determine the link between customers' trust and loyalty to banks. Our findings are also in line with the study of Arasly et al., [40] where the SERVQUAL dimensions were the explanatory variables in predicting customer satisfaction and the reliability dimension turned out to have the greatest impact on overall customer satisfaction. Othman and Owen [41] suggested that there is a strong link between SERVQUAL and customer satisfaction in the banking sector which supports previous studies. There is evidence to suggest that service quality leads to customer satisfaction and helps to retain existing customers and attract new customers.

Management Recommendations

The results of this study show that banks should pay more attention to increasing customer satisfaction, trust and loyalty that customers have towards banks. This will help them not only keep their existing customers but also increase the number of new customers.

Albanian Banks must provide customers loyalty to achieve stable financial growth and improve their position in the market. They need to develop strategies to ensure increased customer satisfaction and loyalty through improved service quality, if loyalty increases this can lead to significant profit growth. Moreover, customers will stay loyal to their banks when there is an increase in the level of satisfaction. For this, we consider the vital role of customer satisfaction in customer relationships and the positive impact on loyalty.

Based on the above analysis and conclusions we recommend:

1. Banks need to make greater efforts to promote electronic banking services. In this context, banks should increase cooperation with civil society, the Ministry of Finance, the Directorate of Prevention and Money Laundering, the Directorate of Taxation, the Bank of Albania, etc., in order to raise public awareness in general to reduce the use of money physical (cash) and the realization of payments electronically. This will increase the effectiveness of the economy as a whole.

2. Banks should try to expand their network, they can promote, subsidize costs, free training, access to multiple facilities, motivating programmes for users and all people. E-banks should make efforts to aggressive marketing campaigns. Due to the rapid development of technology, banks can interact closely in the field of standards development in order to provide services to third parties.

3. Banks' managers should: consider the importance of overall customer satisfaction, improve their relationships with their customers, know the reasons that may cause dissatisfaction or attraction of products offered by competitors of the bank. They need to pay attention to the needs of their customers to keep them more satisfied, trustworthy and loyal to the bank.

4. Banks' managers should evaluate the importance of e-service quality and service quality with all their components, as significant factors that affect satisfaction, trust and loyalty of customers to the bank.

5. An open-minded business culture, assessing technological development and being willing to put into production new advanced solutions, is another aspect that should be embraced by the banking system in Albania for the development of "e-banking". Implementation of electronic banking is not a campaign, but a long-term process, which should be seen as an investment and not as an expense.

6. Development of technological solutions should not focus on a product or e-banking service, but on the relationship with the customers. The success or failure of E-banking depends to a large extent on the integration of technology infrastructure with business processes.

7. Another important aspect in the development of e-banking services is the quality of the legal framework. Approval of electronic signature laws and the protection of personal data will significantly accelerate the development of electronic banking, helping to build customer trust.

8. These important developments in the banking system are closely related to the further growth of the supervisory role of the Bank of Albania. Further development of the relevant legislation and regulations of the Bank of Albania will serve as a guide and guarantee for the continuous consolidation of electronic banking services and in particular "e-banking" services as well as guarantees for customer security on the other hand. The Bank of Albania should conduct regular examinations in the banking system to ensure that the technical infrastructure, transparency towards the customer and all risks associated with the provision of such a service are addressed in accordance with the Bank of Albania regulatory framework and best international practices.

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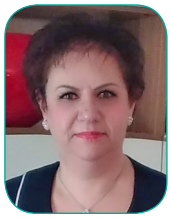

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Financial Wealth in Macroeconomic Dynamics

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ABSTRACT

The article examines the financial wealth that affects macroeconomic dynamics from a comparative perspective for some countries. **The purpose** of the study is to identify changes in financial wealth and determine their impact on macroeconomic dynamics, taking into account the assessment of the impact of the level of social indicators — inequality and poverty, in particular, on changing the goals of economic development — growth rate, human development index. **The methodology** consists of empirical, structural, comparative analysis, econometric modeling, which is reduced to the construction of multiple regressions based on the Gretl 2020b software module, multiplicative models by the type of production functions. Taking into account these methods, an analysis algorithm **has been developed** to assess the impact of financial wealth on macroeconomic dynamics. The implementation of this algorithm made it possible to carry out a comparative analysis of the results for Russia, the G7 countries and China in terms of the influence of financial wealth on their development. The main **empirical result** is that financial wealth has a stronger effect on economic dynamics and social indicators of development than non-financial wealth, and is associated with the growth rate of highly developed countries. For Russia, the growth of financial wealth, albeit small, was associated with high growth rates, however, the **econometric analysis** revealed that financial wealth did not have a decisive influence on growth rates, reducing the human development index, unlike other countries, this affected the increase in this index. **The authors conclude** that the Russian economy showed the lowest sensitivity of GDP to financial wealth, but high to the Gini index, with only China and Russia having a higher sensitivity to non-financial rather than financial wealth compared to other reviewed countries. **The prospect** of using the results is to adjust macroeconomic policy, monetary and financial instruments, taking into account the sensitivity of target macroeconomic parameters to financial wealth, including the differentiation of policy instruments for each country.

Keywords: financial wealth; economic growth rate; gross domestic product; inequality; poverty; human development index; macroeconomic dynamics; comparative analysis of countries

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INTRODUCTION

Modern economic growth is largely determined not only by investments [1] but also by their distribution between financial and non-financial assets [2]. The ability of a country to develop its economy depends on the amount of wealth and its structure in the form of financial and non-financial parts. Many studies have been devoted to the problem of assessing the impact of the financial structure and investments on economic growth [1–5]. In particular, financial development is assessed by whether it is determined by the banking sector or the securities market [6]. For some countries, the stock market may increase opportunities for economic development, while the banking market may slow it down; for others there is feedback. An outcome is possible when too rapid development of the financial sector will lead to a slowdown in economic growth or provoke a crisis [7]. At the same time, the structural parameters for income and risk will be of great importance in terms of ensuring the strength of influence on economic growth in both directions. Financial cycles also affect growth [8], including in the regional context.

However, the mentioned studies, as a rule, do not concern with the study of the consistency of the set of parameters of macroeconomic dynamics, including the components of wealth that characterize economic development. Although some of them set the task of assessing the impact of financial wealth on consumption,

it is presented in the aspect of providing, for example, housing wealth i.e. includes a complex of particular questions [9–11]. A significant part of the research is devoted to studying the structure of financial wealth and its impact on savings, portfolio investment, and other individual parameters of macroeconomic development [12, 13].

The authors believe that it is necessary to talk about the relationship between financial wealth, GDP growth, changes in inequality and poverty, and the human development index. The study of the relationship between these parameters allows us to find out how much growth is associated with an improvement or deterioration in the main social indicators of development along with a change in financial activity, an increase in the dominance of the financial sector and financial wealth.

The available studies of the relationship between inequality, poverty and growth [14–16] do not cover the above range of issues, which cannot but affect the ongoing macroeconomic policy, including the regulation of financial markets by monetary instruments. Usually, the subject of study is what exactly determines growth — inequality or poverty, and how the ratio between poverty and inequality, or some kind of financial conditions, changes. Aspects are also considered — how the macroeconomic dynamics changes in crisis conditions, in particular, the COVID-19 crisis of 2020 [17, 18]. The impact of the minimum wage on the level of poverty and inequality [19], and the relationship between economic growth, financial development, and the level of corruption [20] are assessed. A significant, if not overwhelming part of research is devoted to the impact of financial assets on various aspects of economic growth and financial savings and their relationship with various decision-making options, wealth and development [21–27]. The issues of the functioning of the financial sector in the context of globalization and integration are considered [28, 29].

At the same time, it certainly matters how the structure of wealth changes — financial and non-financial assets, what is its impact on macroeconomic dynamics, including the impact on these social indicators. Some studies show that banks and financial markets do not reduce poverty [30]. However, they can influence growth rates in other countries, increasing the possibility of increasing incomes. Then the solution to the problem of poverty comes down to the existence of institutions for the distribution of the created income. However, R. Zhang and S. Naceur in their study convincingly prove that the availability, depth, efficiency and stability of the country's financial development reduce inequality and poverty, and financial liberalization increases inequality and poverty [31]. The above estimates and works clearly show convincing data on the impact of financial wealth on economic dynamics, especially in a systemic context, i.e. considering changes in social indicators and their impact on growth. This is most clearly characteristic of the Russian economy and the system of public administration. Therefore, for the formation of a new model of economic growth in Russia, such a statement of the problem, a comparative analysis of the most economically developed countries, seems to be very relevant in practical terms and significant in scientific terms.

The foregoing allows us to indicate that the aim of this study is to assess the impact of financial wealth on macroeconomic dynamics, including changes in inequality and poverty. A research method is an econometric approach that allows, based on panel data for countries selected for comparative analysis, to conduct a generalized measurement of such an impact, considering the relationship of these parameters. Econometric modeling is carried out using panel data on the example of eight countries: USA, Canada, Germany, France, UK, Italy, Japan (G7 countries), and China. Separately, for the time series, simulations were carried out for Russia, so that the results obtained for the G7 countries and China could be compared. At the stage of calculations, the Gretl 2020b software module was used. Factorial models are also applied using the classical production function modified for the research problem. Here, the same countries are selected for comparative analysis, with the exception of Japan, since the time series for this country, in particular, for the Gini coefficient,

is incomplete.[1] Multiplicative models make it possible to estimate the sensitivity of the impact of financial wealth on the value of the gross domestic product and the level of inequality, measured by the Gini coefficient. In the article, wealth is understood as a value that consists of the sum of financial and non-financial parts: non-financial wealth is a combination of tangible and intangible assets (intellectual property); under financial wealth — the totality of liquid assets, i.e. money, securities, deposits, mutual funds, etc. Financial wealth does not necessarily have a physical form, unlike non-financial wealth.[2] The given idea of the structure of wealth, divided into non-financial and financial parts, allows us to set the task of finding out the impact of these parts of wealth on economic development (in terms of GDP dynamics) together with social indicators.

Next, we designate the methodology of the analysis being carried out and present the general algorithm and the main stages of this study.

RESEARCH METHODOLOGY. IMPACT OF FINANCIAL WEALTH ON ECONOMIC DYNAMICS

Previous studies have shown that changes in the economic structure significantly affect the development of the financial system [32], which adapts to them. The strength of the relationship between financial development and growth has been found to depend for a number of countries on private lending relative to real production growth [33], and the causal relationship between financial development and growth is bidirectional depending on the length of the period [34]. On short and medium-time scales, for low- and middle-income countries, such links are not found, and for high-income countries, growth affects financial development. As you can see, many studies reflect a stronger impact of growth on financial development and not vice versa, and they do not take into account the structure of wealth in the form of its financial and non-financial parts that affect economic growth in different ways. Some studies have shown that such influence can be quite significant [2, 35]. But over time, it changes and depends on many conditions [36], in particular, on the level of economic development, insurance institutions, and the functioning of financial markets. For individual countries, the impact may differ even due to existing differences, including institutional ones, in the functioning of stock and bond markets within each country.

Thus, the task of identifying the degree of influence of financial wealth in the context of changes in other relevant macroeconomic parameters on the target function (GDP dynamics) seems to be significant from the point of view of growth management. Its solution is reduced to the implementation of the following sequential set of steps that make up the research search algorithm.

Firstly, it is necessary to quantify the wealth structure of the analyzed countries (comparable objects), highlighting two main components — financial and non-financial wealth, bringing to the base year for comparability of estimates.

Secondly, to conduct an empirical study of the relationship between inequality, poverty, GDP and GDP growth rates on the size of financial and non-financial wealth, respectively. This will allow us to present the joint dynamics in the considered time interval and compare it across the studied objects — countries, understanding and presenting the relationships that have developed between the parameters.

Thirdly, to formulate the task of econometric modeling on panel data for the G7 countries and China and separately for Russia, in order to conduct a comparative analysis, setting the following target functions: human development index, gross domestic product, share of gross product in national wealth, economic growth rates (in terms of GDP).

Here is a general scheme of econometric research based on panel data for the G7 countries

[1] When using panel data, this circumstance is hidden, and with a factorial-multiplicative model, there are not enough points to build a model with good statistical verification.

[2] The Global wealth report 2021. Research Institute Credit Suisse. 2021. URL: https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html (accessed on 01.08.2021).

and China. Let us introduce the following designations:

Y — GDP, billion US dollars, in 2010 prices;

y — the GDP growth rate, %;

Y/W — the share of GDP in national wealth, %;

X_1 — the human development index;[3]

X_2 — the Gini index, %;

X_3 — the poverty level, %[4];

X_4 — financial wealth, billion US dollars, in 2010 prices;

X_5 — non-financial wealth, billion US dollars, in 2010 prices;

X_6 — the share of financial wealth in the total wealth, %;

X_7 — the share of non-financial wealth in total wealth, %.

The construction of a regression on the original data with a different number of factors based on panel data was carried out in the Gretl 2020b program. Regression model for a group of countries:

$$F(X_1. Y, Y/W, y) = b_{0i} + b_{1i}*X_2 + \\ + b_{2i}*X_3 + b_{3i}*X_4 + b_{4i}*X_5 + b_{5i}*X_6 + b_{6i}*X_7 + \varepsilon. \quad (1)$$

The factor selection method builds possible models with 2–6 factors for each of the chosen explanatory variables (X_1, Y, Y/W, y).

To identify multicollinear factors, a matrix of paired correlations is constructed.

To test the heteroscedasticity of random errors in the regression model, the Durbin-Watson statistical test was used. The test results showed the homoscedasticity of the random error variances of the models presented below in the study of regressions.

The H_0 hypothesis about the absence of residual autocorrelation was carried out using the Durbin-Watson test by comparing the DW statistics with the theoretical values of d_1 and d_u. In the models presented below, the DW values are in the interval $d_u < DW < 4 - d_u$, which indicates the absence of autocorrelation.

According to the analysis, multicollinear factors with linear pair correlation coefficients of more than 0.7 are the following factors: $X_2 - X_3$; $X_1 - y$; $X_3 - X_4$; $X_3 - X_5$; $X_3 - Y$; $X_4 - X_7$; $X_4 - X_5$; $X_4 - Y$; $X_5 - Y$.

The best models were identified by the rejection method (according to the tightness of the connection of the series, while observing other statistical criteria for checking the model), without considering collinear factors. All the models obtained for the G7 countries and China are significant according to the Fisher criterion, the regression coefficients for all factors are significant with a high coefficient of determination for all models, except for the GDP growth rate, where the regression coefficients are not significant for all factors with a low coefficient of determination.

For the Russian economy, according to the analysis, the following factors are multicollinear factors with linear pair correlation coefficients of more than 0.7: $Y/W - X_2$; $Y/W - X_6$; $Y/W - X_7$; $X_1 - Y/W$; $X_1 - X_6$; $X_1 - X_7$; $X_2 - X_4$; $X_2 - X_5$; $X_2 - X_7$; $X_3 - Y$; $X_3 - X_4$; $X_3 - X_5$; $X_4 - Y$; $X_4 - X_5$; $X_5 - Y$; $X_6 - X_7$.

The application of the method of successive elimination of collinear factors made it possible to obtain the best regression models for Russia.

The models for Russia are significant according to the Fisher criterion, and the regression coefficients for the factors are also significant with a high coefficient of determination, with the exception of one coefficient for the X_3 actor in the model for the human development index. However, this circumstance does not greatly affect the picture of both the comparative analysis of countries and the actual analysis of the relationship between the relevant parameters, since the main subject is the assessment of the impact of the financial part of wealth on economic development.

The results of the econometric analysis are presented in a separate paragraph, where the best

[3] The Human Development Index (HDI, is a summary composite measure of a country's average achievements in three basic aspects of human development: health, knowledge and standard of living. United Nations. URL: http://hdr.undp.org/en/indicators/137506# (accessed on 01.08.2021).

[4] Measured by the headcount ratio at the national poverty threshold (% of population). Represents the percentage of the population living below the national poverty threshold. National estimates are based on population-weighted subgroup estimates from household surveys. For countries for which data are from EU-SILC, the reference year is the reporting year of income, i.e. the year preceding the year of the study. World bank. URL: https://data.worldbank.org/indicator/SI.POV.NAHC?view=chart (accessed on 01.08.2021).

versions of the models by goals are immediately given, in *Table 1* for the G7 countries and China and separately for Russia.

Fourth, using production functions,[5] the GDP dynamics of these countries (with the exception of Japan) are modeled by the value of financial wealth and the Gini index, which makes it possible to identify the sensitivity of the target to financial non-financial wealth and the level of income inequality in the country. The result obtained allows not only to compare the situation in different countries but also to establish the need for changes in macroeconomic policy, which boil down to a shift in the influence of the components of national wealth on economic growth.

Fifthly, a comparative analysis of the countries included in the study for the third and fourth steps of this algorithm is carried out, showing how different the impact of financial wealth and inequality on macroeconomic dynamics in the countries under consideration.

It should be noted that the models of this class used in the above algorithm (multiplicative, by the type of production function) do not reflect a complete causal relationship, they allow you to establish the presence of the force of influence of factors and the sensitivity of the objective function to the studied factors included in the model.

For the study, the base period of 2000–2019 was taken, for which it is possible to find and include in the analysis the necessary data on the considered macroeconomic parameters and to build the necessary models.

Let us move on to the implementation of the indicated steps of the research algorithm and the application of the econometric modeling technique based on the Gretl 2020b software module. First, we present an empirical analysis of changes in financial and non-financial wealth with the corresponding indicators of economic dynamics — GDP, GDP growth rates, inequality, and poverty levels.

DYNAMICS OF WEALTH ELEMENTS AND KEY MACROECONOMIC PARAMETERS

Let us analyze according to statistics, considering in pairs the change in the types of wealth (financial and non-financial) and the corresponding macroeconomic indicators. Non-financial wealth includes objects owned by business entities that bring them real or potential benefits: fixed assets (fixed capital), inventories, values, technologies, human capital, intellectual property, know-how and other results of intellectual activity. Financial wealth includes: monetary gold, special drawing rights, cash (currency), derivatives, deposits, securities, loans, insurance technical reserves, other accounts receivable and creditor. The available data on financial and non-financial wealth[6] make it possible to establish at least a twofold superiority of financial wealth over non-financial wealth (*Fig. 1, 2*). The USA is the absolute leader in financial wealth. In terms of non-financial wealth, since about 2012, China has caught up with the United States, while remaining behind in terms of financial wealth. Russia is inferior in terms of the value of each type of wealth to all the countries under consideration (if we consider wealth by source[7]).

It should be noted that only the US and China[8] how significant growth in these two types of wealth. This, among other things, determines their impact on the global economy and finance.

Figures 3 and *4* show a clear empirical relationship between the components of wealth

[5] This approach is the most acceptable, since it is widely used and convenient in solving the problem of estimating the sensitivity of the parameters included in the model. According to the principle of the presumption of the theory of J. Commons, the theory or model that explains a larger set of aspects with less means will be considered the most acceptable and adequate. In relation to the problem posed, a sufficient form of the model was chosen, which is not too complicated, but gives an answer to the question about the influence of factors.

[6] The Global wealth report 2021. Research Institute Credit Suisse. 2021. URL: https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html; Росстат. URL: https://www.gks.ru/bgd/free/B 99_10/IssWWW.exe/Stg/ d000/i000390r.htm (accessed on 01.08.2021).

[7] The Global wealth report 2021. Research Institute Credit Suisse. 2021. URL: https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html (accessed on 01.08.2021).

[8] The Global wealth report 2021. Research Institute Credit Suisse. 2021. URL: https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html (accessed on 01.08.2021).

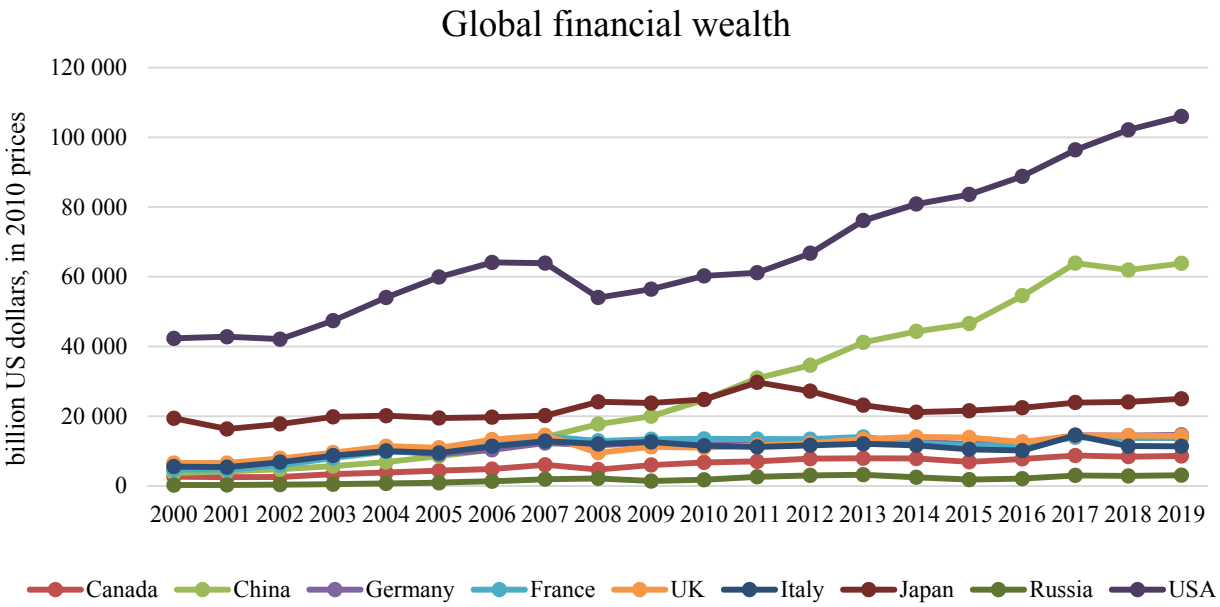

Fig. 1. **Financial wealth of the G7 countries, China and Russia**

Source: compiled by the authors. URL: https://www.investopedia.com/terms/f/financialasset.asp; https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html (accessed on 01.08.2021).

and countries' gross domestic product in 2010 prices.

Based on the presented data, it can be seen that a higher gross domestic product corresponds to a large amount of financial and non-financial wealth in the considered time interval 2000–2019. The United States and China are in the lead. For example, with the same financial wealth, China's GDP exceeds that of Japan, and Germany's GDP is equal to that of Italy and the UK (*Fig. 3*). Among these countries, Russia ranks lowest in terms of financial wealth and GDP. The same applies to the relationship between GDP and non-financial wealth (*Fig. 4*).

With the same value of non-financial wealth, Japan's GDP exceeds that of Germany, France, and Italy (*Fig. 4*).

It should be noted that the relationship between GDP and financial wealth is described for the countries under consideration by a convex curve relative to the abscissa axis, while GDP and non-financial wealth is described by a concave curve.

For each country, the structure of wealth matters — the ratio between financial and non-financial wealth and the sensitivity to them of the gross domestic product and other development parameters.

The *Appendix* shows pairwise empirical ratios of GDP growth rates, the Gini coefficient and the poverty level of countries with financial and non-financial wealth (*Fig. 1–6 of the Appendix*).

In general, we can say that there is no close relationship between the growth rate and the size of wealth, both financial and non-financial. For example, Russia with a low value of financial and non-financial wealth showed very high growth rates until 2008. The United States with a high value of financial and non-financial wealth demonstrates lower growth rates (*Fig. 1, 2 of the Appendix*). At the same time, for the group of countries under consideration, it can be noted that, on average, higher financial wealth does not correspond to significantly lower or higher growth rates (*Fig. 1 of the Appendix*). *Fig. 1 of the Appendix* clearly shows the size of financial wealth, up to which the growth rate in a number of countries increases with the growth of financial wealth, then decreases. Nevertheless, there is some relationship with the pace and is already visible at the level of empirical analysis. *Fig. 2 of the Appendix* also shows that more non-financial wealth corresponds on average to lower growth rates. This relationship is due to the influence of two countries — China and Russia, since if we remove the data for these countries in

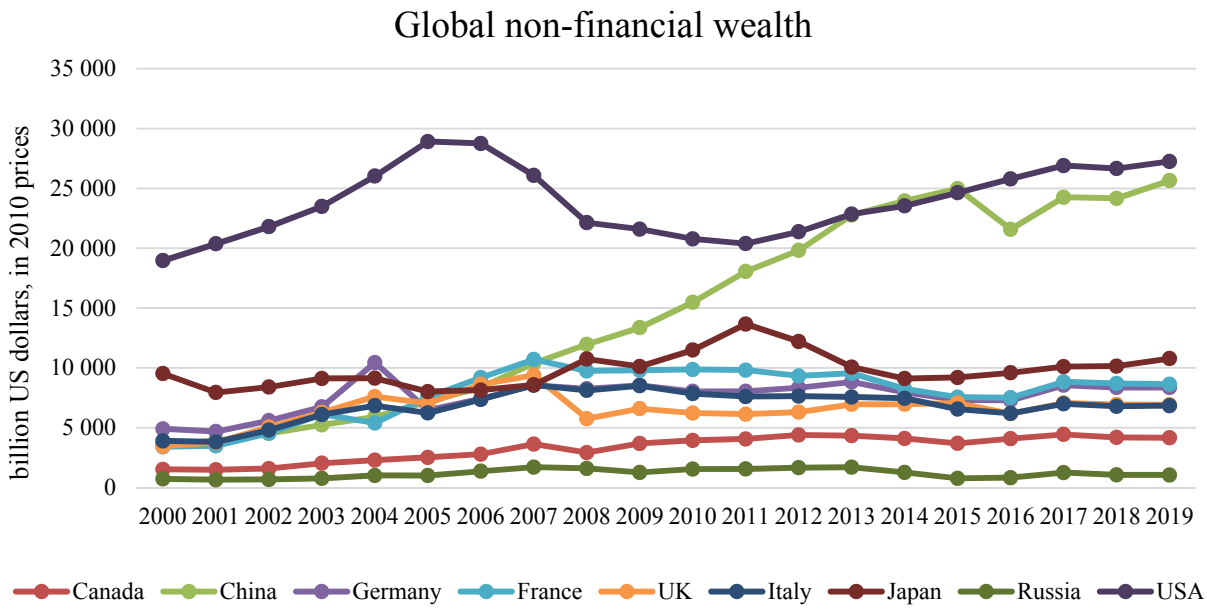

Fig. 2. **Non-financial wealth of the G7 countries, China and Russia**

Source: compiled by the authors. URL: https://www.investopedia.com/terms/f/financialasset.asp; https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html (accessed on 01.08.2021).

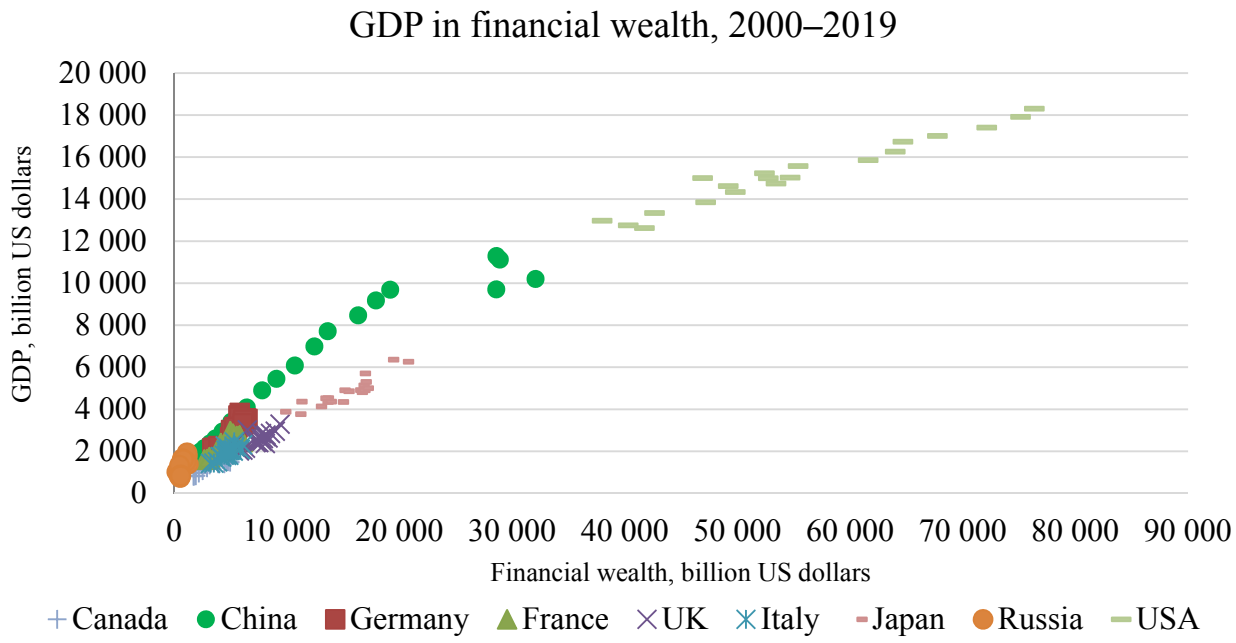

Fig. 3. **GDP and financial wealth of the G7 countries, China and Russia in 2010 prices**

Source: compiled by the authors based on World Bank's data. URL: https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?view=chart; https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html (accessed on 01.08.2021).

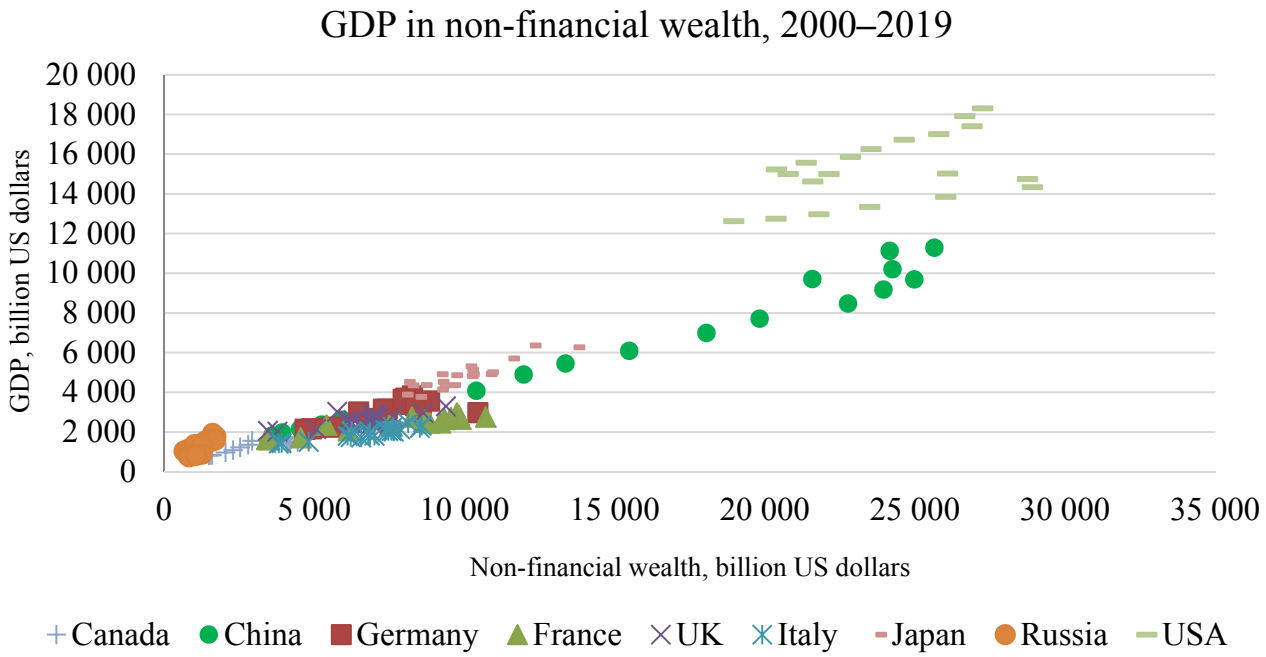

Fig. 4. **GDP and non-financial wealth of the G7 countries, China and Russia in 2010 prices**

Source: compiled by the authors based on World Bank's data. URL: https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?view=chart; https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html (accessed on 01.08.2021).

Fig. 1, 2 of the Appendix, there is no relationship in the scatter of points between the growth rate and the size of financial and non-financial wealth (the scatter of points along the ordinate — the growth rate is from 0 to 5%). It can be seen that with the same growth rates in different countries there is a different combination of financial and non-financial wealth. However, the influence of the Chinese economy on world development has become very significant, therefore, by including this country in the panel data of the econometric study, we will see in the next paragraph that a large share of financial wealth still has a positive effect on the growth rates of the group of countries under consideration. Although the share of non-financial wealth has a weak downward effect for the same group of countries, which is quite consistent with the empirical analysis (*Fig. 1, 2 of the Appendix*).

A study of the relationship between the level of inequality and financial and non-financial wealth (*Fig. 3, 4 of the Appendix*) shows that more financial as well as non-financial wealth corresponds to a higher level of inequality in the countries under consideration. Although in one country there may not be such a noticeable relationship. However, there are various types of wealth up to $ 10 trillion in which an increase in wealth does not show a clear relationship with an increase in inequality in the Gini coefficient. If we exclude Russia, China and the United States from consideration, then for the G7 group of countries there is a relationship that the inequality in the Gini coefficient increases with the growth of financial wealth, but with the growth of non-financial wealth, such a relationship is not confirmed by empirical points.

Considering that inequality and poverty are closely related (*Fig. 7 of the Appendix*), i.e. as inequality grows, poverty grows and vice versa (for a given group of countries), the relationship between the level of poverty and financial and non-financial wealth (*Fig. 5, 6 of the Appendix*) resembles the relationship between inequality and the same components of wealth. *Fig. 5, 6 of the Appendix*, reflecting the empirical values of the parameters, show that a higher value of both financial and non-financial wealth corresponds in the country comparison to a higher level of national poverty — China and the United States (*Fig. 5 of the Appendix*). In relation to non-financial wealth, such a relationship is not confirmed

Table 1

Regression models based on panel data from the G7 countries, China and Russia, 2000–2019

No.	Regression target	Models based on panel data from G7 countries and China	Models in Russia
1	Human development index	$X_1 = 1.36 - 0.01*X_2 - 0.009*y + 0.09*X_6 - 0.25*X_7$ (2)	$X_1 = 0.86 - 0.0007*X_3 - 0.08*X_6 - 0.002*y$ (6)
2	Gross domestic product	$Y = -6523 + 5781*X_1 + 0{,}61*X_7$ (3)	$Y = 4636 - 5823*X_1 + 0.99*X_5$ (7)
3	Gross Domestic Product in National Wealth	$Y/W = 0.38 - 0.36*X_1 - 0.004*X_3 + 0.31*X_6 + 0.24*X_7$ (4)	$Y/W = 42.5 - 28.4*X_1 - 0.33*X_2 - 0.14*X_3$ (8)
4	GDP growth rate	$y = 28.5 - 31*X_1 + 0.02*X_2 + 0.00002*X_6 - 0.000009*X_7$ (5)	$y = -1.93 + 7.2*X_1 + 1.4*X_2$ (9)

Source: compiled by the authors.

even by empirical points; rather, with the growth of non-financial wealth, there is some reduction in the level of poverty (*Fig. 6 of the Appendix*).

Thus, financial wealth at the present stage very strongly determines the economic development of the leading countries, slowing down growth rates, increasing inequality and poverty, or at least making it difficult to reduce them. At the same time, as a rule, it works to increase the gross domestic product. At least, such conclusions are visible in the analysis of specific empirical data and comparative analysis of countries.

In addition to comparative empirical analysis, it is useful to assess the impact of macroeconomic parameters on the goals of economic development, in particular, the human development index, GDP growth rate, GDP value, and its share in the country's wealth. Let us conduct an econometric study of the influence of a number of relevant factors, including financial and non-financial wealth, on development goals.

ECONOMETRIC ESTIMATES OF CHANGES IN MACROECONOMIC DYNAMICS

The target parameters of economic development were regression variables depending on a number of selected factors included in the basic econometric model (1). Further econometric analysis, which is reduced to the selection of the most reliable models by the rejection method, made it possible to obtain the best models based on panel data for the G7 countries and China [models (2)–(5)], separately for Russia [models (6)–(9)], summarized in *Table 1*.[9]

Analysis of the obtained models in *Table 1* makes it possible to single out qualitative assessments of the influence of relevant factors on the regression variable, the target parameter of macroeconomic dynamics. *Table 2* reflects the comparative estimates.

The conducted econometric modeling and analysis of its results make it possible to identify the most important differences in the relationship of macroeconomic parameters with a clarification of the impact of financial and non-financial wealth on economic development in these countries (a group of G7 countries with China and Russia separately).

Firstly, for the G7 countries and China, an increase in the share of financial wealth in its total value has a positive effect on the human development index, in contrast to Russia, where a similar change causes a deterioration in the human development index (see *Tables 1, 2*). At the same time, growth rates restrained the increase in this indicator both in this group of countries and in Russia. Non-financial wealth and inequality had a constraining effect on a group of countries, and the level of poverty on Russia.

[9] In this study, statistical hypotheses were tested that showed the acceptability of models selected by the rejection method. The calculations were carried out on the Gretl 2020b software module. To save space, statistics on models are not given in the article.

Table 2

Comparative assessment of the influence of factors (according to *Table 1*) on the target development parameters

No.	Target development parameter	Assessment for G7 countries and China	Assessment for Russia
1	Human development index	An increase in the share of financial wealth in its total value has a positive effect on the human development index. At the same time, inequality and high growth will slow it down	An increase in the share of financial wealth has a negative impact on the human development index. At the same time, poverty rates and growth rates slow down the growth of the human development index
2	Gross domestic product	Determined by the human development index and non-financial wealth in its total value	Determined by the value of non-financial wealth and limited by the human development index
3	Gross Domestic Product in National Wealth	Depends on the share of financial wealth, less than non-financial wealth. The decrease is facilitated by the level of poverty and the growth of the human development index (more rapid growth of the denominator — wealth rather than the product)	The level of poverty, inequality and the human development index in the studied interval acted in the direction of reducing this target parameter
4	GDP growth rate	Increasing inequality and the share of financial wealth has a positive impact. The slowdown is due to the growth of the human development index and non-financial wealth	Positive impact of the human development index and the level of inequality. The influence of financial wealth or wealth structure on the pace was not revealed

Source: compiled by the authors.

Secondly, in developed countries and China, the human development index is positively related to GDP; in Russia, this relationship is negative over the interval under consideration; the increase in the human development index was accompanied by the absence of significant GDP growth.

Thirdly, the share of GDP in wealth, as well as the growth rates of the group of countries under consideration, are positively related to the share of financial wealth in its value; for Russia, no such dependence was found. The poverty level reduces the target indicator in the form of the share of GDP in the value of wealth for all considered objects, and in Russia there is also a level of inequality. For the G7 countries and China, the human development index is negatively related to growth rates, in Russia the relationship is positive, the level of inequality also had a positive impact on growth rates. For the G7 countries and China, this influence is less pronounced.

Thus, the analysis allows us to conclude that financial wealth (its share in the total value) in developed countries has a positive effect on the human development index, the share of GDP in wealth, and growth rates. For the Russian economy, the impact on the human development index is negative, and other target parameters of dynamics are not revealed, with the exception of GDP, for which the value of financial wealth has a positive impact [formula (7), *Table 1*].

An important point and the next stage of the research algorithm is to assess the sensitivity of GDP to changes in financial wealth. It is useful to use the classical production functions to obtain it.

GDP SENSITIVITY TO FINANCIAL WEALTH AND INEQUALITY

Given the trends in increasing financial wealth [2], it seems natural to set the task of determining its impact on changes in the main macroeconomic indicator — the country's gross domestic product.

Let us take the following multiplicative function as the main model: $Y = A F^a G^b$, where Y — the GDP value, billion US dollars, in 2010 prices; F — financial wealth, billion US dollars, in 2010 prices, G — Gini index, %; A — the coefficient of the model; a, b — indicators that allow assessing the sensitivity of the goal to a factor sign — financial wealth and the level of inequality.

Tables 3 shows a model for the above countries (excluding Japan, since the scores in the Gini coefficient, as already noted, are not enough for such a model).

The results of *Table 3* confirm that financial wealth in the considered time interval has a more significant impact on the gross domestic product than the level of inequality in all developed countries except Russia. Moreover, in the Russian economy, with the same change in factors, the level of inequality had a much more significant impact on the value of GDP than financial wealth. Only in Canada, the impact of inequality on GDP was also stronger than in other G7 countries and China, however, high levels of inequality constrained GDP growth, which is reflected in the model presented in *Table 3*.

Thus, a further increase in inequality in Canada will act in the direction of lowering the value of the gross domestic product. This indicates a certain exhaustion of opportunities in the field of stratification of society by income in the period under study. Russia during this period showed GDP growth with rising inequality, high sensitivity to changes in inequality. In other countries, GDP was more sensitive to financial wealth than to inequality. At the same time, Italy and Germany showed the greatest sensitivity of GDP to financial wealth. This may well indicate the specifics of the creation of monetary and financial institutions of the European countries of the Rhine capitalism, as well as the subordination of the development of the financial sector and financial institutions to the tasks of development and wealth improvement. At the same time, the sensitivity of GDP to changes in inequality in Italy is higher than in Germany, and to financial wealth, which may mean that there are differences in the organization of methods for regulating the monetary sphere and financial institutions. The sensitivity of Russia's GDP, despite the most significant growth in financial investments [2], is 2 times lower than in the United States, and even lower than in European countries. This may mean that there is a significant difference between the development of the financial sector and the increase in financial wealth and the development of the economy. For a promising model of economic growth, such a gap is a very non-trivial problem, since the emerging and growing disproportion must be corrected to ensure competitive growth.

CONCLUSIONS

Summing up, we note that the impact of financial wealth on macroeconomic dynamics, represented by GDP, is not the same in different countries, which reflects the specifics of the interacting institutions of the financial system of each country, the genesis and evolution of financial markets. And these conditions require separate consideration and study for each object of the study. This position means that the transfer of financial policy prescriptions from one country to another or the implementation of any unification without additional justification for its expediency can be an absolutely useless waste of efforts in the field of financial and macroeconomic policy.

Firstly, the study showed that the Russian economy is significantly different in terms of the impact of financial wealth on economic development from the G7 countries and China. In particular, an increase in the share of financial wealth in the total acted to reduce the human development index. Sufficiently developed institutions of the financial sector abroad strongly determine the development of transactional types, which is largely due to the positive change in this indicator. The low share of financial wealth and low sensitivity

Table 3

Dependence of GDP on the amount of financial wealth and the level of inequality for the countries under consideration

Country	Model	Model statistics
UK	$Y = 3.2\ F^{0,78}\ G^{-0,06}$	$R^2 = 0.63$ $R^2_{adj} = 0.59$ F-test = 15 $DW = 1.59 \in [1.41; 2.39]$ White test: $\chi 2^{calcul.} = 5.27$ $\chi 2^{crit.} = 30.1$
Germany	$Y = 0.23\ F^{0.86}\ G^{0.62}$	$R^2 = 0.86$ $R^2_{adj} = 0.85$ F-test = 53 $DW = 2.15 \in [1.41; 2.39]$ White test: $\chi 2^{calcul.} = 2.21$ $\chi 2^{crit.} = 30.1$
Italy	$Y = 0.07\ F^{0.88}\ G^{0.79}$	$R^2 = 0.73$ $R^2_{adj} = 0.7$ F-test = 22 $DW = 1.59 \in [1.41; 2.39]$ White test: $\chi 2^{calcul.} = 1.49$ $\chi 2^{crit.} = 30.1$
Canada	$Y = 14153\ F^{0.72}\ G^{-2.4}$	$R^2 = 0.92$ $R^2_{adj} = 0.91$ F-test = 92 $DW = 2.31 \in [1.41; 2.39]$ White test: $\chi 2^{calcul.} = 0.88$ $\chi 2^{crit.} = 30.1$
China	$Y = 2.7\ F^{0.78}\ G^{0.12}$	$R^2 = 0.9$ $R^2_{adj} = 0.87$ F-test = 196 $DW = 1.72 \in [1.41; 2.39]$ White test: $\chi 2^{calcul.} = 1.23$ $\chi 2^{crit.} = 30.1$
Russia	$Y = 0.0003\ F^{0.24}\ G^{3.7}$	$R^2 = 0.73$ $R^2_{adj} = 0.7$ F-test = 23.4 $DW = 1.67 \in [1.41; 2.39]$ White test: $\chi 2^{calcul.} = 3.25$ $\chi 2^{crit.} = 30.1$
USA	$Y = 25\ F^{0.49}\ G^{0.28}$	$R^2 = 0.93$ $R^2_{adj} = 0.92$ F-test = 110 $DW = 1.39 \in [1.41; 2.39]$ White test: $\chi 2^{calcul.} = 1.28$ $\chi 2^{crit.} = 30.1$
France	$Y = 2.3\ F^{0.73}\ G^{0.24}$	$R^2 = 0.88$ $R^2_{adj} = 0.86$ F-test = 59 $DW = 2.41 \in [1.41; 2.39]$ White test: $\chi 2^{calcul.} = 2.18$ $\chi 2^{crit.} = 30.1$

Source: compiled by the authors.

to it also emphasize the weak influence on the development of the relevant types of activities in relation to the Russian economy.

Secondly, only China and Russia show a greater sensitivity of GDP to non-financial rather than financial wealth. Moreover, in Russia the determining factor of dynamics is the level of inequality. Other countries are more sensitive specifically to financial wealth, both in terms of the non-financial part of wealth and the level of inequality.

These circumstances are clearly not considered when developing macroeconomic policy measures, using monetary and financial instruments. In particular, the growth of financial wealth in developed countries has a positive effect on the main development goals — GDP, growth rates, human development index. Russia shows the opposite effect, or no significant association with financial wealth.

Consequently, the revealed relationship between policy goals and measures, including influencing factors, requires expanding approaches in the field of managing macroeconomic dynamics, creating institutions of monetary and macroprudential policy.

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APPENDIX

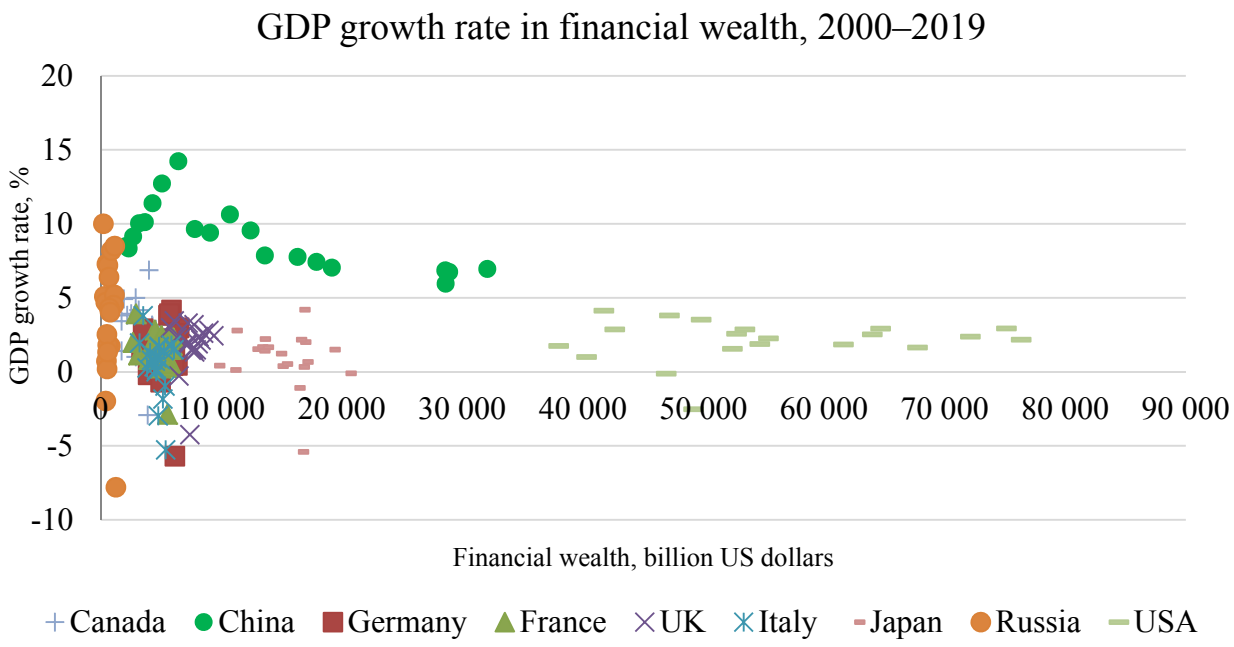

Fig. 1. **GDP growth rates and financial wealth of the G7 countries, China and Russia**

Source: compiled by the authors based on World Bank's data. URL: https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG?view=chart; https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html (accessed on 01.08.2021).

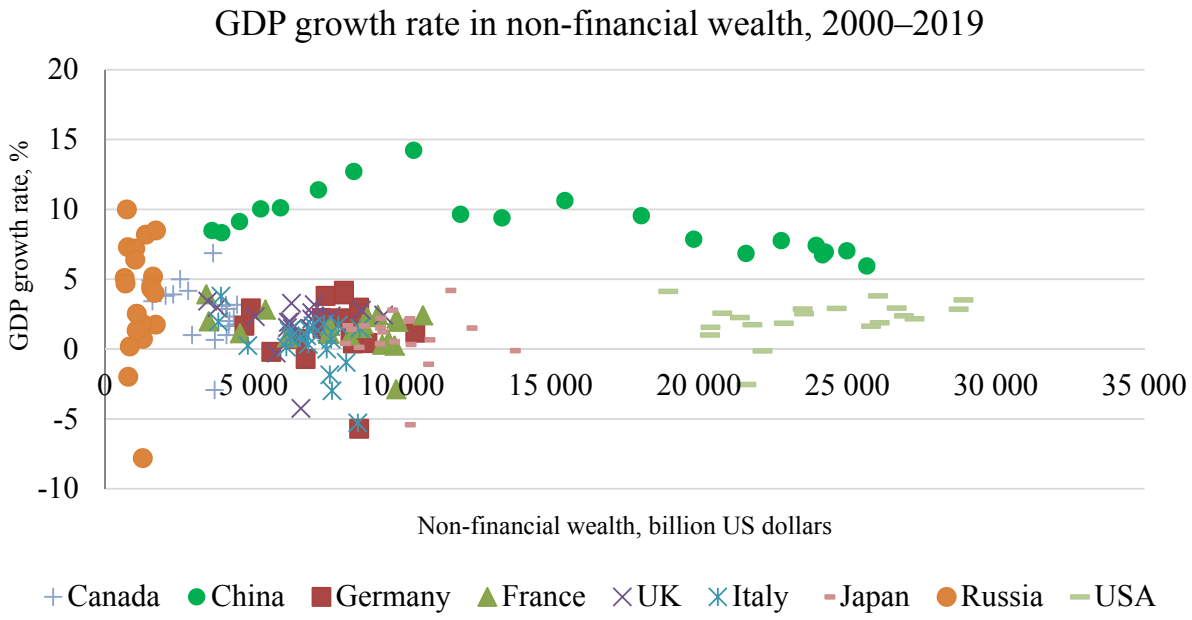

Fig. 2. **GDP growth rates and non-financial wealth of the G7 countries, China and Russia**

Source: compiled by the authors based on World Bank's data. URL: https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG?view=chart; https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html (accessed on 01.08.2021).

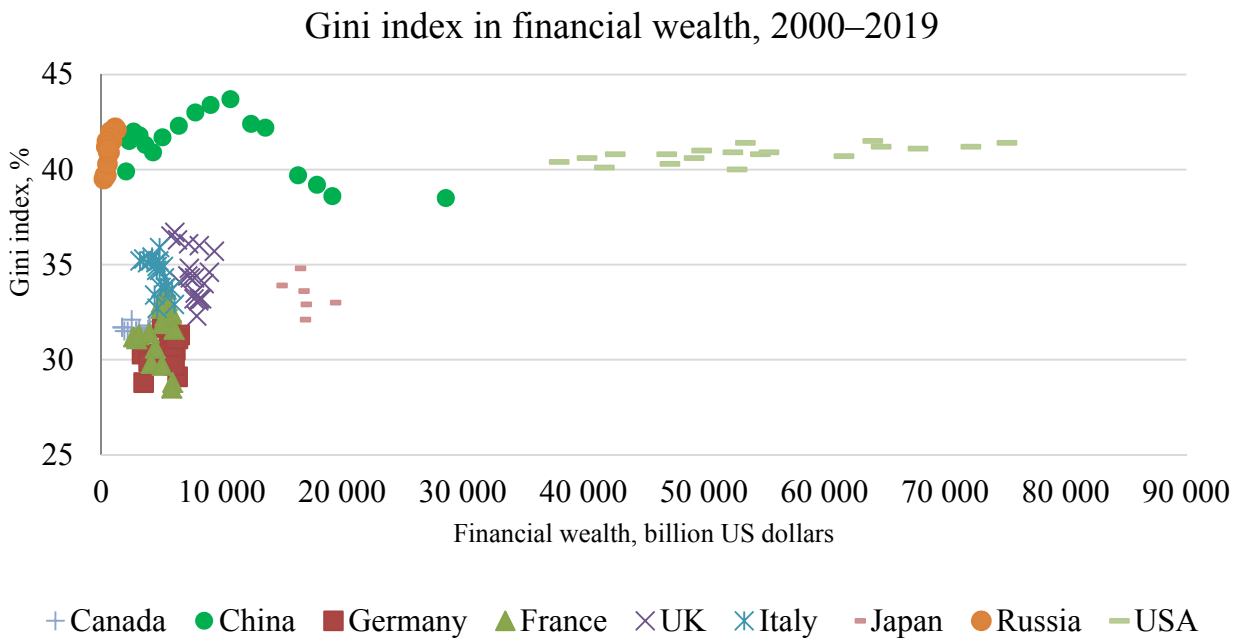

Fig. 3. **Gini index and financial wealth of the G7 countries, China and Russia**

Source: compiled by the authors based on World Bank's data. URL: https://data.worldbank.org/indicator/SI.POV.GINI?view=chart; https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html (accessed on 01.08.2021).

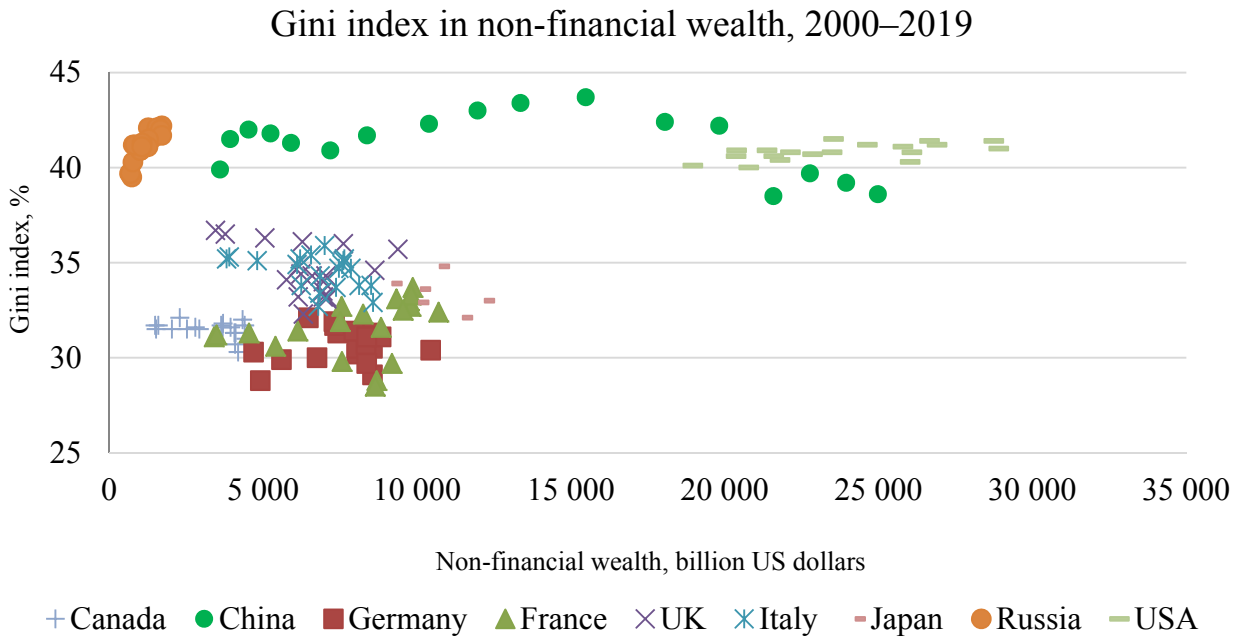

Fig. 4. **Gini index and non-financial wealth of the G7 countries, China and Russia**

Source: compiled by the authors based on World Bank's data. URL: https://data.worldbank.org/indicator/SI.POV.GINI?view=chart; https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html (accessed on 01.08.2021).

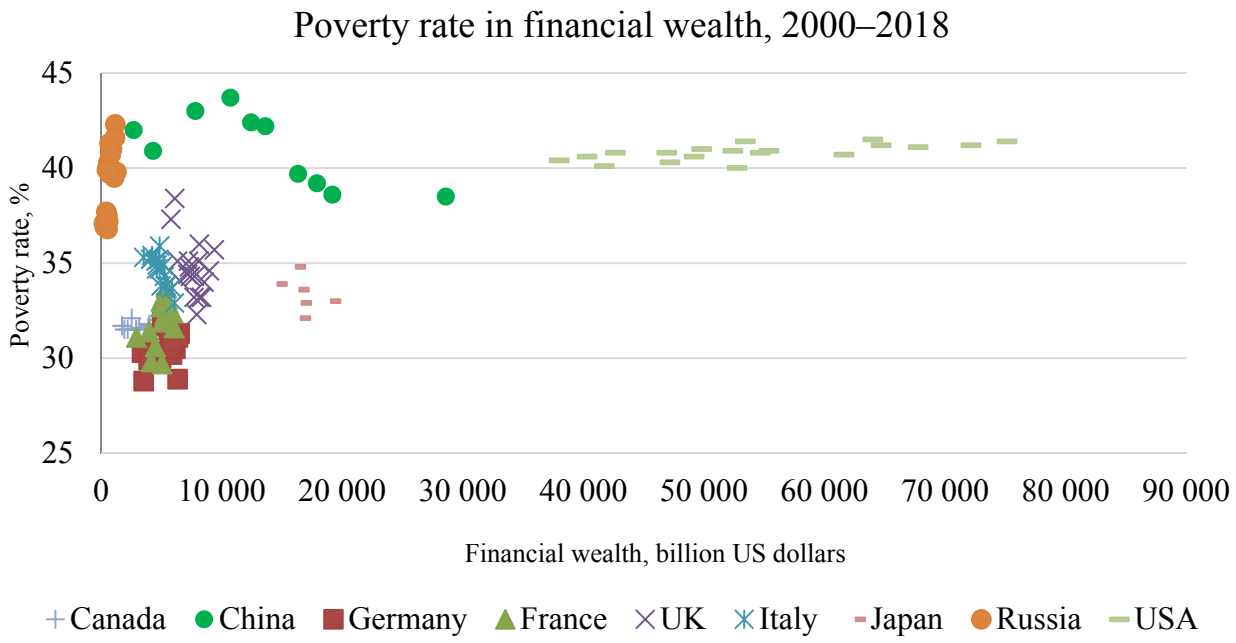

Fig. 5. **Poverty rate and financial wealth of the G7 countries, China and Russia**

Source: compiled by the authors based on World Bank's data. URL: https://data.worldbank.org/indicator/SI.POV.NAHC?view=chart; https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html (accessed on 01.08.2021).

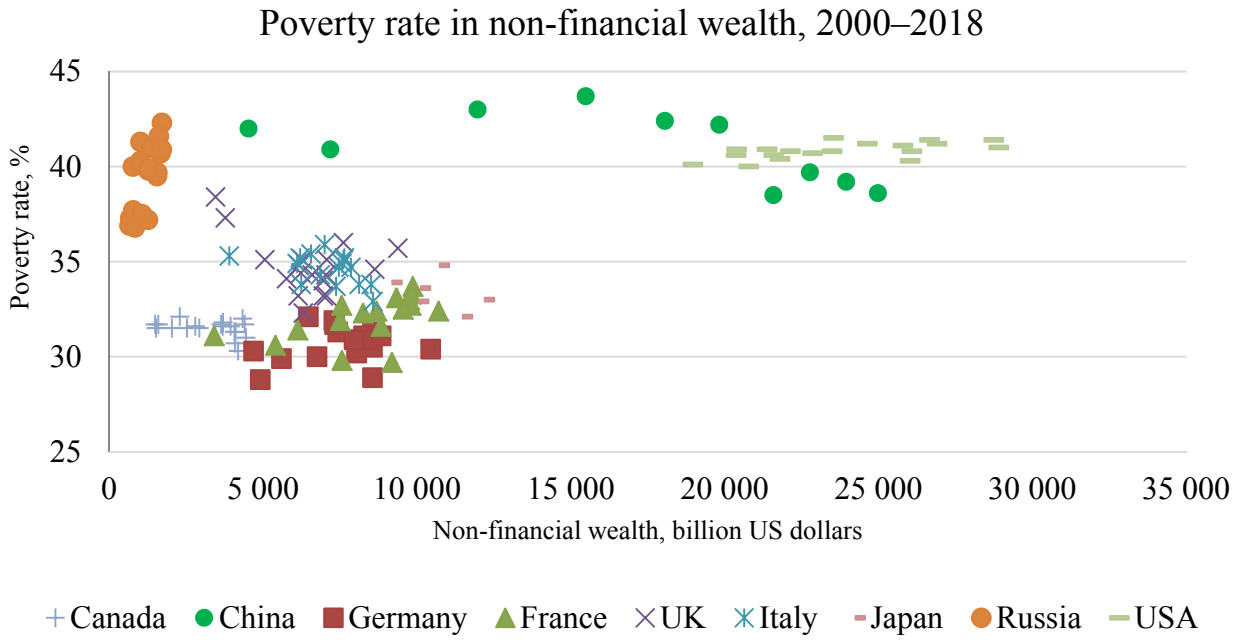

Fig. 6. **Poverty rate and non-financial wealth of the G7 countries, China and Russia**

Source: compiled by the authors based on World Bank's data. URL: https://data.worldbank.org/indicator/SI.POV.NAHC?view=chart; https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html (accessed on 01.08.2021).

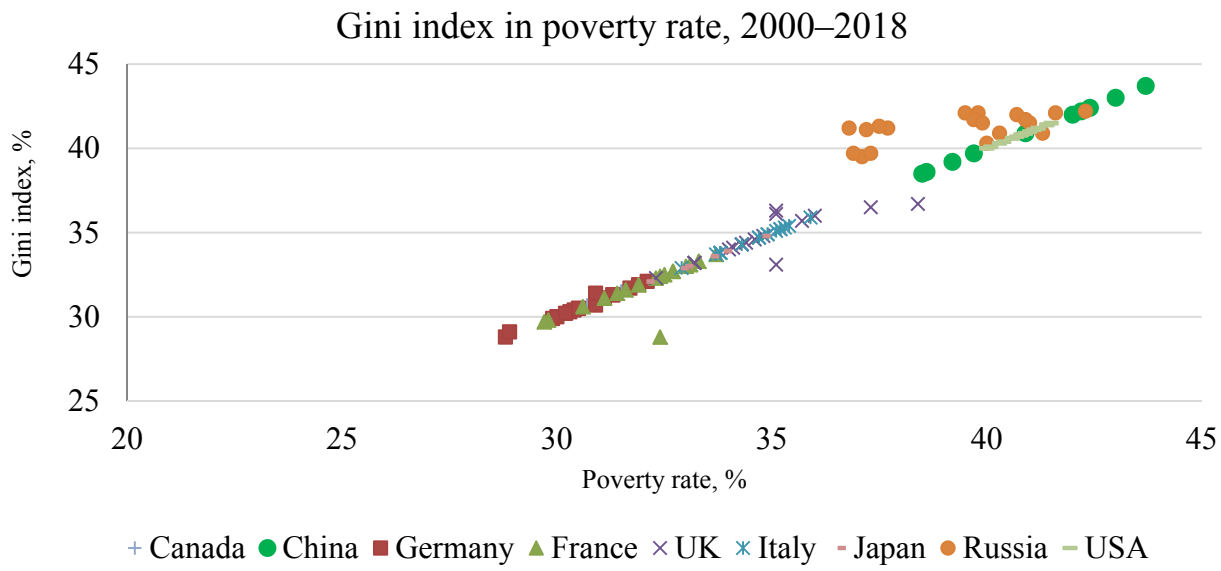

Fig. 7. **Poverty rate and Gini index for the G7 countries, China and Russia**

Source: compiled by the authors based on World Bank's data. URL: https://data.worldbank.org/indicator/SI.POV.GINI?view=chart (accessed on 23.03.2022).

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Efficiency of Inter-Budgetary Regulation of Heavily Subsidized Budgets at the Subnational Level

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ABSTRACT

The subject of this article is the set of economic and financial relations that develop in the process of inter-budgetary regulation and equalization of budgetary provision and balance of heavily subsidized budgets at the subnational level. **The purpose** of the study is to identify the degree of influence and effectiveness of the existing system of inter-budgetary regulation and fiscal decentralization in Russia in relation to heavily subsidized budgets at the subnational level in the context of their socio-economic, budgetary and financial condition and development. **The methodological** basis of the study is based on the Russian budgetary legislation, as well as domestic and foreign scientific studies devoted to the theory of fiscal decentralization (federalism), mechanisms for equalizing budgetary provision at the subnational level, approaches to assessing the degree of influence of fiscal decentralization on stimulating economic growth in regions and states. In the course of the study, the author applies a systematic approach, as well as general scientific and special methods: coefficient method, comparative, structural dynamic retrospective analysis. The analysis of the relationship and dispersion of the financial parameters of subnational budgets using the Pearson pair correlation coefficient, as well as the coefficients of variation and oscillation. The study reveals the problematic aspects of the effectiveness of the existing system of inter-budgetary regulation and the convergence of the socio-economic state of heavily subsidized regions in recent years. This result contradicts most budgetary practices and the theory of fiscal decentralization, which justifies the need for a qualitative change in the existing system of inter-budgetary regulation. **The main conclusion** of the study is that the existing mechanism of inter-budgetary regulation and the existing instruments for equalizing budgetary provision do not contribute to a significant change in the fiscal and socio-economic parameters of the development of heavily subsidized budgets at the subnational level. The nature of the use of the gratuitous aid received for this category of subjects of the country is reduced to short-term coverage of the gap in financing expenditure obligations but does not change the model of either the organization of budget regulation or the regional economy. Soft budget constraints create weak incentives and lead to financial and economic problems — increased dependency and subsidies.

Keywords: inter-budgetary relations; budget subsidies; subnational level; budgetary provision; budget revenues; inter-budgetary transfers

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INTRODUCTION

Regional socio-economic systems exist within a complex set of institutional mechanisms with political, legal, constitutional and economic aspects that ensure the achievement of the well-being of the population and economic growth. One of the most important aspects is fiscal policy as a result of the choice of individual economic and financial instruments, political decisions and adopted laws and regulations. The combination of methods of budgetary and tax regulation makes it possible to form a complex mechanism for organizing inter-budgetary relations within the framework of the emerging budgetary structure, which depends on the form of the state and political structure (unitary or federal state). The importance of the mechanism of inter-budgetary regulation that has developed within the framework of the national economy in ensuring the balance of the budgetary system is of paramount importance. For countries with diverse and large geography, and different climate and environmental conditions, the key factor in achieving economic growth of territorial entities is inter-budget equalization, since it is designed to level out vertical and horizontal disproportions in subnational and local budgets resulting from economic unevenness and regional polarization.

This issue is particularly acute in relation to fiscal regulation of the category of recipient regions with a depressed socio-economic and budgetary-financial state and development. Outsider regions are characterized by long-term, chronic budgetary insecurity and imbalance, which mediates the need to systematically attract inter-budgetary transfers and grants to maintain the established level of public service delivery.

In Russia, in the last two decades, a group of regional budgets has been formed that have a high subsidized dependence on the federal level of the budget system. These subnational budgets (in recent years, 6 constituent entities of the Russian Federation) experienced problems with budgetary security and sustainability for a long time, which required significant infusions of gratuitous assistance to ensure the balance of both the budgets themselves and the entire budget system of the country [1]. In this regard, the question arises: how effective is the mechanism of inter-budgetary equalization in relation to highly subsidized subnational budgets, if this category of regions retains its depressive character and the recipient budget model? The aim of this study is to identify the criteria for the effectiveness of the current mechanism of inter-budgetary regulation to equalize the budgetary security of highly subsidized subnational budgets with the determination of the feasibility of qualitative changes in the socio-economic and budgetary state and development of these regions.

THE THEORY OF BUDGET DECENTRALIZATION AS A BASIS FOR THE DEVELOPMENT OF THE SYSTEM OF INTERBUDGET REGULATION

In the scientific literature, particularly foreign, studies of the essence, models and effectiveness of the organization of inter-budgetary relations are reduced to the concept of "fiscal decentralization" — the transfer of certain expenditure and/or revenue responsibilities to lower levels of government.[1]

Federalism and decentralization in general cover a wide range of different political and economic systems, the political and economic properties of which vary greatly [2, 3]. J. Litvack and co-authors note [4] that fiscal decentralization in itself cannot be characterized as effective or ineffective in the system of fiscal policy, which allows achieving economic justice or macroeconomic stability. The establishment of these parameters and their operation is determined by the specific structure and model of budgetary federalism that is taking shape in certain countries. Therefore, it is impossible to talk about the tendencies of federalism as such without reference to certain budgetary practices that

[1] Intergovernmental Fiscal Relations. The World Bank Group. URL: http://www1.worldbank.org/publicsector/decentralization/fiscal.htm (accessed on 20.08.2021).

have developed in a particular country. Some federal systems contribute to macroeconomic stability and economic growth of the regions, while others, on the contrary, using the exhaustive potential of fiscal regulation instruments, cannot ensure the achievement of high socio-economic indicators for the development of individual administrative-territorial units.

The fiscal stimulus approach has important implications for the distribution of inter-governmental transfers within federal systems. At the same time, it should be noted that the theory of fiscal decentralization has been developing for more than 60 years, its categories, approaches, models and specifics have changed. As a result, two generations of fiscal decentralization have been identified, the differences between which are very conditional. Fiscal decentralization of the first generation, formulated by R.A. Musgrave, P.B. Musgrave and D.L. Rubinfeld, focuses on the belief that federal, subnational and local authorities, when making decisions on the delimitation of revenue powers and expenditure obligations between the levels of the budget system and their use, are guided by the principles of increasing public welfare [5, 6].

The rationale for first-generation fiscal decentralization for inter-governmental activity highlights vertical and horizontal tax imbalances, side effects from incentives, and the avoidance of costly tax competition [6, 7]. Vertical imbalance occurs when the center collects taxes at a lower economic cost than local governments; it also occurs when the central government crowds out the subnational government's revenue sources. The efficiency thesis suggests that the center collects more taxes and then passes the funds to local governments to finance part of its spending. Horizontal disparities arise because regional economies differ in income and therefore in their ability to provide citizens with public goods and services. Here, too, transfers from the center can alleviate this imbalance by providing more funds to poor areas.

Second-generation fiscal decentralization models emphasize the importance of revenue generation by subnational governments [8–10], which have a significant portion of their own revenues, tend to be more accountable to citizens in providing public goods that promote market development and are less corrupt. However, as noted by J.W. Hatfield [11], W.E. Oates [12], G. Garzarelli et al. [13], the disadvantage of the theory of fiscal decentralization of the first generation is that in practice the authorities, when making budgetary and tax decisions, are guided by other motives than the intention to maximize the welfare of society locally. As a result, the efficiency of using the instruments of fiscal federalism is reduced.

Regional governments without independent sources of income can never truly enjoy financial autonomy; they may be, and probably are, under the control of the central government. Similarly, R.W. Bahl and J.F. Linn in their study of local fiscal federalism in developing countries, note that grants and transfers can reduce the responsibility of local governments for their financial decisions (they can now increase spending without increasing taxes); therefore, there will be less incentive to improve the performance of local governments and develop innovative methods for delivering public services [14].

Despite these observations, analysis of inter-governmental transfers tends to focus on equity rather than on the incentive effect of transfers on policy making.

N. Singh and T.N. Srinivasan [15] also suggest that the efficiency of tax distribution in the tax system in the standard sense of the social economy is of secondary importance compared to fiscal autonomy on the revenue side.

The logic of second-generation fiscal decentralization provides two interrelated reasons for these findings. Firstly, transfers that are negatively or slightly positively associated with subnational income growth provide local governments with weak financial incentives to stimulate local economic growth. Secondly, such systems of inter-governmental

transfers contribute to the growth of corruption.

The attempt to correct vertical and horizontal imbalances in developing countries often means that these transfer systems do not respond well to local conditions that promote local economic growth. This type of system of inter-governmental transfers provides subnational jurisdictions with weak financial incentives to stimulate local economic growth: most of the increase in local income goes to the center [15].

The model of fiscal federalism of the first generation suggests the need to reduce the tax burden on the economy and limit tax competition; while the second-generation fiscal stimulus approach promotes the organization of the system of inter-governmental transfers in such a way as to encourage subnational governments to ensure the growth of the local economy. The discussion above shows that many transfer systems achieve equalization through subnational government incentives to promote economic prosperity.

The fundamental question of public economics is how to allocate spending and taxing powers between the central government and the lower government. One of the most famous approaches, originally proposed by W.E. Oates [12], states that federal structures balance the various inefficiencies of central and local provision of public goods. With central provision, there is an inefficient homogeneity of public goods across locations, while the cross-border distribution of public goods creates an inefficiency in decentralized provision.

THE ROLE OF BUDGET DECENTRALIZATION IN ENSURING THE ECONOMIC GROWTH OF REGIONAL SOCIO-ECONOMIC SYSTEMS

There is extensive literature spanning decades, both theoretical and empirical, on the impact of fiscal decentralization on growth and other economic performance. Without explicitly addressing the issue of growth, the traditional "first generation" literature emphasized the efficiency gains associated with it and the potential role of fiscal decentralization in boosting growth [16]. On the other hand, the "second generation" theory of fiscal decentralization emphasizes the role of government officials as selfish agents, so the results of decentralization may not always be growth-enhancing [17].

The literature directly addressing the relationship between fiscal decentralization and economic growth has been largely empirical, and results have varied widely in direction and size. Much of the research has been based on cross-country comparisons and correlations, especially in developed countries, due to the higher quality of data available [18, 19].

At an early stage, J. Martinez-Vazquez and R. McNab concluded that there was no empirical consensus on the impact of fiscal decentralization on economic growth [20], and this conclusion was recently confirmed by T. Baskaran, L.P. Feld, J. Schnellenbach [21].

A fair conclusion should be drawn from this work: the question of the causal effect of fiscal decentralization on economic growth remains open. Apart from many instances of conflicting findings, much of the previous empirical work on this subject has a potential endogeneity issue due to reverse causation and the omitted bias variable [22].

The issue of the causal impact of fiscal decentralization on economic growth has been one of the most studied in the literature on fiscal federalism.

Fiscal decentralization may also exacerbate regional disparities as jurisdictions with certain geographic or socio-demographic challenges fall further behind. These problems can be mitigated to some extent by equalization transfers between governments to compensate for external imbalances.

FISCAL DECENTRALIZATION IN RUSSIA

Theoretical work on the drivers of fiscal decentralization suggests that countries or regions will be more decentralized if their populations are more diverse in various ways if the relevant public goods can be efficiently

provided at lower levels of government, and if lower levels of government have access to adequate sources of income [23]. However, it is important to state that these theoretical considerations depend to some extent on the political system of the country, in particular on the degree of government accountability to citizens at all levels. Thus, L. Freinkman and A. Plekhanov empirically established a high degree of correlation between fiscal decentralization and population in the regions of Russia that have a high share of income from inter-budgetary transfers or income from natural resources rent. In addition, an inversely proportional relationship between urbanization and fiscal decentralization has been revealed [24]. However, if we consider the later literature on the inter-dependence of fiscal decentralization and indicators of the state of Russian regions, then the works of M. Alekseev and A. Mamedov show that, unlike the United States, almost no regional characteristics have a permanent influence on the degree of intra-regional fiscal decentralization in Russia. According to the authors, this conclusion is mainly due to the weakening of democratic institutions in the regions of Russia and the strengthening of the political and economic centralization of the country as a whole [23].

The decrease in local decentralization in the budget system of Russia may be a consequence of the weak activity of local governments in the exercise of their powers, the growth potential of which has been exhausted [25]. On the other hand, there is a constant link between local fiscal decentralization and fixed capital investment, as well as aggregate value added.

For the Russian budgetary system, the key role of inter-budgetary transfers in stimulating regional development remains, but has become less effective. E. N. Timushev, having studied the impact of the public debt of the regions of Russia on the ongoing fiscal policy, believes that for the period 2008–2018 the stimulating function of inter-budgetary transfers has decreased, especially in such forms of gratuitous assistance as grants and subsidies [26].

Research by V. A. Fedosov indicates the growth of fiscal centralization in Russia. Although the decrease in income decentralization can be traced in most countries of the Organization for Economic Cooperation and Development (hereinafter referred to as the OECD), data from Russia indicate: firstly, lower values of fiscal decentralization; secondly, the higher rates of decline in this indicator over the past 10 years [27].

One of the key problems of the Russian model of budgetary federalism is the discrepancy between revenue sources and expenditure commitments, which are also delegated to lower levels of the federal government. A similar gap can be seen between excessive spending and insufficient revenue decentralization of the budget, which, when implemented, is negatively and significantly associated with regional economic growth [28, 29].

Despite the ambiguity of empirical studies of the impact of fiscal federalism on economic growth (the difference in the results is caused by the lack of a unified methodology and polar variables), the thesis about the positive impact of inter-budgetary transfers on stimulating the economic growth of regions and local provinces is largely determined by the mechanism of inter-budgetary regulation that has developed within any federal systems. The lack of a unified approach to regulating inter-budgetary relations allows different interpretations of the results of fiscal decentralization in developed and developing countries.

A. G. Isaev empirically reflected the negative relationship between the dynamics of inter-budgetary transfers and regional economic growth, which, according to the author, is due to the high share of social spending in certain regions of the country and the low share of capital spending, which positively correlates with economic growth in terms of GRP per capita [30].

Both politically and financially, Russia is one of the most centralized federal countries

in the world. The Federal Tax Service collects all taxes, and then the revenues are directed to the budgets of the corresponding level of government. Although there are federal, state, and municipal taxes by law, federal law places limits on the ability of lower levels of government to change the base and rate of "their" taxes. Moreover, almost all revenues from two important federal taxes (income tax and personal income tax) go to regional and municipal budgets in accordance with federal law. In addition, regional governments can transfer certain regional tax revenues to municipalities.

Considering the scientific literature review on the organization of inter-budgetary regulation and the impact of fiscal decentralization on the regional economic development of foreign countries and Russia, it should be noted that the impact of equalization transfers on certain categories of budgets has not been sufficiently studied by the subjects of the country, namely: regional budgets with a high subsidized dependence on the federal level of the budget system. The theory of fiscal decentralization boils down to the fact that the division of revenue sources and expenditure obligations by levels of government contributes to an increase in budget efficiency, the principle of justice, and an increase in the financial independence of each level of the budget system. The result of such vertical and horizontal alignment should be the stimulation of the economic and social development of this group of regions. In this regard, according to the author, an adequate assessment of the effectiveness of the existing system of organizing inter-budgetary relations in Russia is to study how fiscal decentralization affects the state and the dynamics of the development of a separate category of outsider regions. If this group of subjects of the country is not characterized by an improvement in the indicators of the socio-economic and fiscal aspects, then the current system of inter-budgetary regulation does not comply with the principles of fiscal decentralization and its potential is not used enough.

MATERIALS AND METHODS

The study includes several stages of analysis and evaluation of the effectiveness of inter-budgetary regulation and fiscal decentralization in relation to highly subsidized budgets of the constituent entities of the Russian Federation.

1. The dynamics of the number of budgets of the subject of the country (time horizon 2005–2020) is considered, the share of which in the volume of subsidies in the revenue part of the consolidated budget of the subject exceeds the 40% norm for the last 2 years in a row. To determine the subsidization of regional budgets, the formula of the corresponding coefficient (1) was used:

$$C_{si} = \frac{S_i}{OIB_i} * 100\%, \quad (1)$$

where C_{si} — the coefficient of subsidization of the corresponding budget of the subject of the country; S_i — the total amount of subsidies provided for the year to the budget of the subject of the country; OIB_i — the volume of own income in the interpretation of the budget code of the Russian Federation (tax, non-tax revenues and gratuitous receipts, with the exception of subventions).

2. A comparative dynamic and structural analysis of inter-budgetary transfers for the period 2005–2020, provided to the budgets of the constituent entities of Russia and the category of highly subsidized budgets of the country, was carried out.

3. The degree of connection between the volumes of inter-budgetary transfers and macroeconomic and budgetary indicators of the Russian Federation was revealed according to the formula (2):

$$r = \frac{\sum_{i=1}^{n}\left(x-\breve{x}\right)\left(y-\breve{y}\right)}{\sqrt{\sum_{i=1}^{n}\left(x-\breve{x}\right)^2\left(y-\breve{y}\right)^2}}, \quad (2)$$

where r — the correlation coefficient; x — a factor sign; y — the resulting variable.

3. The parameters of the socio-economic state and development of highly subsidized

regions of Russia and their dynamics were determined in comparison with 2005 in terms of per capita GRP and its structure, as well as the standard of living of the population and other 20 indicators reflecting the social and economic state of the regions.

4. The degree of homogeneity of highly subsidized regions in terms of the level of socio-economic development in dynamics over 16 years was revealed using the coefficients of variation and oscillation according to the following formulas:

$$\upsilon = \frac{\sigma}{\kappa} * 100\%, \quad (3)$$

where σ — standard deviation, calculated by the formula:

$$\sigma = \sqrt{\frac{\sum x^2}{n} - \frac{(\sum x)^2}{n^2}};$$

κ — the arithmetic mean value.

$$V_R = \frac{R}{\kappa} * 100\%, \quad (4)$$

where R — the range of variation calculated by the formula:

$$R = X_{\max} - X_{\min}$$

5. An assessment was made of the fiscal parameters of the development of highly subsidized budgets of the constituent entities of Russia in terms of per capita budgeting and financing, and the balance of budgets according to the following formulas:

$$CI_i = \frac{CBI_i / P_i}{CBI_r / P_r} * 100\%, \quad (5)$$

where CI_i — the ratio of the sum of incomes of the consolidated budget of a constituent entity of the Russian Federation per capita to the country's incomes.

$$IBT_i = \frac{IT_i / P_i}{IT_r / IT_r} * 100\%, \quad (6)$$

where IBT_i — the ratio of the volume of inter-budgetary transfers of the consolidated budget of the subject of the Russian Federation per capita to the volume in the country.

$$TTI_i = \frac{TNTR_i / P_i}{TNTR_r / P_r} * 100\%, \quad (7)$$

where TTI_i — the ratio of tax and non-tax revenues of the consolidated budget of a constituent entity of the Russian Federation per capita to the country's revenues.

$$S_i = \frac{CBI_i / P_i}{CBI_r / P_r} * 100\%, \quad (8)$$

where S_i — the ratio of subsidies from the consolidated budget of the subject of the Russian Federation per capita to the country's subsidies.

The information base for statistical analysis was the data of the Federal Treasury of the Russian Federation (reports on the execution of the consolidated budgets of the constituent entities of the Russian Federation by years), the Federal State Statistics Service (official statistics, Statistical Compilation "Regions of Russia" by years), the Organization for Economic Cooperation and Development (databases of the fiscal decentralization of OECD countries) for the period 2005–2020.

RESEARCH RESULTS

Subnational budget subsidies, as one of the key problems of ensuring the stability and balance of the budget system, have become particularly relevant in recent years, which is reflected in the adoption of a number of legislative and regulatory acts prescribing one of the goals of social and economic development of regions, federal districts and territories — reducing the level of subsidies.[2] However, in the budget legislation

[2] Decree of the President of the Russian Federation dated January 16, 2017 No. 13 "On approval of the fundamentals of the state policy of regional development of the Russian Federation for the period up to 2025". SPS ConsultantPlus. Resolution of the Government of the Russian Federation No. 1485-r of September 6, 2010 (as amended on October 28, 2014) "On approval of the strategy for the socio-economic development of the North Caucasus federal district until 2025". SPS ConsultantPlus. Resolution of the Government of the Russian Federation of December 28, 2009 No. 2094-r "On approval of the strategy for the socio-economic development of the Far East and the Baikal region for the period up to 2025". SPS ConsultantPlus.

Table 1

Number of heavily subsidized regional budgets of Russia for the period 2005–2020

Region	The share of subsidies in own revenues of the consolidated budget of the region, %																Average
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Altai Region	42	37	30	28	31	27	24	22	23	21	20	20	24	29	24	25	27
Sevastopol										55	37	35	26	31	23	19	32
Jewish Autonomous Region	43	37	33	26	29	26	29	25	23	26	29	27	23	23	27	31	29
Kabardino-Balkarian Republic	45	42	36	32	36	33	26	27	35	35	30	28	37	38	37	32	34
Kamchatka Krai	49	42	43	38	45	53	56	58	57	58	55	55	52	49	42	43	50
Karachay-Cherkess Republic	44	50	43	40	43	34	33	39	35	39	32	35	36	38	36	35	38
Magadan Region	35	32	33	40	45	43	35	32	32	32	23	19	18	19	16	11	29
Republic of Adygea	45	49	42	34	38	34	29	25	28	27	26	22	20	21	18	18	30
Altai Republic	53	53	51	52	49	51	43	48	50	44	52	55	58	54	47	40	50
Republic of Buryatia	37	33	34	32	39	35	28	29	29	33	31	29	34	35	29	31	32
Republic of Dagestan	63	60	57	47	51	52	47	48	55	56	55	53	56	56	55	48	54
Republic of Ingushetia	58	65	61	50	65	53	50	43	45	43	43	43	50	50	58	43	51
Republic of Crimea										58	45	33	24	25	23	23	33
Mari El Republic	42	35	32	31	28	24	26	24	28	26	22	21	21	25	22	22	27
Republic of North Ossetia — Alania	40	35	35	34	36	33	34	36	39	39	38	39	32	31	28	27	35
Tyva Republic	71	68	64	62	65	64	62	49	60	60	65	60	63	65	58	47	61
Chechen Republic	58	54	74	33	49	50	58	55	70	70	61	64	61	65	57	47	58
Chukotka	14	61	68	51	41	20	25	18	14	42	35	38	36	28	22	24	34
The Russian Federation	10	8	7	7	10	9	8	7	8	9	7	7	7	9	7	9	8

Source: author's calculations according to the Federal Treasury of the Russian Federation, reports on the performance of consolidated budgets of the constituent entities of Russia by year. URL: https://roskazna.gov.ru/ispolnenie-byudzhetov/konsolidirovannye-byudzhety-subektov/ (accessed on 20.08.2021).

Table 2

Changes in subnational budgets of Russia by type of subsidies from 2010 to 2020

Type of regional budget	Level of subsidy, %	Quantity	
		2010	2020
Self-sufficient	0	6	4
Low-subsidized	1–10	44	26
Moderately subsidized	10–25	19	41
Averagely subsidized	25–40	10	8
Highly subsidized	> 40	6	6

Source: author's calculations according to the Federal Treasury of the Russian Federation, reports on the performance of consolidated budgets of the constituent entities of Russia by year. URL: https://roskazna.gov.ru/ispolnenie-byudzhetov/konsolidirovannye-byudzhety-subektov/ (accessed on 20.08.2021).

of Russia, there is still no interpretation of this phenomenon, although there are a number of scientific papers offering various interpretations of budget subsidies. One of the author's works is devoted to identifying and developing a definition of "budget subsidies are a long-term form of the unstable financial condition of the territorial budget, which manifests itself in depressed regions that are chronically unable to fulfill current spending obligations established by law, intra-regional sources of income, which leads to low financial independence and significant dependence on gratuitous budgetary assistance in the form of subsidies" [1]. The above concept is proposed for use in this study.

Using the formula (1), let us consider the quantitative dynamics of highly subsidized budgets of the constituent entities of the Russian Federation (highlighted in gray) for the period 2005–2020 in *Table 1*.

From 2005 to 2020, the number of highly subsidized regional budgets in Russia has halved to six entities: the Kamchatka Krai, the Altai Republic, the Republic of Dagestan, and the Republic of Ingushetia, the Tyva Republic and the Chechen Republic. According to the presented data, we can talk about a decrease in the problem of subsidization in the budget system of Russia, since the number of budgets of the country's subjects with a high level of subsidization has decreased. However, while individual regional budgets have reduced the level of their subsidization, a consistently high value was assigned to six subjects that continue to experience significant problems with budgetary security. At the same time, the average subsidization of these regions over 16 years ranges from 61% (Tyva Republic) to 50% (Kamchatsky Krai and the Altai Republic). These regions are located in different geographic and climate conditions, so it is rather problematic to determine the criteria that unite them and similar features that have become factors of a low level of fiscal development [31].

A feature of the six subjects presented is the unstable dynamics of subsidies. If in most regions there is a systematic linear decrease in subsidized dependence, then this category of budgets has a spasmodic character and instability in its dynamics. This is another confirmation of their high budget instability. On the other hand, while reducing the number of highly subsidized subnational budgets, the number of regions whose total subsidization has increased is growing. Using the method of typology of regional budgets by the level of subsidies, a comparison was made of subnational budgets over the past 10 years by 4 types (*Table 2*).

With a constant number of highly subsidized budgets, there is a significant increase in moderately subsidized subnational

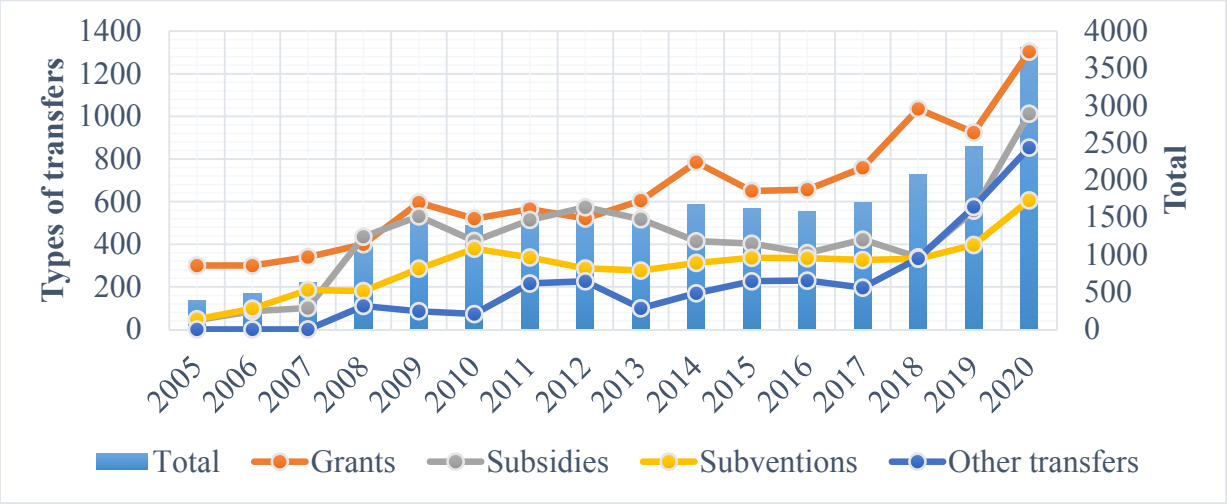

Fig. 1. **Dynamics of inter-budgetary transfers to subnational and local budgets for the period 2005–2020, billion rubles**

Source: Federal Treasury of the Russian Federation. URL: https://roskazna.gov.ru/ispolnenie-byudzhetov/konsolidirovannye-byudzhety-subektov/ (accessed on 20.08.2021).

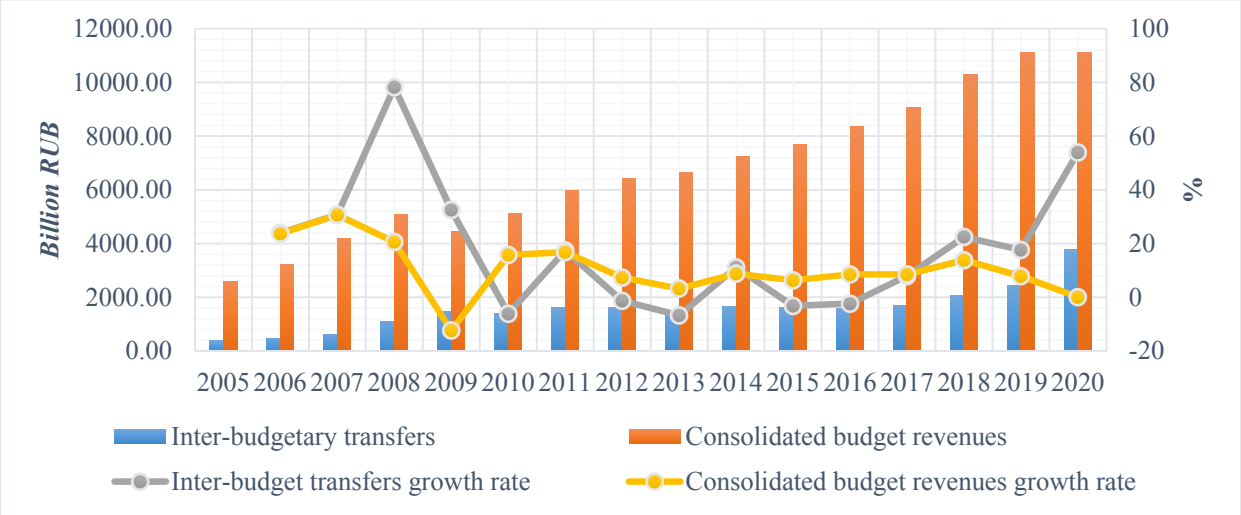

Fig. 2. **Indicators of the dynamics of inter-budgetary transfers and own revenues of the consolidated budgets of the constituent entities of the Russian Federation for the period 2005–2020**

Source: Federal Treasury of the Russian Federation. URL: https://roskazna.gov.ru/ispolnenie-byudzhetov/konsolidirovannye-byudzhety-subektov/ (accessed on 20.08.2021).

budgets and a decrease in self-sufficient ones, the number of which amounted to 4 regions in 2020. At the same time, low-subsidized budgets decreased by 18 units over 10 years. Accordingly, if in 2010 the level of subsidization of most budgets of the subjects of Russia was less than 10%, then by 2020 the situation has changed to the opposite. An increasing number of subnational budgets are experiencing fiscal security problems, and this vertical gap has continued to widen in recent years, indicating increased systemic fiscal instability and imbalances. This aspect concerns only one form of inter-budgetary transfers, respectively, in the case of analyzing the dynamics of other forms of transfers, the shares of gratuitous receipts to the budgets of the subnational level will be much higher.

Over 15 years, the total volume of inter-budgetary transfers has grown by almost

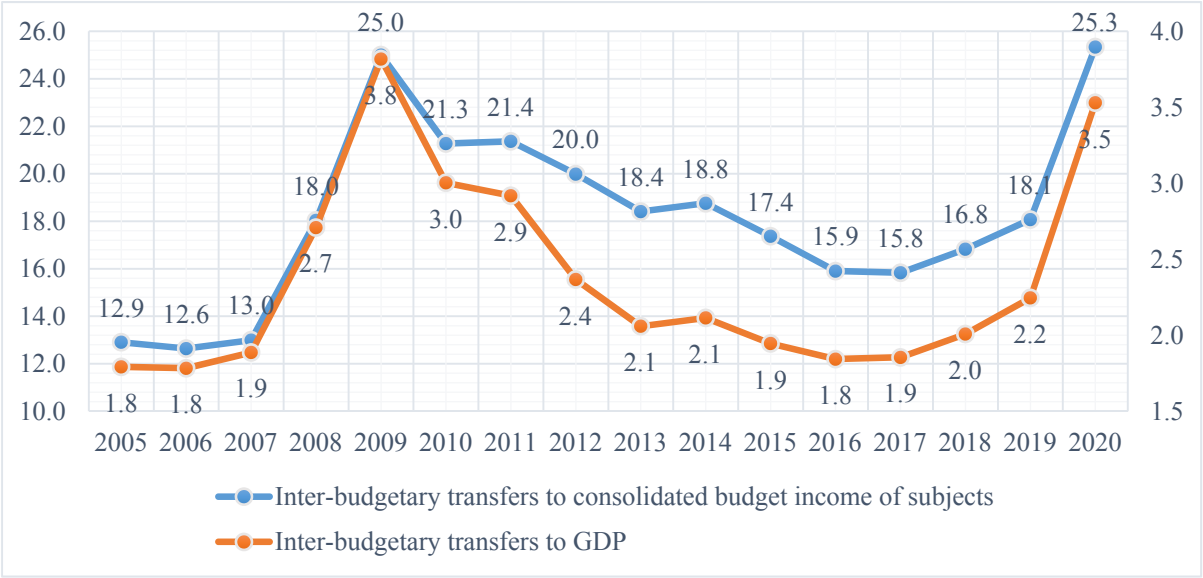

Fig. 3. **Dynamics of relations of inter-budgetary transfers to income of the consolidated budgets of the constituent entities and gross domestic product of Russia**

Source: calculated by the author according to the Federal Treasury of the Russian Federation, the Federal State Statistics Service of the Russian Federation. URL: https://roskazna.gov.ru/ispolnenie-byudzhetov/konsolidirovannye-byudzhety-subektov/; https://rosstat.gov.ru/accounts (accessed on 20.08.2021).

10 times, while the structure of the forms of transfers shows differences in growth volumes: subsidies by 23 times, subventions by 12.6 times, other transfers by 7.7 times and grants by 4 times. The situation is similar in terms of average annual growth rates: subsidies — 38%, other transfers — 26%, subventions — 23%, grants — 12%. Despite the prevailing share, the smallest increase over the period under review is observed in the form of grants, while targeted types of transfers grew at a higher rate.

If in the period 2008–2013 the volumes of grants and subsidies were approximately at the same level, differences and domination of grants are also observed in subsequent years. Also, since 2017, other transfers began to play a more significant role in the structure of inter-budgetary transfers than subventions, the distribution volumes of which began to decline. On an accrual basis for the period under review, the average shares of forms of inter-budgetary transfers are grants — 44%, subsidies — 26%, subventions — 19% and other transfers — 10%. Over the past three years, the share of grants has declined significantly in favor of an increase in targeted funding in the form of subsidies and other transfers.

From 2009 to 2017, the total amount of grant assistance changed little, but since 2018, annual growth rates have accelerated by 22%, 18% and 54%, respectively. Obviously, in the context of the COVID-19 pandemic, 2020 was characterized by the need to increase budgetary assistance to the regions.

This assumption is confirmed by the data in *Fig. 2*.

The increase in the volume of inter-budgetary transfers to the subnational and local levels of the budget system is inversely proportional to the indicators of the volume of tax and non-tax revenues of regional and local budgets, which remained practically unchanged in 2019 and 2020, while expenditures increased over the same period by 15%. One of the main reasons for the increase in the number of subsidizations of regional budgets and the level of subsidized dependence is the insufficiency of the budget of expenditure obligations with revenue sources in the form of tax and non-tax revenues, which allow achieving financial independence and pursuing a more effective local economic policy.

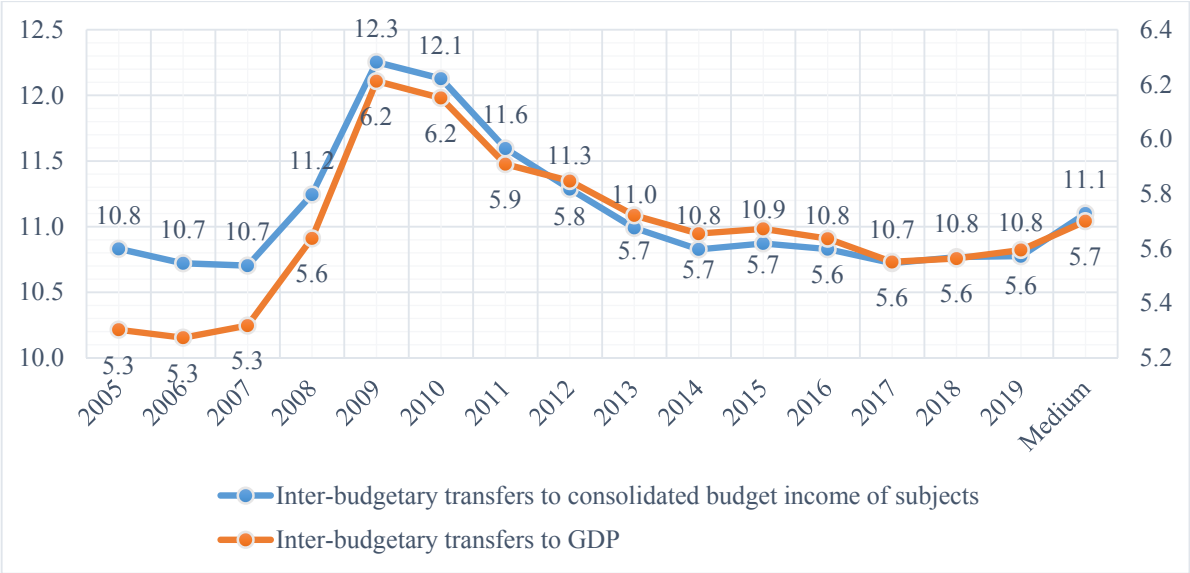

Fig. 4. **Dynamics of relations of inter-budgetary transfers to income of the consolidated budgets of the constituent entities and gross domestic product of OECD countries**

Source: calculated by the author according to the Federal Treasury of the Russian Federation, the Federal State Statistics Service of the Russian Federation, OECD. URL: https://roskazna.gov.ru/ispolnenie-byudzhetov/konsolidirovannye-byudzhety-subektov/; https://rosstat.gov.ru/accounts; https://www.oecd.org/tax/federalism/fiscal-decentralisation-database/ (accessed on 23.08.2021).

The allocation and distribution of gratuitous aid to subnational and local budgets over the analyzed period grew linearly with the development of the national economy and the general indicators of the consolidated budgets of Russian regions.

Fig. 3 data show that there is a close relationship between the volume of inter-budgetary transfers and the total revenues of the budgets of the country's constituent entities, as well as GDP. Analyzing the dynamics of the presented indicators, it is clearly seen that the role of gratuitous aid increases during periods of economic instability, as was the case during the financial crisis of 2008–2009, as well as in 2020. Economic uncertainty and problems with the receipt of own revenues in the budgets of subnational and local levels (as a result of crisis phenomena) cause an increase in the share of transfers in the income structure of the consolidated budgets of the constituent entities of the Russian Federation and in the country's GDP, which is associated with the need to compensate for the increased volume of expenditures on the provision of public goods.

If in the post-crisis period the ratio of transfers to GDP returns to the pre-crisis level, then this does not happen in the case of the incomes of the consolidated budgets of the subjects — until 2008, the indicator was about 13%, in the period 2011–2019 — an average of 18%. This circumstance may indicate the persistence of unresolved problems in the budgetary and financial condition of a larger number of subnational budgets. Foreign countries are characterized by other signs of such dependence (*Fig. 4*).

Fig. 4 presents data for 35 countries that are members of the OECD, with the calculation of the average value for all participants for each year. The first difference from Russian practice is the large share of inter-budgetary transfers in the GDP of countries and a smaller share in the total volume of consolidated incomes at the subnational and local levels. The second difference, despite the similar growth of indicators in 2008–2010, is the less volatile dynamics for the period under review, as well as the return of values to the pre-crisis period for the two analyzed indicators. It is logical to assume that these countries, both federal and unitary, use the

Table 3

Values of the Pearson correlation coefficient between inter-budgetary transfers, budget revenues of the constituent entities and GDP of Russia

Factor trait	Inter-budgetary transfers
Revenues of the consolidated budgets of the constituent entities of the Russian Federation	0.922784
Expenses of the consolidated budgets of the Russian Federation	0.940423
GDP at current prices	0.973926

Source: calculated by the author according to the Federal Treasury of the Russian Federation, the Federal State Statistics Service of the Russian Federation. URL: https://roskazna.gov.ru/ispolnenie-byudzhetov/konsolidirovannye-byudzhety-subektov/; https://rosstat.gov.ru/accounts (accessed on 20.08.2021).

Fig. 5. **Indicators of subsidies in the system of inter-budgetary relations in Russia for the period 2005–2020**

Source: calculated by the author according to the Federal Treasury of the Russian Federation. URL: https://roskazna.gov.ru/ispolnenie-byudzhetov/konsolidirovannye-byudzhety-subektov/ (accessed on 23.08.2021).

potential of fiscal decentralization to the maximum in developing the system of inter-budgetary regulation. This approach makes it possible to direct less financial resources of the consolidated budget revenues to financial assistance to the subnational and local levels of the country.

Given the similarity of the dynamics of indicators in *Fig. 3*, it is advisable to determine the degree of correlation between the presented values. As a result, a closer relationship between the inter-budgetary transfers and GDP at current prices over the past 16 years was found according to formula (2) (*Table 3*).

Table 3 shows that the volume of distributed inter-budgetary transfers is in a higher direct relationship with the GDP indicator than with the total revenues of the consolidated budgets of the country's subjects, which determines

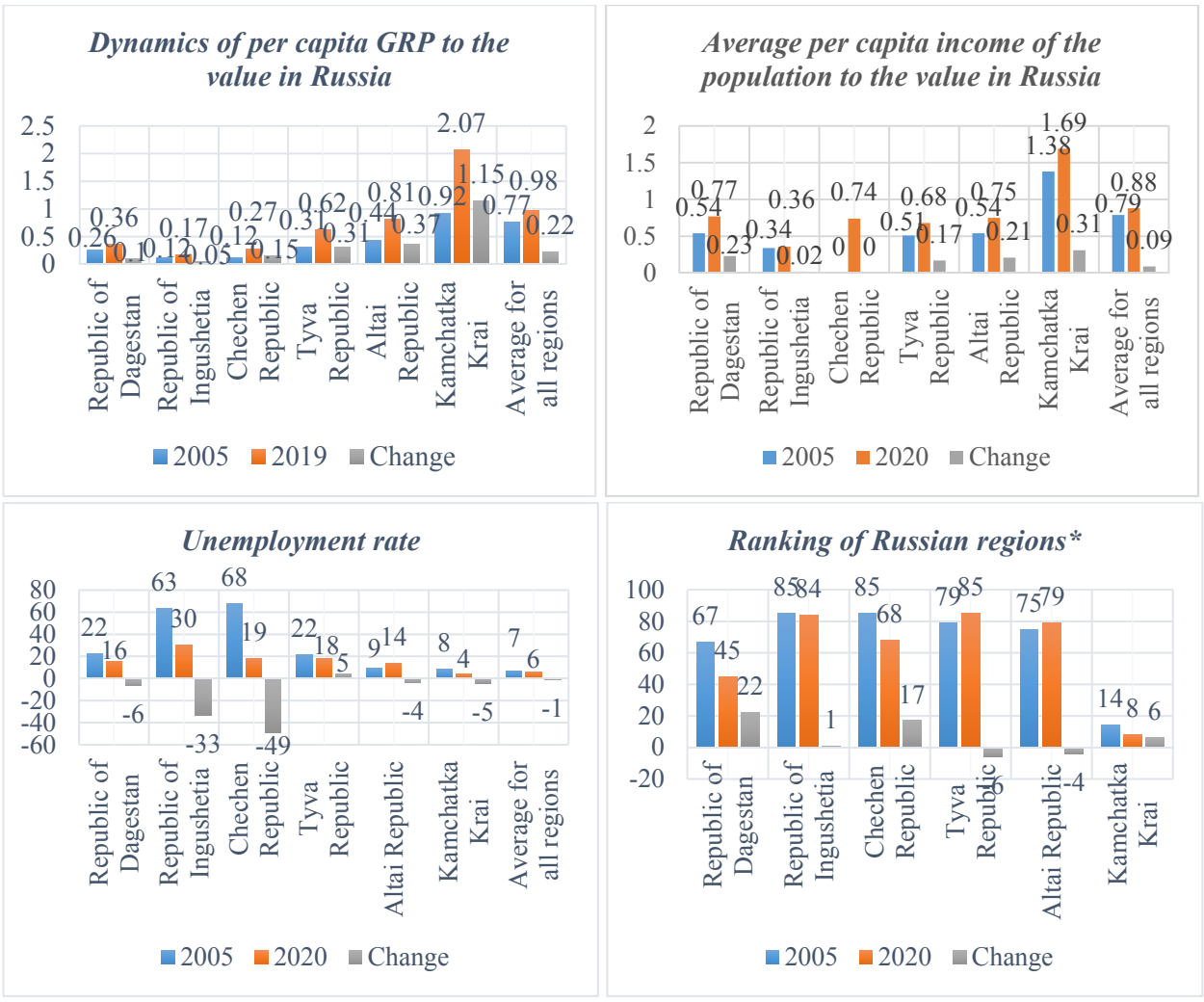

Fig. 6. **Parameters of socio-economic development of heavily subsidized subnational budgets of Russia**

Note: * the rating of Russian regions is based on 20 indicators characterizing the socio-economic condition of the subject

Source: Regions of Russia. Socio-economic indicators. 2006–2020. URL: https://rosstat.gov.ru/accounts; https://www.oecd.org/tax/federalism/fiscal-decentralisation-database/ (accessed on 24.08.2021).

the importance of exogenous indicators of the external environment in the system of inter-budgetary regulation. On the other hand, expenses also have a more direct impact on the volume of grants allocated.

In general, the rapid growth of inter-budgetary transfers in recent years is logically caused by an increase in the number of regional budgets with an average subsidy, as shown in *Table 2*, and maintaining a high level of subsidized dependence in six subjects, the dynamics of expenditures of which is growing disproportionately to the growth of tax and non-tax revenues. Despite the persistence of highly subsidized budgets, the negative effects of the increase in the budget deficit at the subnational level, which is reflected in the growth of fiscal insecurity in more regions, need to be neutralized.

Over the past 16 years, highly subsidized subnational budgets of Russia in the amount of six units have concentrated on average 24% of the total amount of distributed subsidies to equalize budgetary security and balance budgets (*Fig. 5*). If before 2014 the share of subsidies directed to highly subsidized regions accounted for almost a third of the total volume of subsidies, then by 2020 this figure has dropped to 17%. This dynamic is understandable, as subsidies in the structure of intergovernmental transfers have also almost halved their share to 35% in 2020.

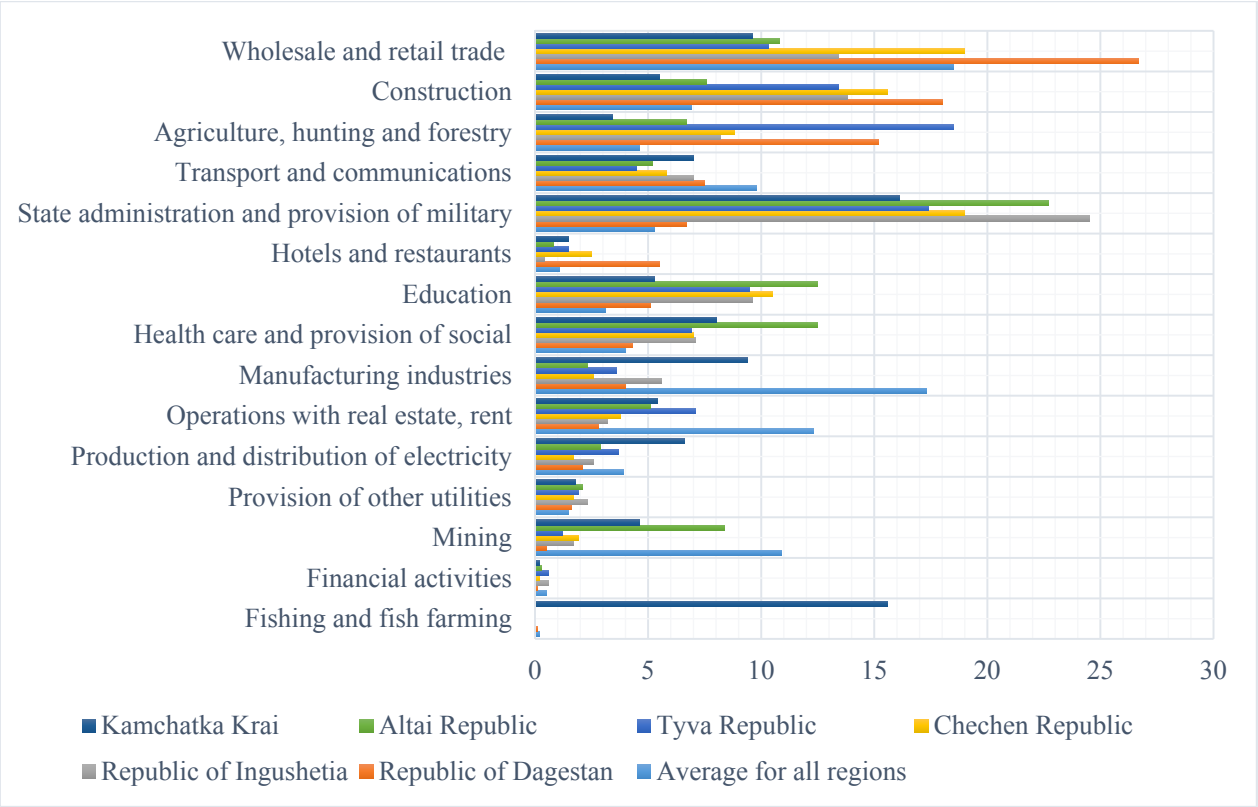

Fig. 7. **The structure of the regional economy in terms of GRP of heavily subsidized regions of Russia on average for the period 2010–2020, %**

Source: Regions of Russia. Socio-economic indicators. 2006–2020. URL: https://rosstat.gov.ru/accounts; https://www.oecd.org/tax/federalism/fiscal-decentralisation-database/ (accessed on 24.08.2021).

However, intergovernmental transfers are on the rise, indicating a change in the nature of transfers in favor of targeted transfers.

Given the volume of transfers provided to highly subsidized subnational budgets of Russia over the past 16 years, it should be assumed that the cumulative effect of such financial assistance should affect the improvement of the socio-economic situation in this category of regions. To assess the socio-economic performance of allocated inter-budgetary transfers to the budgets of regions with a high share of subsidized dependence, a dynamic assessment of the parameters of the socio-economic state of this category of subjects of the country was carried out from 2005 to 2020 (*Fig. 6*). Since the comparison of the absolute values of indicators of the socio-economic development of outsider regions with other regions or among themselves in time will not have a comparative potential and significance, the calculations were carried out in relation to similar indicators for Russia as a whole, with the allocation of average regional values.

With the exception of the Kamchatka Krai, the rest of the analyzed regions had one of the worst indicators of the socio-economic condition in 2005, which is represented by the diagram with the ranking of the constituent entities of the Russian Federation. For all assessed parameters, this category of regions was characterized by values below the average for all regions. Slightly more than 4% of the country's population lives in highly subsidized entities, with four of them having populations of less than 500,000, making the provision of public goods more expensive as there are no economies of scale. On the other hand, the Kamchatka Krai, the republics of Tyva and Altai have a vast territory with an underdeveloped transport and logistics infrastructure, as well as harsh natural and climate conditions. In addition, these regions

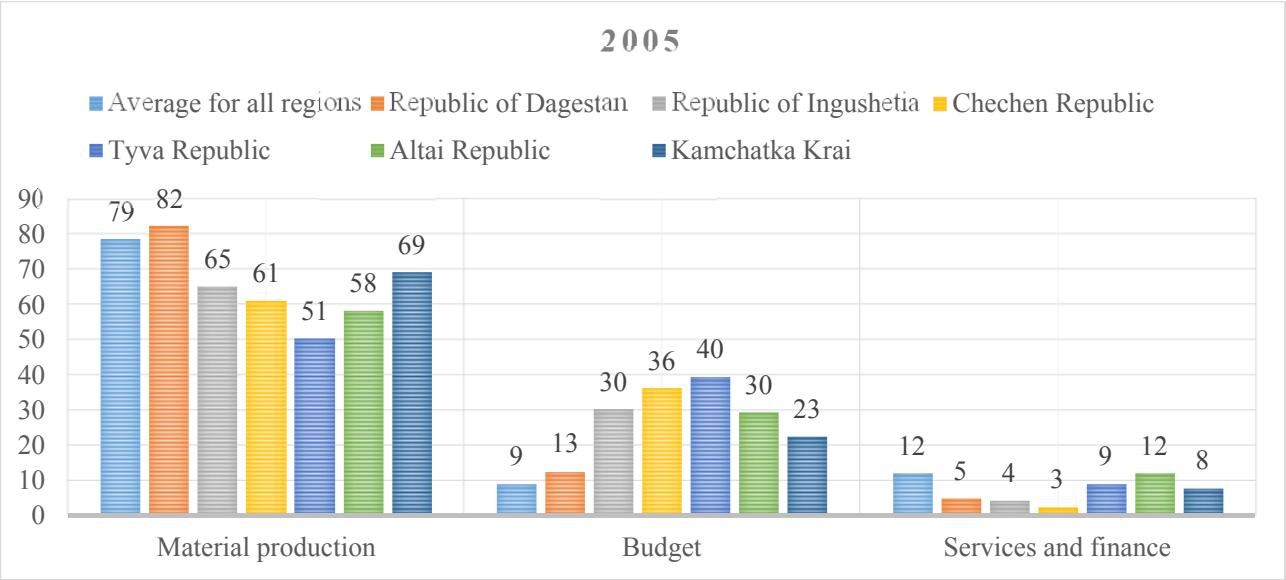

Fig. 8. **Structure of the regional economy of Russia in 2005 by GRP industry indicator, %**

Source: Regions of Russia. Socio-economic indicators. 2006–2020. URL: https://rosstat.gov.ru/accounts; https://www.oecd.org/tax/federalism/fiscal-decentralisation-database/ (accessed on 24.08.2021).

are quite remote from the centres of supply of resources and products. The regions of the North Caucasus, on the contrary, are distinguished by a high population density, developed transport routes and a favorable warm climate.

The share of the created GRP of the six regions under consideration in the total structure in 2005 was less than 2%, reaching only 2.2% in 2019. However, in terms of per capita GRP to the average value of this indicator in Russia, there is a noticeable increase, especially in the Republics of Chechnya, Tyva and Altai, and the Kamchatka Krai. At the same time, it should be noted that the growth rates of GRP in these regions exceeded values in recent years (on average by 2–4%), which could be the basis for increasing the tax potential and improving budget parameters. Positive shifts can be traced in terms of average per capita monetary incomes of the population in relation to the average for the Russian Federation, as well as the unemployment rate (with the exception of the Altai Republic — an increase in unemployment to 14%).

According to the cumulative result from 2005 to 2020, when assessed by 20 criteria of the socio-economic condition, three regions significantly improved their performance (Republic of Dagestan, Chechnya and Kamchatka Krai), a slight improvement in the Republic of Ingushetia. The deterioration of the social condition and economic development in the ranking of regions is observed in the republics of Tyva (from 79th to 85th place) and Altai (from 75th to 79th place).

A characteristic feature of regions with a high subsidized dependence is the similarity in the structure of the regional economy and a significant difference in values from other federal subjects of the country. The leading economic-forming sectors on average for all highly subsidized regions of Russia are public administration, wholesale and retail trade, construction, and agriculture (*Fig. 7*). The differences between the regions are insignificant, however, compared with the average values of the GRP structure for all federal subjects of Russia, the differences are significant, with the exception of the trade sector.

The regional economy of Russia as a whole is characterized by the predominant role in the creation of added value of four industries: trade, manufacturing, real estate and mining. The last three industries in highly subsidized

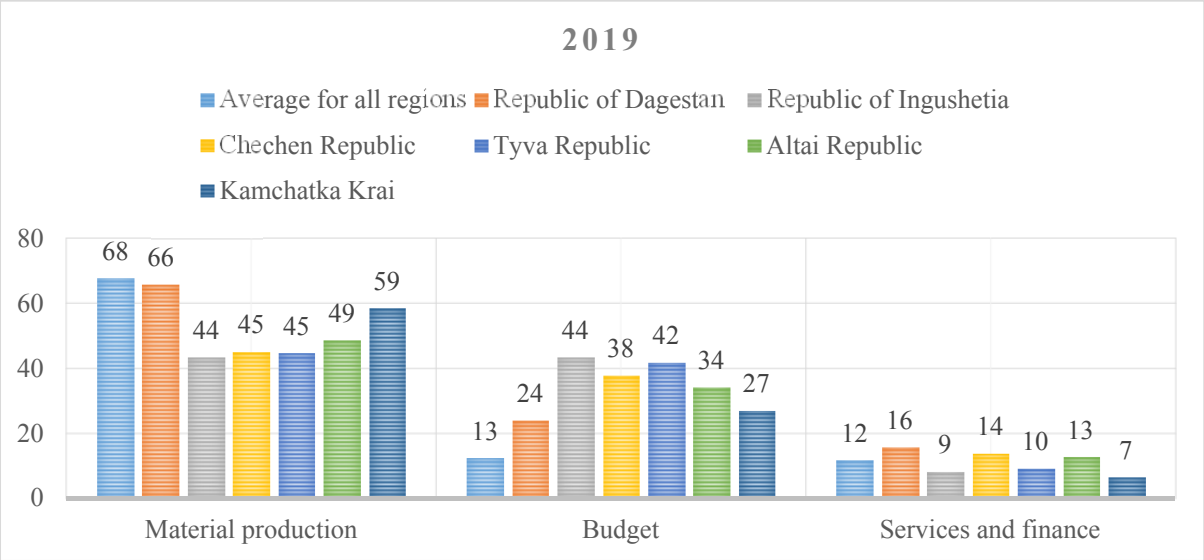

Fig. 9. **Structure of the regional economy of Russia in 2019 by GRP industry indicator, %**

Source: Regions of Russia. Socio-economic indicators. 2006–2020. URL: https://rosstat.gov.ru/accounts; https://www.oecd.org/tax/federalism/fiscal-decentralisation-database/ (accessed on 24.08.2021).

regions account for a share from 7.3% in the Republic of Dagestan to 19.4% in the Kamchatka Territory, although the average for all regions of the country is 40.5%, which is several times higher. At the same time, the share of the public sector (education, healthcare and public administration) in the GRP structure of our sample ranges from 16.1% in the Republic of Dagestan to 47.7% in the Altai Republic. For all regions of Russia — 12.4%, respectively. It should also be noted that the branch of public administration is the most significant in highly subsidized regions, except the Republics of Dagestan and Tuva, which does not allow for the effective implementation of the regional economic potential and the formation of tax revenues.

Since the data in *Fig. 7* illustrate the average values of the GRP structure of the regions over the past 10 years; to determine the effectiveness of inter-budgetary equalization for the period under consideration of 15 years, it is advisable to compare the data of 2019 and 2005. For comparison, sectors of the economy are grouped into three types of economic activity: material production (manufacturing, mining, construction, trade, transport and communications, agriculture, energy); public sector (public administration, education, healthcare); services and finance (real estate, hotels and restaurants, financial activities, other services). Such a grouping will make it possible to determine how much the socio-economic nature of the development of highly subsidized regions has changed compared to the average values for the country. On the other hand, the tax potential is most effectively realized in the sphere of material production, and not in the public sector, which does not allow stimulating tax autonomy and competition at the subnational level.

In 2005, the public sector in the regions of Russia occupied a smaller share in the GRP structure (*Fig. 8*). However, in highly subsidized subjects of the country, this indicator is much higher, with the highest value in the Republic of Tyva (39.5%), and the lowest in the Republic of Dagestan (12.7%). The discrepancy between the sample of regions and the average values for the country can also be traced in the sphere of material production, with the exception of the Republic of Dagestan (82.3%).

The structure of Russia's regional economy has changed over the past 15 years (*Fig. 9*). Firstly, the share of material production in the creation of added value in all regions of Russia decreased by 14%, services and finance by 1%,

Table 4

Indicators of variation and oscillation of the socio-economic state of heavily subsidized regions of Russia in 2005 and 2019

Types of economic activities	2005		2019		Changes 2019/2005	
	variation coef., %	oscillation coef., ea	variation coef., %	oscillation coef., ea	variation coef.	oscillation coef.
Material production	17%	0.49	18%	0.44	1	–0.05
Budget	34%	0.94	23%	0.55	–12	–0.39
Services and finance	52%	1.40	31%	0.81	–20	–0.59

Source: author's calculations according to *Fig. 8* and *9*.

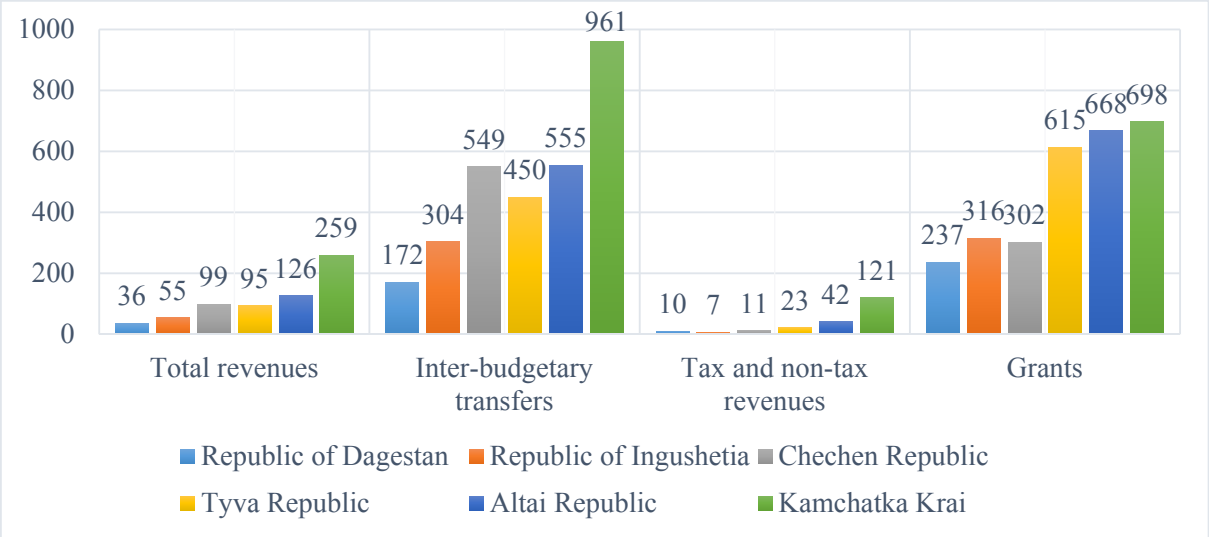

Fig. 10. **Parameters of budget and tax status of highly subsidized subnational budgets of Russia in 2005–2007**

Source: calculated by the author according to the Federal Treasury of the Russian Federation, the Federal State Statistics Service of the Russian Federation. URL: https://roskazna.gov.ru/ispolnenie-byudzhetov/konsolidirovannye-byudzhety-subektov/; https://rosstat.gov.ru/accounts (accessed on 25.08.2021).

and the growth of the public sector amounted to 37%. Secondly, if in 2005 the Republic of Dagestan was ahead of the average values of the regions in terms of material production, then in 2019 all highly subsidized regions reflect values below the average value in Russia. Thirdly, all highly subsidized regions reduced the share of material production sectors in the GRP indicator by an average of 20% (from –11% in the Republic of Tyva to –33% in the Republic of Ingushetia). Fourthly, the share of budgetary sectors of the regional economy of highly subsidized territories increased inversely proportionally by an average of 30%, with the highest value in the Republic of Dagestan (+91%). Fifthly, one can positively assess the rapid growth of the services and finance sector in highly subsidized regions, which grew by an average of 127% (Chechen Republic +460%), with the exception of the Republic of Tyva (–16%).

An important feature of the presented data is significant changes in the homogeneity of the socio-economic situation of highly subsidized regions over the period under review. Since regional budgets with a high

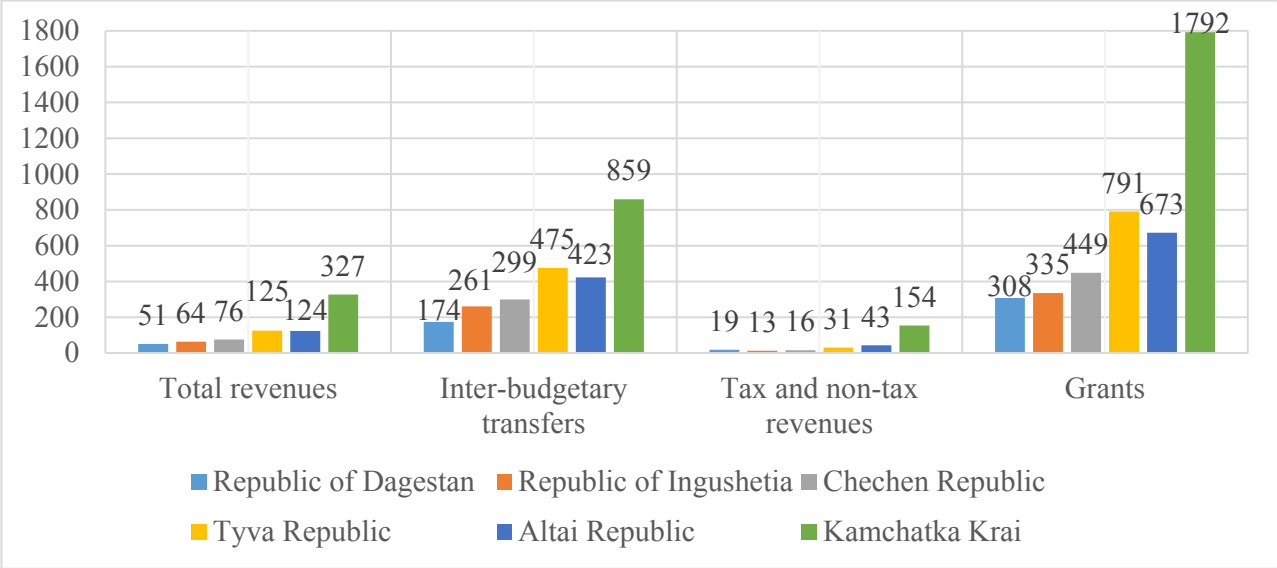

Fig. 11. **Parameters of budget and tax status of highly subsidized subnational budgets of Russia in 2018–2020**

Source: calculated by the author according to the Federal Treasury of the Russian Federation, the Federal State Statistics Service of the Russian Federation. URL: https://roskazna.gov.ru/ispolnenie-byudzhetov/konsolidirovannye-byudzhety-subektov/; https://rosstat.gov.ru/accounts (accessed on 25.08.2021).

share of subsidization have similar properties in the structure of the regional national economy, it is necessary to determine the dispersion index of these properties in their dynamics since 2005.

Using the data in Fig. 8 and 9, as well as applying the formulas for calculating the coefficients of variation (3) and oscillations (4), revealed the dynamics of the degree of homogeneity of highly subsidized regions in the structure of their socio-economic structure (*Table 4*).

In 2005, the degree of homogeneity of the structure of the economy of highly subsidized regions was within a moderate value only in the sectors of material production, based on the normality of the interval values of the dispersion of the data array when calculating the coefficient of variation (< 33.3%). Also, the oscillation coefficient, as an indicator that determines the remoteness of extreme values from the entire data scale (range of variation), is characterized by high levels in the public sector, services and finance [32].

In 2019, there is a significant approximation of all highly subsidized regions to a homogeneous set of analyzed data on sectors of the regional economy with low standard deviations, which indicates the homogeneity of regions with high subsidies according to the criteria of socio-economic development.

Another unifying criterion for highly subsidized regions is the lack of an established production and economic specialization in the national system of labor division [33], as well as the weak development of enterprises with highly productive industrial production, which indicates a low role of the manufacturing industry in creating added value.

Thus, over the 15 years of development of highly subsidized regions, they have converged in terms of the characteristics of the economic state in the direction of reducing the contribution of value added to the material production sector (as the most suitable sector for stimulating the local budget's own revenues). The role of the public sector in the creation of the GRP of highly subsidized regions has increased, which does not allow us to speak about the effectiveness of the regional economic and financial policy pursued over the years by both the federal government and local governments. Highly subsidized regions not only retained a low level of realization of the regional economic potential, but also increased the dependence

of the economy on the public sector. Accordingly, over the past 16 years, the model of a "resource-intensive" regional economy, which was formed in highly subsidized regions in 2005, has strengthened, which, in the context of injecting more than a third of all subsidies to equalize budgetary security and balance, has not led to a change in the development model.

In addition to the socio-economic aspect of the state and development of regions with high subsidized dependence, their fiscal component is of great importance. To determine the fiscal efficiency of inter-budgetary regulation of highly subsidized subnational budgets, an analysis was made of the parameters of per capita financing for this category of regions in comparison with Russian values. *Fig. 10* and *11* show the ratios of these indicators calculated by formulas (5)–(8). The data were calculated for three years of the initial (2005–2007) and final (2018–2020) periods with averaging for a more accurate statistical picture.

In highly subsidized regions, per capita financing in terms of the total revenues of the consolidated budget of a constituent entity of the country exceeds the Russian value in the Republic of Altai and Kamchatka Krai in the period 2005–2007, which is due to the small population. The lowest values are in the republics of Dagestan and Ingushetia. However, regarding the volume of inter-budgetary transfers and subsidies per capita, highly subsidized regions exceed the Russian values by an average of 5 and 4.7 times, respectively. An essential feature of the obtained data is the low level of tax and non-tax revenues per capita in relation to a similar indicator in Russia. With the exception of the Kamchatka Territory, which subsidized dependence is mainly due to the peculiarities of natural and climate conditions and geographical location, all other highly subsidized regional budgets are characterized by catastrophically low results.

Flows of inter-budgetary transfers to regions with high subsidized dependence in 2005–2020 did not have a significant positive impact on their fiscal position, which is expressed in the following aspects. Firstly, with the growth of total per capita income in two subjects, this indicator decreased (the Chechen Republic –23% and the Republic of Altai –2%). Secondly, on average, the reduction in non-repayable funding per capita (–15%) was offset by a 45% increase in per capita subsidies compared to the national figures. The largest increase was in the Kamchatka Krai (+157%), the Republics of Chechnya (+48%) and Dagestan (+30%). Thirdly, the indicator of per capita tax and non-tax revenues relative to Russian values remained low, despite a slight increase.

CONCLUSIONS

The conducted research and the research results allow us to draw the main conclusion that the existing mechanism of inter-budgetary regulation and the existing tools for equalizing budgetary security do not contribute to a significant change in the fiscal and socio-economic parameters of the development of highly subsidized subnational budgets. The nature of the use of gratuitous aid received by this category of subjects of the country is reduced to short-term coverage of the gap in financing expenditure obligations but does not change the model of either the organization of budgetary regulation or the regional economy.

The local economic administration did not use the economic potential at the disposal of highly subsidized regions to stimulate the tax base, which caused an increase in the budget burden on the federal level of the budget system and became an incentive to deprive donor regions of motivation for budgetary efficiency. This statement boils down to the fact that in the conditions of the Russian model of fiscal decentralization, stable regional budgets and regions with stable socio-economic and financial characteristics experience more difficulties than they receive preferences. Regional donor budgets with a high level of tax and non-tax revenues are forced to redistribute a significant part of their revenues within the framework of vertical

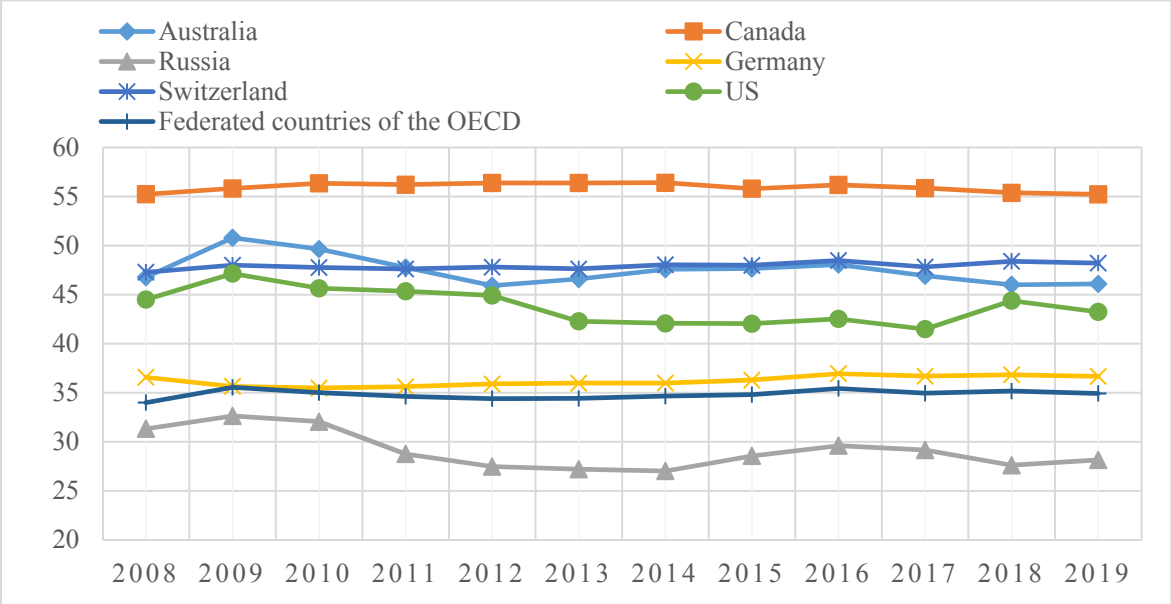

Fig. 12. **Fiscal decentralization by income in Russia and federal OECD countries, %**

Source: calculated by the author according to OECD data. URL: https://www.oecd.org/tax/federalism/fiscal-decentralisation-database/ (accessed on 26.08.2021).

budget equalization, deducting a share of income tax and rental income, ultimately in favor of recipient budgets. In the modern budget practice of Russia, there are no mechanisms to stimulate budget stability and balance, which deprives the self-sufficient type of subnational budgets of motivation for self-sufficiency and tax competition.

Heavily subsidized subnational budgets with an increasingly high share of the public sector in the creation of value added to the gross regional product do not contribute to stimulating tax revenues. This category of budgets for the period 2017–2020 mobilized on average less than 1% of tax and non-tax revenues in the total volume of this type of income of the consolidated budgets of the constituent entities of the Russian Federation.

Chronic subsidies to outsider regions contributed to the development of "budget dependence" and high dependence on federal funding, which led to the practice of planning budget expenditures taking into account future subsidies, without looking for additional sources of income. In the context of the rise in the cost of providing public goods, such a significant financial and budgetary lack of independence leads to the fact that the volume of inter-budgetary transfers is forced to increase, at the federal level it is required to allocate more funds to regulate inter-budgetary relationships with continuing low efficiency.

The implementation of nationwide functions for the provision of public goods is based on the sustainability of budgets at all levels and their balance. The persistence of the problem of high and medium subsidization of a number of budgets at the subnational level does not allow for sustainable financing of expenditure obligations. Accordingly, these categories of outsider regions create barriers to stimulating the receipt of revenues in the consolidated budgets of the country's subjects, thereby maintaining a low level of fiscal decentralization. The share of revenues at the regional level of the Russian budget system in the volume of consolidated state revenues is significantly lower than that of the federal lands in the OECD (*Fig. 12*). Despite the theses about the growth of decentralization in the budgetary system of the state, this statement is contrary to practice.

The dynamics differ in the context of states both with a federal system and with a unitary

one. However, Russian data show a larger decline in fiscal decentralization.

The results of evaluating the effectiveness of the current mechanism of inter-budgetary regulation of highly subsidized budgets at the subnational level allow us to highlight the following key features:

The almost complete lack of efficiency from the realization of the economic potential of highly subsidized regions, considering the available natural resources and geographical location.

Extremely low tax potential to stimulate tax revenues to increase the level of tax competition and autonomy.

The public sector plays an increasingly important role in creating the added value of the GRP of highly subsidized regions, which can reduce the quality of economic growth assessment due to the lack of sectoral industry specialization in the nationwide division of labor.

Flows of inter-budgetary transfers, especially subsidies, do not stimulate social and economic development at the pace that is typical for foreign countries, according to a review of the literature. On the other hand, the current pace of economic development is largely based on transfer flows, as tax and non-tax revenues remain low.

An important issue of the current situation is the unsecured volume of expenditure obligations provided at the subnational level. This issue is especially acute for outsider regions, which, in conditions of low financial self-sufficiency, are not able to ensure the search for additional sources of income.

Where outsider regions receive inefficiently low public goods from the federal government, one way to mitigate this inefficiency may be to supplement these types of spending with their own provision of the same public goods. But in this case, the tax rates chosen by outsider regions can be significant even in the case of complete centralization, when the entire spectrum of public goods is provided at the federal level. As a result, tax increases caused by the decentralization of the provision of a small number of public goods can lead to a loss of first-order efficiency. Whether welfare falls or not will depend on the size of these tax increases.

It should also be noted that those budgetary restrictions that are imposed on regional budgets with a high share of subsidies in the structure of their own income (more than 40% over the past 2 years) are not tough enough and do not fulfill their function. This conclusion is based on an analysis of the parameters of the fiscal situation in highly subsidized regions. It should be recognized that it is of the utmost importance to establish hard budget limits for all levels of government, especially for subnational ones. Soft budget constraints create weak incentives and lead to a number of financial and economic problems — an increase in dependency and subsidization.

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Assessment of the Contribution of the Arctic Zone to the Economic Development of the Country

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ABSTRACT

The scientific study examines the ways and methods of assessing the contribution of the Arctic zone to the level of economic development of the subjects of this zone and the country as a whole through the process of ensuring national security. The relevance of the study is due to the relationship between the indicators of territorial development of the subjects of the Russian Federation belonging to the Arctic zone and the indicator of the gross domestic product as a whole as the main indicator for assessing the level of economic development. **The aim** of the research is to improve the mechanisms for assessing the contribution of the Arctic zone to the level of economic development. The authors apply dialectical scientific cognitive **methods** based on a set of recognized private scientific and general scientific methods: formal logic, comparative law, statistics, and cross-sectoral legal analysis. The scientific novelty of the research lies in the identification of major risks that affect the processes of national security assurance in the Arctic zone, as well as their impact on national economic development and private business. The authors conclude about the potential of the Arctic zone for the formation of innovative projects with the growth of spatial risks, considering the peculiarities of the economy of the North. The results of this study may be used in practical activities by the state executive authorities of the Arctic zone in order to adjust existing regulatory documents, as well as to develop new directions of state policy in the field of ensuring national security in this region.

Keywords: Arctic zone; national security of Russia; Northern Sea Route; risks and threats of the Arctic zone; assessment of financial and innovative potential; the resource potential of the Arctic

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INTRODUCTION

Currently, the world community is showing increased attention to the Arctic zone. This is due, firstly, to the changed geopolitical factor of countries both bordering the Arctic (the United States, Denmark, Canada, Norway, claiming to secure the legal status of this territory for them), and located in other parts of the world (primarily China, for which the Arctic is both a potential source of resources and a convenient transport corridor to Europe). Secondly, economic factors, in particular the presence of minerals, since the total territory of the Arctic zone is 27 million square kilometers. For comparison, the total area of united Europe is only 10.5 million square kilometers.[1] According to expert estimates, about a third of the world's natural gas reserves and up to 13% of oil are concentrated in the Arctic zone, reserves of platinum, gold, nickel, coal and other minerals have been discovered. Consequently, these factors directly affect the territorial development of Russia, and there is an objective need to consider the specifics of the Arctic zone [1, p. 132–147]. The complexity of the development of the Arctic zone require the adoption of effective measures to stimulate investment activity on the basis of public-private partnerships, the provision of tax incentives for the exploration and production of hydrocarbons and minerals, which will ultimately contribute to the rational and efficient use of the raw materials, logistics and social potential of this territory [2, p. 62]. The efficiency and effectiveness of the development of the Arctic zone also depend on the integrated development of the Northern Sea Route as a driver of economic growth [3, p. 113–120]. Analysis and assessment of risks in the implementation of transport and logistics projects involves consideration of the processes of spatial development, considering the territorial features of the region. All these factors require an urgent solution in ensuring the national security of Russia.

SPATIAL RISKS OF THE ARCTIC ZONE

In accordance with the adopted regulatory documents in Russia, the following regions belong to the Arctic zone:

- Murmansk region.
- Nenets Autonomous Okrug.
- Chukotka Autonomous Okrug.
- Yamalo-Nenets Autonomous Okrug.

In accordance with the spatial development, part of the territories of the Republic of Karelia, the Republic of Komi, the Republic of Sakha (Yakutia), the Krasnoyarsk Territory and the Arkhangelsk Region are also assigned to the Arctic zone [4, p. 135]. The law of the sea also includes internal sea waters, territorial seas, and the Arctic continental shelf.

Based on the results of geological exploration in the Arctic, Russia has applied to the UN Commission to expand the boundaries of the continental shelf by joining the Lomonosov Ridge and other continental formations. According to international rules, each country has the right to expand this territory, with the exception of the coastal 200-mile zone. According to Arctic researchers, the Lomonosov and Alfa-Mendeleev ridges were connected with the margin of the Barents Sea 120 million years ago, then began to crawl away from it as a result of deep processes in the bowels of our planet.

The total land area of the Arctic zone is 5 million square kilometers with a total population of 2.5 million people. It should be noted that each subject of the Arctic zone has territorial and sectoral risk factors that directly or indirectly affect the level of economic development of the country. In this regard, the successful development of the Arctic zone of the country is possible only if both external and internal threats and risks are identified.

As the main external threats, one can single out the political statements of the states of Northern Europe that these countries belong to part of the Arctic territory [5, p. 210].

[1] Reference point. The development of the Arctic is a matter of Russia's national security. URL: http://orientir.milportal.ru/osvoenie-arktiki-strategicheskij-vopros-natsionalnoj-bezopasnosti/ (accessed on 31.05.2021).

These claims are based on their geopolitical and economic ambitions as global warming makes the Arctic more accessible to economic activity and transportation opportunities. A real prospect is opening up not only to significantly reduce many trade routes, but also to begin active mining. Another threat to Russia's national security is the lack of an international treaty that would fully regulate the economic activities of stakeholders in the Arctic. Currently, this activity is regulated by the national legislation of the states located in the northern territories, as well as international treaties.

One of the internal threats to the socio-economic development of the region is the outflow of the able-bodied population to the central regions of the country [4, p. 210]. By 2031, about half a million people are expected to leave Pomorie (now the population of the region is 1.3 million people) [5, p. 212]. The main reason for the outflow of the population from Primorye is the economic decline of the region, as well as the poor development of infrastructure facilities, including the inability to obtain quality medical care.

Today, one of the territorial risks that negatively affect the successful development of the Arctic zone is the uneven development of its subjects [6, p. 80]. The main reason for this is insufficient financing of infrastructure facilities both from the state and from private investors.

Industry risks include a high degree of deterioration of transport equipment, low return on investment due to the long process of implementing design solutions, and other risks.

In existing scientific studies, many authors recommend using not only the mechanisms of strategic management of the Arctic zone, but also qualitative and quantitative methods for assessing the economic contribution [7, p. 78].

Thus, the assessment of the contribution of the Arctic zone to the economic development of the country can only be carried out with an integrated approach based on taking into account all significant risk factors.

METHODS

The methodological basis of this study is the strategic regulatory documents that determine the state policy,[2] and regulate economic activity in a given territory.[3]

It should be noted that the organization of an effective system of financial control over the implementation of the main provisions of strategic documents in the field of innovative development of the Arctic zone of Russia, including on issues related to the organization of diagnostics and monitoring, the assessment of the economic contribution of each subject of the country, is an urgent task of public administration. The regions of the Russian Federation are territorial units of the upper level, but their characteristic feature is a high differentiation in terms of the level of economic development, which exacerbates the influence of both global and interregional risk factors [8, p. 72].

Applied economic research considers various methods for assessing the level of economic development of the constituent entities of the Russian Federation using a system of indicators consisting of various subsystems, each of which characterizes one of the sides of expanded reproduction, ranked by the level of innovative development, according to the standard of living of the population, etc. [9, p. 92]. In this regard, the existing methods for assessing the level of economic development of the constituent entities of the Russian Federation do not fully meet the modern requirements of state policy due to the lack of statistical studies in them, on the basis of which alternative management decisions can be designed to produce an end

[2] Decree of the President of the Russian Federation of October 26, 2020 No. 645 "On the Strategy for the Development of the Arctic Zone of the Russian Federation and Ensuring National Security for the Period until 2035". URL: https://www.garant.ru/products/ipo/prime/doc/74710556/ (accessed on 31.03.2021).

[3] Regulation of the Government of the Russian Federation of March 18, 2020 No. 297 "On Approval of the Rules for the Selection of Investment Projects Planned for Implementation in the Arctic Zone of the Russian Federation" (with amendments and additions). URL: https://base.garant.ru/73765723/ (accessed on 31.03.2021).

Table 1

Calculation of the correction factor for the subjects of the Russian Federation in the Arctic zone

Subjects of the Russian Federation belonging to the Arctic zone	Composition (number of ATUs related to the Arctic zone)	Percentage of ATUs related to the Arctic zone (correction factor)
Murmansk region	All ATU	1
Nenets Autonomous Okrug	All ATU	1
Chukotka Autonomous Okrug	All ATU	1
Yamalo-Nenets Autonomous Okrug	All ATU	1
Republic of Karelia	6 ATU out of 18	0.333333333
Komi Republic	4 ATU out of 20	0.2
The Republic of Sakha (Yakutia)	13 ATU out of 36	0.361111111
Krasnoyarsk Region	4 ATU out of 57 (exclud. 3 closed cities)	0.070175439
Arhangelsk Region	9 ATU out of 28	0.321428571

Source: compiled by the authors.

result that meets the criteria for efficiency and effectiveness.

This study uses a methodology for assessing the economic contribution based on economic and statistical methods (regression analysis), which allows us to assess the economic contribution of the Arctic zone to the overall economic development of the country. The result of statistical analysis is the selection of stimulating and destructive factors, on the basis of which certain measures are developed to accelerate the development of the country's economy [10, p. 23].

RESULTS

Regression analysis as a statistical research method allows us to trace the degree of influence of one or more independent variables *X* on the dependent variable *Y* and includes several stages.

At the first stage, through the correction factor, the values of indicators for the subjects of the Russian Federation included in the Arctic zone are determined, since not all subjects are entirely included in it [11, p. 67]. The correction factor will be determined by the percentage ratio of the number of administrative-territorial units (ATU) included in the Arctic zone to the total number of ATU of the subject.

The results of calculations of the correction factor are presented in *Table 1*.

At the second stage, a list of indicators is determined that most fully characterizes the economic development of each subject of the Russian Federation. But these indicators can have different units of measurement [12, p. 335]. In this regard, the implementation of this stage is associated with the solution of various problems noted below:

- uneven development of territories;
- low level of labor productivity [13, p. 115];
- outflow of the able-bodied population;
- low standard of living;

Table 2

Initial data for regression analysis

Year	GDP at current prices, billion rubles	GRP per capita, thousand rubles	Average monthly nominal accrued wages of employees for a full range of organizations in the economy, RUB	Cargo turnover of motor vehicles, million tons/km	Internal research and development costs, mln rubles	Number of unemployed aged 15–72 years, thousand people	Turnover of medium-sized organizations, million rubles
	Y	X_1	X_2	X_3	X_4	X_5	X_6
2011	60 114.0	8834.2	36 500.6	6264.0	6936.4	137.6	114 660.6
2012	68 103.4	9201.0	41 357.3	7194.2	8085.7	121.4	139 814.6
2013	72 985.7	10 006.5	45 892.5	7662.6	8200.4	124.9	128 341.7
2014	79 030.0	11 277.2	49 775.0	7448.9	10 144.5	122.3	126 936.1
2015	83 087.4	12 963.5	52 487.2	6339.9	10 776.9	132.5	136 680.4
2016	85 616.1	14 409.0	55 892.9	5115.4	10 710.7	132.6	208 567.5
2017	91 843.2	15 529.3	59 092.9	4979.8	10 288.7	121.1	141 936.5
2018	103 861.7	19 131.0	65 183.0	4020.7	12 709.3	111.7	151 094.1
2019	109 241.5	20 075.6	69 890.0	4167.6	14 218.9	99.9	128 568.4

Source: compiled by the authors according to the Federal State Statistics Service. Russian Statistical Yearbook 2020. Moscow: Rosstat; 2020. 700 p.

- underdeveloped infrastructure;
- lack of efficient transport communication, etc.

To conduct a study to assess the economic contribution, the following economic indicators for 2011–2019 were selected, which, according to the authors, most fully characterize the features of the development of territories:

- gross domestic product, billion rubles;
- gross regional product per capita, thousand rubles;
- average monthly nominal accrued wages of employees across the entire range of organizations, rubles;
- cargo turnover of motor vehicles, million tkm;
- internal costs for R&D, million rubles;
- number of unemployed aged 15–72, thousand people [14, p. 10];
- turnover of medium-sized organizations, million rubles.

In our model, the above indicators will be the independent variable X, and the dependent variable Y will be the country's GDP. For each indicator (except for GDP), the total value for the entire Arctic zone was calculated for each of the 9 years of observations. The calculation was made by summing the values of individual subjects using the correction factor from

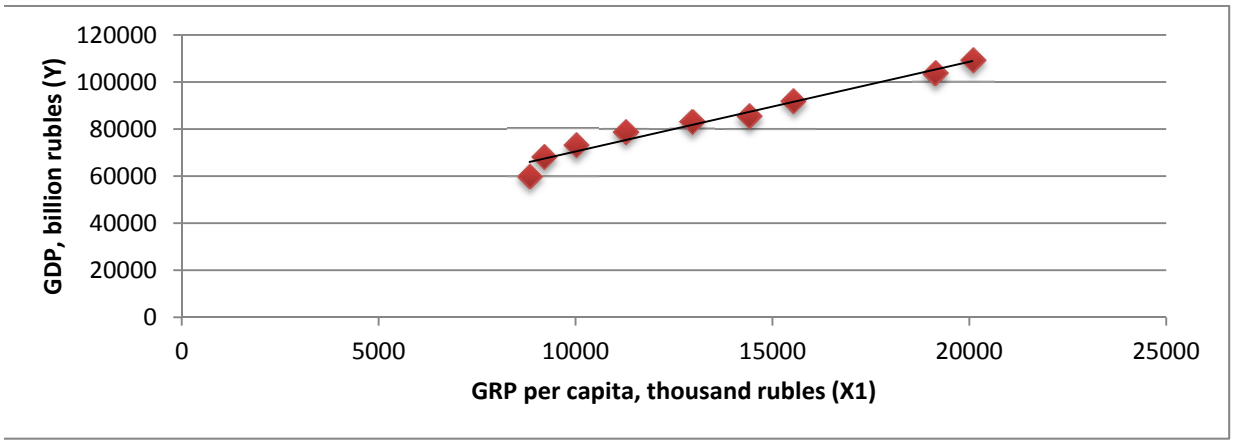

Fig. 1. **Correlation of Y and X_1 indicators (GDP and GRP per capita)**

Source: compiled by the authors.

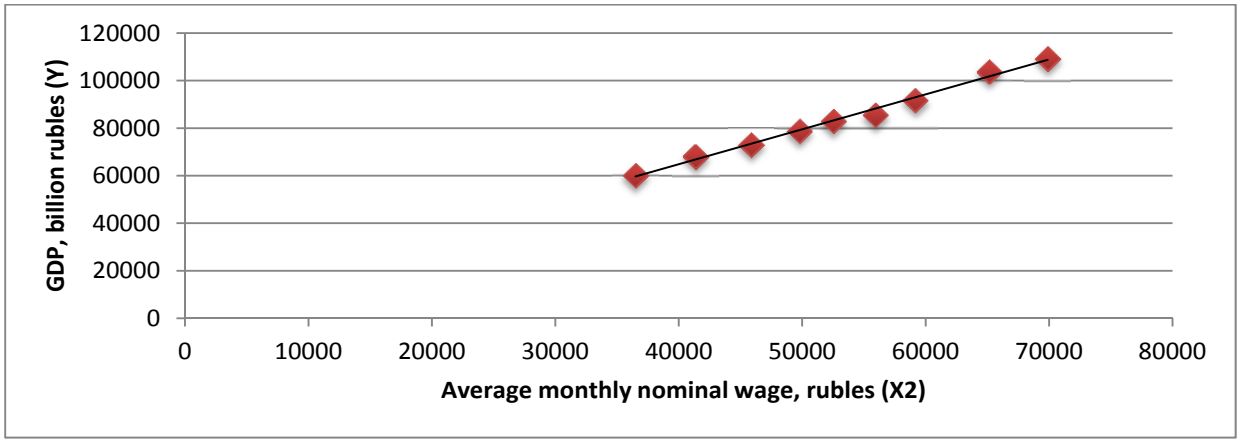

Fig. 2. **Correlation of *Y* and X_2 indicators (GDP and average monthly nominal wage)**

Source: compiled by the authors.

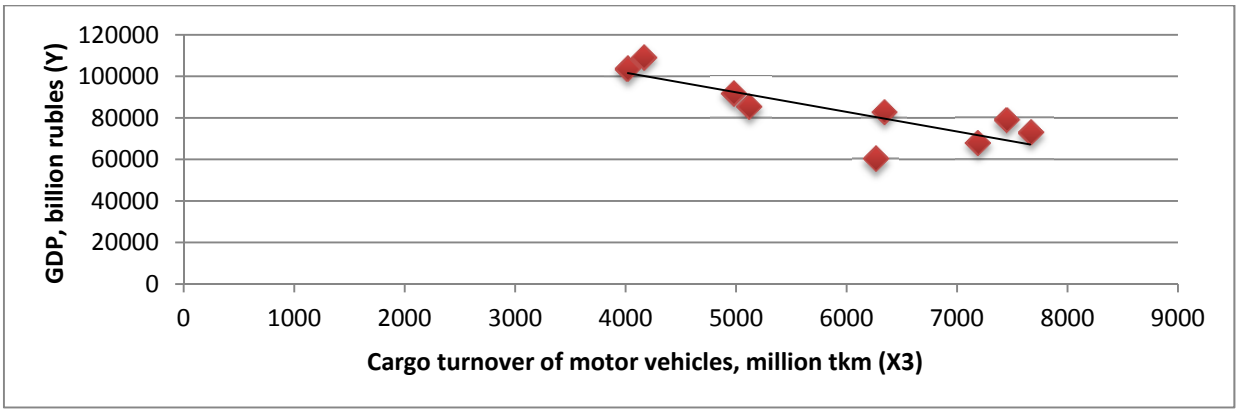

Fig. 3. **Correlation of *Y* and *X3* indicators (GDP and cargo turnover of motor vehicles)**

Source: compiled by the authors.

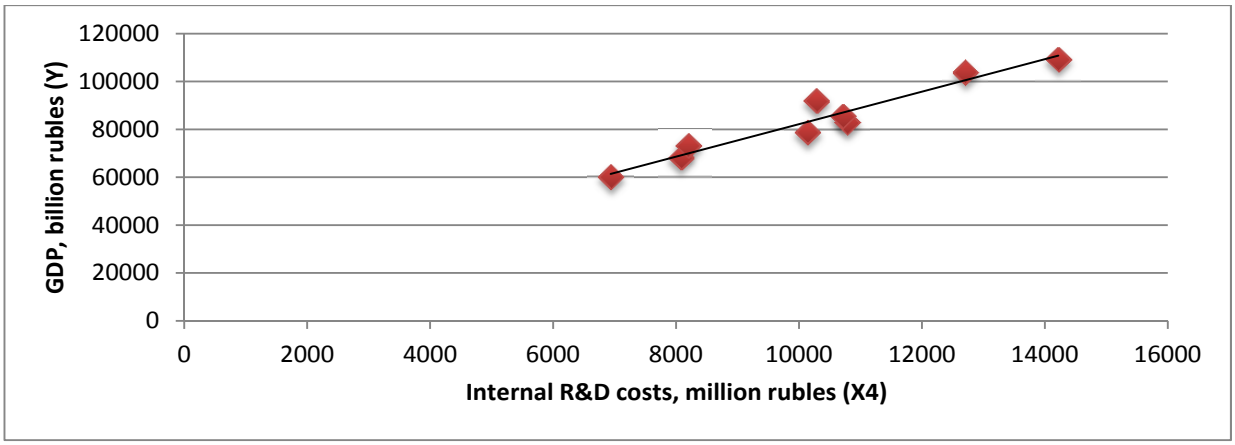

Fig. 4. **Correlation of *Y* and *X4* indicators (GDP and internal research costs)**

Source: compiled by the authors.

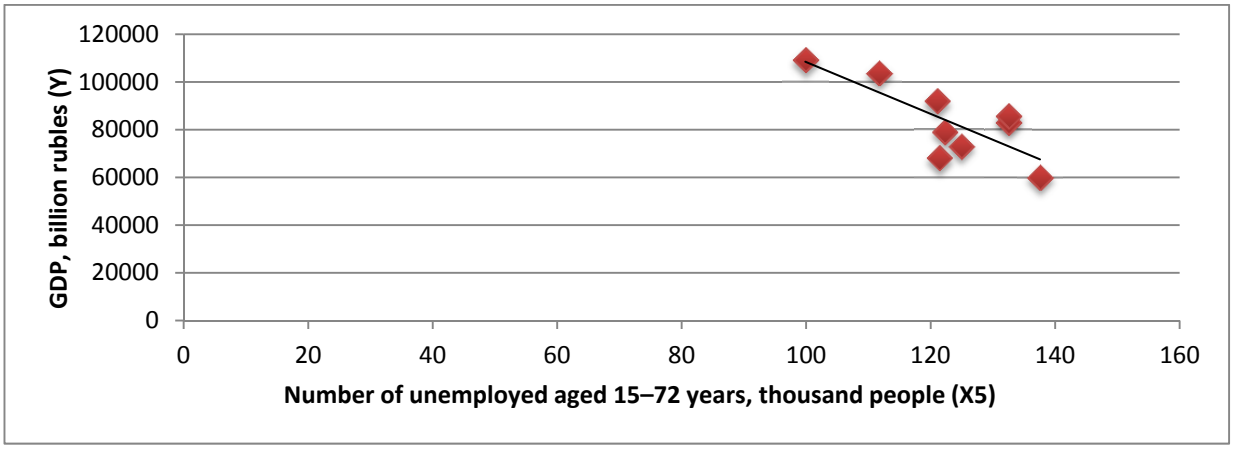

Fig. 5. **Correlation of *Y* and X_5 indicators (GDP and number unemployed aged 15–72 years)**

Source: compiled by the authors.

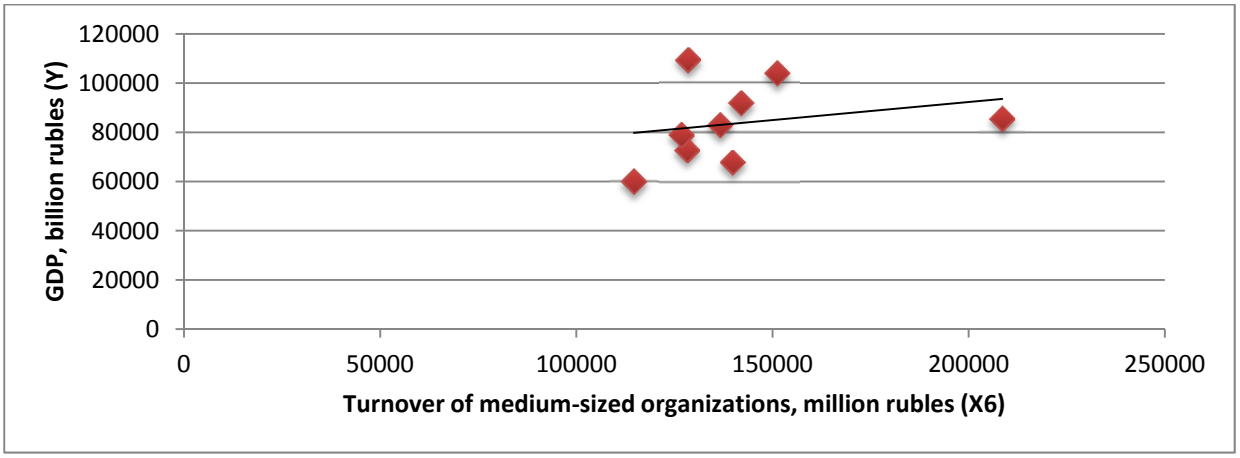

Fig. 6. **Correlation of *Y* and X_6 indicators (GDP and turnover of medium-sized organizations)**

Source: compiled by the authors.

Table 3

Correlation coefficients for X_i factors

GRP per capita, thousand rubles	Average monthly nominal accrued wages of employees for a full range of organizations in general / in the economy, RUB	Cargo turnover of motor vehicles, million tons/km	Internal research and development costs, mln rubles	Number of unemployed aged 15–72 years, thousand people	Turnover of medium-sized organizations, million rubles
X_1	X_2	X_3	X_4	X_5	X_6
0.984884129	0.996573704	–0.817637179	0.969858264	–0.780136884	0.248410145

Source: compiled by the authors.

Table 1 for those entities that are part of the Arctic zone. The results obtained, necessary for assessing the economic contribution, are presented in *Table 2*.

At *the third stage*, the actual regression analysis of the considered factors is carried out. To do this, we use the most common and reliable linear method:

$$Y_t = f(X_i) + e_t,$$

where Y — the volume of GDP; X_i — i-th factor of influence on GDP; e_t — the forecast error. Each factor X_i must be tested to see if it can be used as an independent variable.

Using the paired correlation coefficient, we will establish a close relationship between each of the selected factors separately and the volume of GDP. To do this, we will build graphs (*Fig. 1–6*).

Table 3 shows the correlation coefficients for each factor.

The graphs and correlation coefficients show that a linear relationship between GDP and the factors under consideration exists to varying degrees in all cases, except for factor X_6 — the turnover of medium-sized organizations.

For the purity of the test, we will build one-factor models and check the impact of each indicator on the volume of GDP individually. When checking the significance of the influence of the selected indicators on GDP, it was found that R squared of the X_6 — the turnover of medium-sized organizations turned out to be less than 0.5. This indicates that the model is of poor quality. The influence of this variable X also turned out to be very insignificant, less than 0.15. Given all the results, this factor will not be considered in further study. The calculation results are presented in *Table 4*.

Table 4

Analysis of GDP by the indicator "turnover of medium-sized organizations"

Regression statistics indicators	Meaning
Multiple R	0.248
R squared	0.062
Normalized R squared	–0.072
Standard error	16 638.559
Observations	9
Y-intersection	62 896.378
Variable X_1	0.147

Source: compiled by the authors.

Now, having established that five of the six selected indicators individually give satisfactory results (R-squared indicators are greater than 0.5, and the values of the X variables are greater than 1), we can perform an overall regression analysis of the linear

Table 5

Results of regression analysis of a five-factor linear model

Regression statistics	
Multiple R	0.999
R-squared	0.999
Normalized R-squared	0.997
Standard error	840.770
Observations	9

Analysis of variance

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	2063217942.801	412643588.560	583.741	0.000112
Remainder	3	2120683.272	706894.424		
Total	8	2065338626.073			

	Coefficients	*Standard error*	*t-statistic*	*p-value*	*Bottom 95%*	*Top 95%*	*Bottom 95%*	*Top 95%*
Y-intersection	3087.840	15698.249	0.197	0.857	–46870.995	53046.674	–46870.995	53046.674
Variable *X* 1	2.846	1.251	2.275	0.107	–1.136	6.827	–1.136	6.827
Variable *X* 2	0.643	0.267	2.410	0.095	–0.206	1.493	–0.206	1.493
Variable *X* 3	2.345	1.335	1.757	0.177	–1.903	6.594	–1.903	6.594
Variable *X* 4	–0.099	0.610	–0.161	0.882	–2.041	1.844	–2.041	1.844
Variable *X* 5	–37.521	54.252	–0.692	0.539	–210.176	135.133	–210.176	135.133

Source: compiled by the authors.

five-factorial model. Applying the data analysis package MS Excel, we obtain the following results, reflected in *Table 5*.

The linear model of dependence of GDP on development indicators has the following form:

$$Y = 3087.84 + 2.845X_1 + 0.643X_2 + \\ + 2.345X_3 - 0.098X_4 - 37.521X_5.$$

This model shows that the X_5 — the number of unemployed aged 15 to 72 (thousand people) — turned out to be negative. This indicates the reverse effect of this indicator on the volume of GDP, which is quite logical. The lower the unemployment rate, the greater the return to the economy. Indicator X_4 — internal costs for R&D (million rubles) — is not only negative but also tends to be zero. It turns out that this barely affects the gross domestic product. A rather strange result, given that it is scientific development and innovation that drive the economy forward. However, the specifics of the Arctic zone as an economic territory should be considered. Conducting scientific developments in the extremely harsh conditions of the North, and even with a much less developed infrastructure than in the European part of Russia, is much more expensive and often unproductive. It is more logical and cheaper to develop innovations in other regions of the country, and in the Arctic zone to engage in the direct implementation of their results [15, p. 221].

Based on the obtained model, it is possible to formulate the main priorities for the development of the Arctic zone:

The subjects of the Arctic zone have common problems that need to be addressed: these are low population density, underdeveloped infrastructure for living, insufficient development of the transport system, and the presence of environmental risks.

The presence of large volumes of hydrocarbon reserves requires adjustments to the program for the integrated development of both the Arctic zone and the rest of the mainland of Russia. One of the directions of this development was reflected in the annual message of the President of Russia to the Federal Assembly, which outlined a new goal — the construction of the Northern Latitudinal Railway, which will connect the Yamal

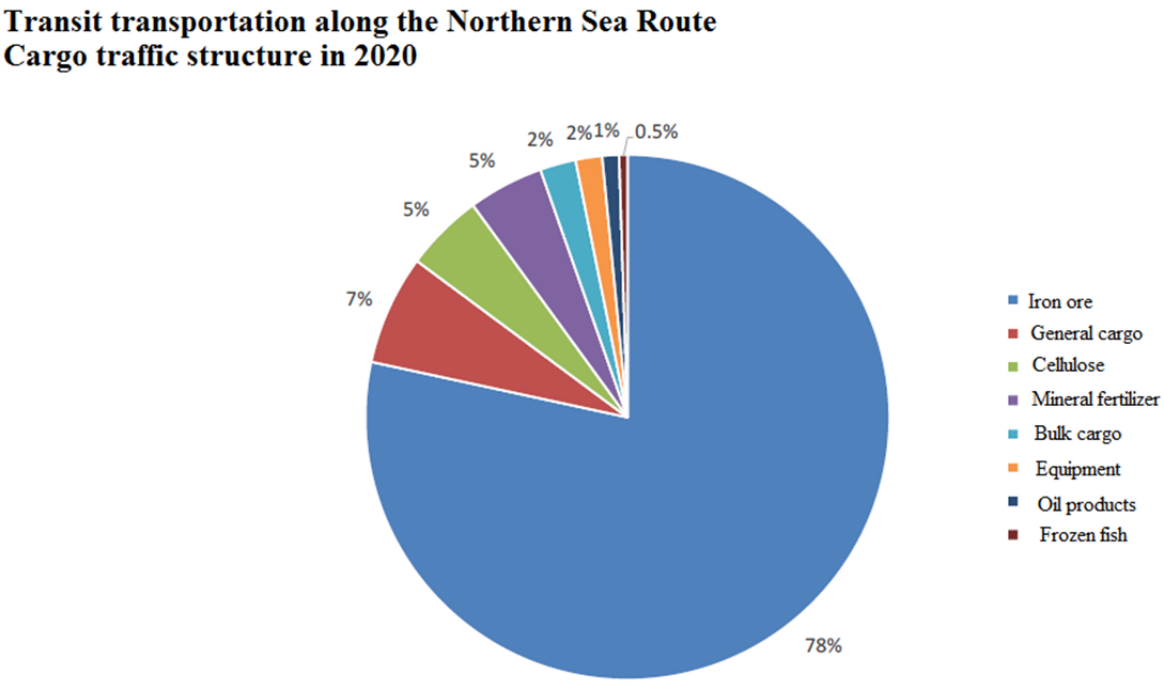

Fig. 7. **Transit traffic along the Northern Sea Route, the structure of cargo traffic in 2020**
Source: URL: https://arctic.gov.ru/wp-content/uploads/2021/02/2020.pdf (accessed on 28.10.2021).

Peninsula with the Urals by rail, which will give impetus to the economic development of this region.[4]

NORTHERN SEA ROUTE

Currently, the main driver for the development of the Arctic zone is the Northern Sea Route (NSR) [16, p. 17]. This is due to the extraction and transportation of minerals and hydrocarbons along the NSR. At the same time, it is important to understand that for Russia the NSR in the coming decades can become a source of income, in the future, able to cover the income from the export of hydrocarbons. This is due to the ever-increasing role of the NSR as an international transport artery. Several factors contribute to this.

- Melting Arctic ice and increased navigation season. If until recently ships sailed along the NSR from July to November, then the last navigation of 2020–2021 started in May and ended at the end of January. If the climate continues to change in the same direction, then year-round navigation may be opened along the NSR in the coming years.
- Nuclear icebreaker fleet. At the moment, Russia is the only country in the world that has a whole fleet of nuclear-powered icebreakers, which, moreover, will be actively replenished with new vessels that have no analogs in the next three years. Our country already now has the opportunity to provide year-round navigation along the NSR, and as the climate warms, this will be even easier.
- No bottlenecks. Up to 20% of all cargo flows from Asia to Europe now pass through the Indian Ocean and the Red Sea, ending in the Suez Canal. As recent events have shown,[5] it turned out that one dry cargo ship was enough to literally block one of the largest cargo transportation routes in the world and endanger entire sectors of the economy. There are no such bottlenecks on the NSR. The problems of one ship will not be able to stop all the cargo flows passing through it.

[4] Project for the Arctic and regional development. URL: https://yamal-region.tv/news/58122/ (accessed on 31.03.2021).

[5] URL: https://ria.ru/20210329/ever-given-1603255675.html (accessed on 31.03.2021).

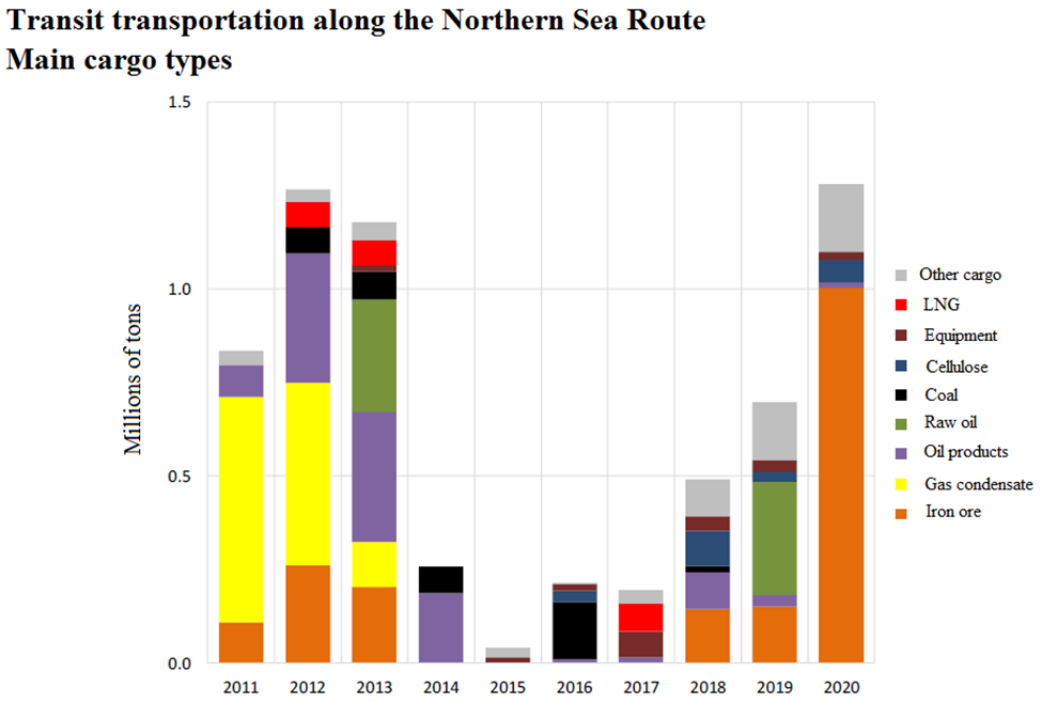

Fig. 8. **Transit transportation along the Northern Sea Route, the main cargo groups**

Source: URL: https://arctic.gov.ru/wp-content/uploads/2021/02/2020.pdf (accessed on 28.10.2021).

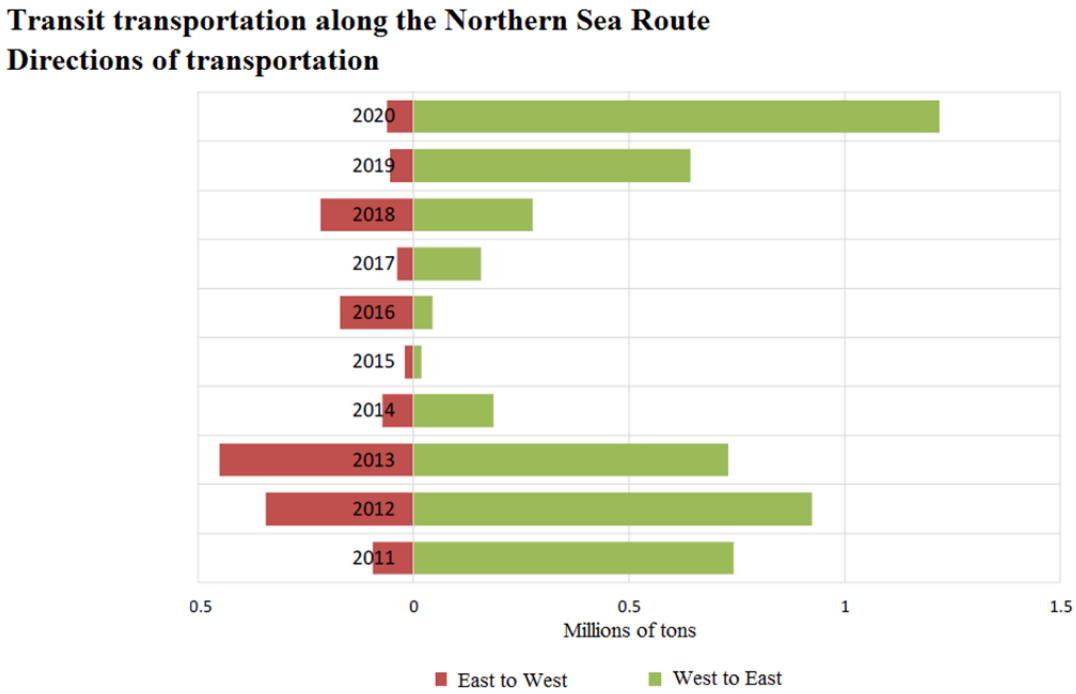

Fig. 9. **Transit transportation along the Northern Sea Route, directions of transportation**

Source: URL: https://arctic.gov.ru/wp-content/uploads/2021/02/2020.pdf (accessed on 28.10.2021).

• More relaxed environment. The traditional route from Asia to Europe, in addition to bottlenecks, passes through the territorial waters of many countries, in some of which the political situation is far from calm. In addition, Somali pirates are still active in the Red Sea area. The NSR is completely under the control of Russia, which is deprived of all these issues. Ships can safely go on their course without fear of becoming a victim of a terrorist attack, a pirate attack, or simply falling under a stray missile of another military conflict.

• Time-saving. Even considering the lower speed of vessels associated with the difficulties of navigation, the NSR is almost two times shorter than its southern competitor — 14 thousand kilometers versus more than 23 thousand kilometers.

The cargo turnover along the NSR is growing from year to year, and this was not prevented even by the outbreak of the coronavirus pandemic at the very beginning of 2020. Thus, the Directorate of the Northern Sea Route of the State Corporation Rosatom reports that in 2020, 32.97 million tons of cargo[6] passed through the NSR, which is 1.5 million tons more than a year earlier. Moreover, the Government of the Russian Federation in the federal project "Northern Sea Route" set a target of 29 million tons. In total, the task is to reach 80 million tons by 2024.

At the same time, the structure of goods transported along the NSR leaves much to be desired. As of 2020, iron ore accounts for more than three-quarters of all transit traffic. That is, the NSR is used to transport raw materials, not finished products (*Fig. 7*).

At the same time, if you look at the map of transit cargo transportation in recent years, it will be clear that the main growth is due to iron ore (*Fig. 8*).

It is no less interesting to analyze the direction of cargo flows (*Fig. 9*).

It turns out that the main cargo flow does not go from Asia to Europe, but vice versa. It is also interesting to note that over the past five years there has been a fairly large increase. Freight traffic from Europe to Asia is growing, despite the active sanctions policy of the Europeans against Russia.

Given the above, the Northern Sea Route has great prospects of becoming one of the most important trade routes in the future [17, p. 125]. Now it is important to develop the infrastructure for its service, laying the prospects for cargo flows many times, or even tens of times more than now. The development of the NSR is impossible without the development of the land territories of Russia adjacent to it, i.e. our Arctic zone [18, p. 57]. The NSR should not be cut off from other roads in the country. Therefore, it would be expedient to connect the ports of the Arctic zone of the country with railway lines, which is already being implemented. As a result, only the NSR, with a skillful approach, can have a huge multiplier effect on the economy of the whole country, and not just the Arctic zone [19, p. 158].

CONCLUSIONS

The potential opportunities possessed by the Arctic zone of Russia are only increasing every year, and a clear growth trend is demonstrated by the assets possessed by this economic zone. As the study showed, the modern Arctic policy of Russia is focused, first of all, on the formation of conditions and foundations for launching innovative projects as the basis for solving all other problems. An important feature of the economy of the modern Arctic is spatial risks that negatively affect the socio-economic development of the region. Scientific and technical capabilities make it possible to implement the most complex logistics, transport and energy plans [20, p. 667]. The authors show that economic activity in the economy of the Arctic has its own specifics. It is as a result of spatial risks in the economy of the Arctic that there is a weakening of economic ties with the more southern regions of the country, an outflow of the able-bodied population, and

[6] URL: https://www.korabel.ru/news/comments/obem_gruzoperevozok_po_sevmorputi_v_2020_godu_sostavil_okolo_ 33_mln_tonn.html (accessed on 28.10.2021).

a decrease in the export of certain types of products (for example, wood), a decrease in the import of necessary goods [21, p. 6330]. Economic activity is concentrated around large mineral projects implemented by large companies, usually with state participation, which leads to the emergence of single-industry towns. All this leads to a departure from the integrated development of the Arctic in the long term and is one of the deterrents in achieving multiplier effects. Indeed, industry restrictions cannot be ignored, primarily in the field of hydrocarbon production and transportation. All these risks create a steady demand for personnel and technologies. The search for reasonable solutions to the emerging problems of the socio-economic development of the Arctic is impossible without scientific support and innovative support.

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Anastasiya I. Kanashina — collection of statistical data.
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EAEU Countries Foreign Trade Policy: Results of Simulation Modeling

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ABSTRACT

The authors examine the impact of foreign trade on the development of the Eurasian Economic Union (EAEU). **The relevance** of the study is related to the role of foreign trade in the integration processes of the EAEU countries. **The purpose** of the study is to identify, on the basis of a modified gravity model of international trade, the possible contribution of changes in the foreign trade policy of the EAEU countries to the growth of their foreign trade. The authors apply a Pseudo-maximum likelihood estimation **method**, which is Poisson regression. Based on the results of the gravity model, covering the data of 97 countries with volumes of 95% of world GDP and 85% of international trade flows, the authors identified the potential contribution of possible changes in the foreign trade policy of the EAEU countries to the growth of their foreign trade turnover, including the reorientation of country directions. The authors gave a quantitative assessment of the foreign trade potential of the EAEU countries in trade with the main partners. The study presents an assessment of the impact on the volume of foreign trade of Belarus of its possible accession to the WTO, which could increase this volume by 11.4%. Particular attention is paid to modeling the trade potential of the EAEU countries with 40 leading trading partners. An analysis of the foreign trade of these countries shows no noticeable changes in the structure of its directions, and the foreign trade turnover continues to grow at an insufficient rate. The simulation results led to the conclusion that the EAEU countries have significant trade potential with the United States, the United Arab Emirates, Singapore, Sweden, Malaysia, Spain and Brazil, and the actual volume of trade with these countries is less than 50% of the potential. Realization of this potential requires, as shown in the study, significant changes in the foreign economic orientation of the EAEU countries and modification of foreign trade policy.

Keywords: foreign economic policy; Eurasian Economic Union; gravity model; foreign trade modeling; foreign trade potential; simulation modeling

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INTRODUCTION

In 2014, Armenia, Belarus, Kazakhstan, Kyrgyzstan and Russia created a new integration association — the Eurasian Economic Union (EAEU),[1] having gone from the implementation of a free trade regime to the formation of a single economic space. The strengthening of integration processes in the EAEU occurs simultaneously with the expansion of economic relations with third countries. The assessment of the potential contribution of possible changes in the foreign trade policy of the EAEU countries in order to promote the growth of the volumes of international trade in these countries is the aim of this study. The assessment was carried out by simulation modeling based on a modified gravity model of international trade. Particular attention in the modeling is paid to the opportunities for developing foreign trade of the EAEU countries with the main trading partners, including the largest economies: China, the USA, India, Japan, Germany, Brazil, etc. It seems important to identify the most likely or profitable areas of cooperation as future vectors for the development of foreign economic activity or the reorientation of foreign trade policy.

NEW PARADIGM OF FOREIGN ECONOMIC POLICY

The foreign trade policy of the countries with economies in transition, as they were called in the 1990s, was an important subject of study, primarily because it underwent fundamental changes in connection with the transition to a market economy and, as a result, a different development paradigm and a new state policy of these countries,[2] including a fundamentally different foreign trade policy of countries with a population of 9.1% of the world's population and almost 56% of the population of Europe, which was "open" to the whole world and transferred to economic life according to the laws of functioning of market mechanisms. These essential changes could not but be the focus of attention of many Western researchers, as well as international organizations in the last decade of the 20th century and at the turn of the century. The transition to a foreign economic policy corresponding to that adopted in states with a market economy was even called trade integration of the countries of Western and Eastern Europe [1]. The task of integrating these countries into the multilateral trading system [2] was also discussed, and the issue of trade with these countries (*SUEE*)[3] as called "of paramount importance" [3].

The radical liberalization of foreign trade in Central and Eastern Europe since 1989 has become a key part of economic reform and has been accompanied by a full-scale geographic reorientation of international trade from East to West. At the same time, the expansion of trade with the EU caused only "surprisingly small changes" in the structure of this trade [4]. As noted in [5], even against the backdrop of sanctions, trade with the EU continued to play an incomparably more important role for Russia in 2019 compared to trade with the EAEU, both in terms of imports (by 4.3 times) and exports (by 4.8 times). Along with the growth of the entire foreign trade turnover of Russia in 2021 compared to 2020 by 38.5%, the share of EU countries in this turnover increased by 2.2 p.p.[4]

Offering in this article a study of the foreign trade policy of the EAEU countries, it is necessary to answer the question: what did this reorientation mean and should the EAEU member countries strive to abandon it, whose foreign trade with the EU countries still occupies the main place and, in general, can contribute to strengthening or slowing down the integration of the EAEU

[1] Treaty on the Eurasian Economic Union. Signed in Astana on May 29, 2014 (as amended on March 15, 2018), entered into force on January 1, 2015.

[2] The foreign economic activity of the CMEA countries was cut off from the world market.

[3] Former Soviet Union and Eastern Europe.

[4] Calculated according to the data of the Eurasian Economic Commission. URL: http://www.eurasiancommission.org/ru/act/integr_i_makroec/dep_stat/tradestat/tables/extra/Pages/2021/12.aspx (accessed on 17.03.2022).

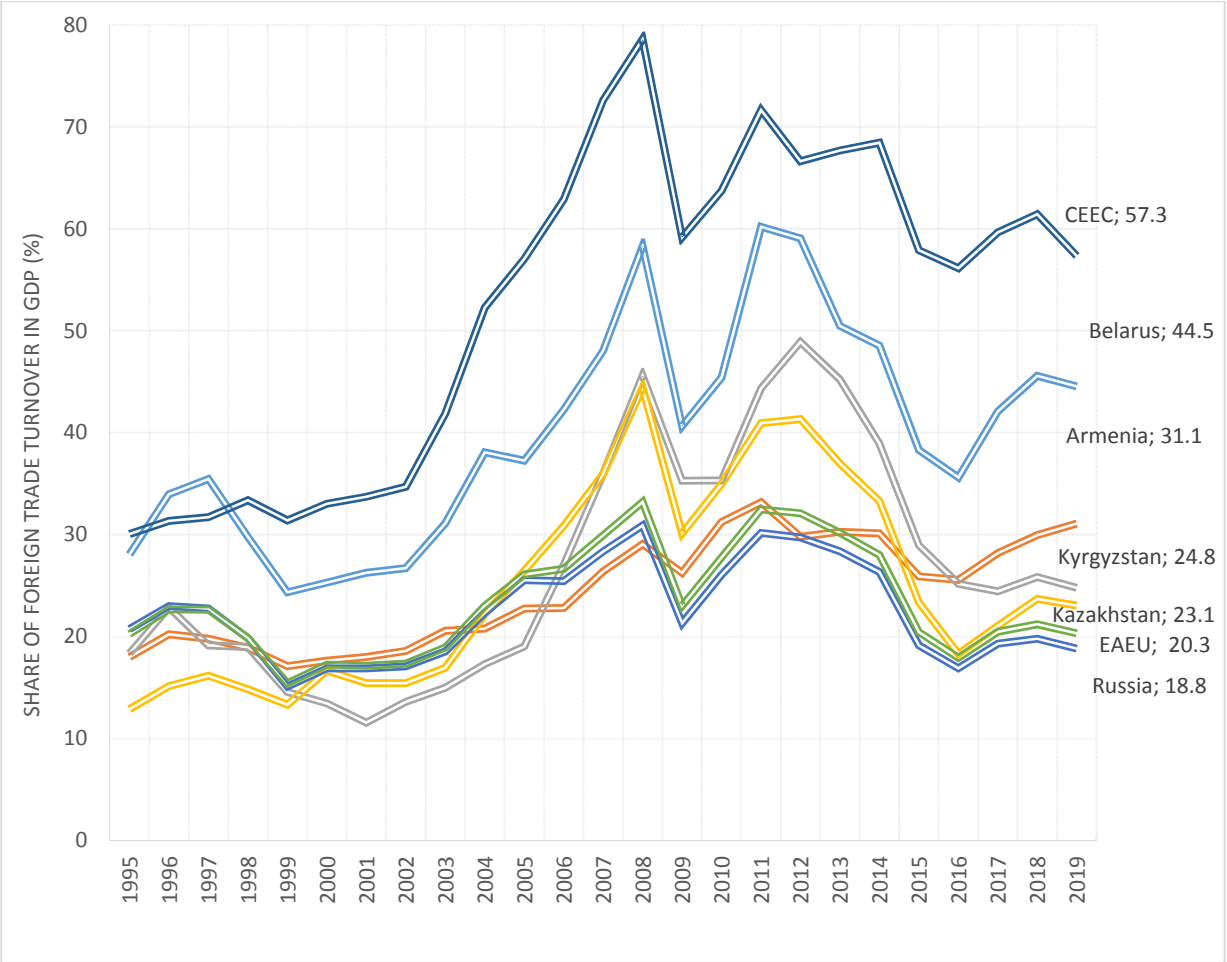

Fig. 1. **Foreign trade turnover of the EAEU and CEE countries**

Note: GDP adjusted for Purchasing Power Parity based on data for EAEU, taking into account intra-EU trade in goods.

Source: compiled by the authors based on the World Bank, World Development Indicators.

member countries. A number of researchers note that numerous contradictions in the coordination of approaches to the foreign economic policy of the EAEU countries do not allow realizing the integration potential of this bloc [6].

In the 30 years since the beginning of the transition to a market economy, the countries of Central and Eastern Europe (CEE or CEEC) and the EAEU have made progress in many areas, including in the field of foreign trade policy and institutional reforms [7]. In the CEE countries that joined the EU in the mid-2000s, there was a significant increase in the volume of international trade and its share of GDP. From 1995 to 2019 in the CEE countries, the share of foreign trade turnover of GDP almost doubled (from 30.1 to 57.3%), in the EAEU countries it remained unchanged (*Fig. 1*),[5] which corresponds only to the global average.[6]

These different patterns of participation of CEE and EAEU countries in international trade are widely discussed in the research literature. The focus is on identifying the reasons why these countries, which initially had very similar conditions, began to observe such different dynamics of foreign trade. Subsequently, the growing differences between these countries in the dynamics and volumes of international trade gave rise to a discussion about the role of various factors in this process: geographical, political, institutional [8, 9], historical, social [10], and others.

[5] 1995 was chosen as the base year due to the lack of data for a number of countries for an earlier period.

[6] International trade and development. Report of the Secretary General. A/74/221. UN, 2019, p. 3.

Table 1

Exports of the EAEU countries to the EU (euro, share)

Countries	2015		2016		2017		2018		2019		2019/ 2015**
	Mln	%	Mln	%	Mln	%	Mln	%	Mln	%	%
Belarus	3,725	2.4	2,948	2.2	3,387.6	2.0	4,433.1	2.3	4,256.9	2.3	14.3
Russia	136,442	87	118,962	88.1	144,686	87.0	168,929.1	86.7	157,808.7	86.7	15.7
Kazakhstan	16,247	10.4	12,762	9.4	17,612.4	10.6	20,547.6	10.5	18,811.9	10.3	15.8
Kyrgyzstan	51	0	73	0.1	165.6	0.1	632.4	0.3	820.0	0.5	16.1 times
Armenia	305	0.2	351	0.3	391.0	0.2	372.8	0.2	406.3	0.2	33.2
EAEU	156,770	100	135,096	100	166,242.6	100	194,915.0	100	182,103.8	100	15.8

Notes: * — the country's share in the total volume of EAEU exports to the EU; ** — increase in the volume of exports for the period.
Source: compiled by the authors based on the Eurostat. URL: https://ec.europa.eu/eurostat/data/database / (accessed on 01.07.2021).

Summing up the results of research on this topic, we can come to a common opinion on two issues. Firstly, the combination of specific characteristics of these countries has mainly contributed to the emergence of such differences in international trade between these groups of countries. Secondly, both the CEE countries and the EAEU countries are involved in international trade at a level below their potential. The main reason for the discrepancy between the dynamics of foreign trade between the CEE countries and the EAEU is seen as the fact that the CEE countries have adopted trade rules[7] used by the "old" EU-15, which brought them tangible benefits, and integration into the EU structures accelerated their development, and they became the main trade and investment partners of the European Union [11]. Although the influence of the integration development of the CEE countries as EU members can be considered dominant, the growth in foreign trade activity of the two groups of countries could be promoted in different ways by the duration of participation in the WTO: the CEE countries joined mainly in 1995–1996, and the largest economies of the EAEU — in 2012 (Russia) and 2015 (Kazakhstan), while Armenia (2003) and Kyrgyzstan (1998) are much earlier. Although the work [12] does not confirm such a role of the WTO.

The positive experience of the CEE countries in the available works, summing up a fairly significant result of the foreign economic activity of these countries, includes issues of trade integration [13, 14], as well as a deep analysis of the impact of the crisis [15]. In addition, there are special works on the generalization of scientific publications on the issues of foreign economic activity of the CEE countries [16].

There are also significant differences between the EAEU countries in the dynamics of foreign trade with the EU countries, which continues to dominate compared to trade between the EAEU countries themselves, the growth rate of which did not accelerate during the first 5 years of its existence of the integration association. In [17], an analysis based on trade complementarity indices led to the conclusion that there is no growth trend for these indices in the mutual trade of the EAEU member countries. Experts also note that although the countries of Central Asia import more goods from Russia than from China, the share of Russia in China's imports has remained insignificant (up to 2%) for

[7] A significant role was played by free trade agreements between the CEE countries and the EU (1992) and the Baltic countries and the EU (1994), which made these countries the main trading and investment partners of the EU [14, p. 36].

Table 2

Imports of the EAEU countries from the EU (euro, share)

Countries	2015		2016		2017		2018		2019		2019/ 2015**
	Mln	%	Mln	%	Mln	%	Mln	%	Mln	%	%
Belarus	5700	6.6	4981	6.0	6035.6	6.2	6450.5	6.5	6851.3	6.5	20.2
Russia	73786	85.2	72369	86.9	85990.0	87.6	85099.1	86.4	90759.6	86.4	23.0
Kazakhstan	6196	7.2	5075	6.1	5082.9	5.2	5832.4	5.9	6324.3	6.0	2.1
Kyrgyzstan	270	0.3	238	0.3	293.1	0.3	284.9	0.3	334.0	0.3	23.7
Armenia	631	0.6	604	0.7	717.3	0.7	862.7	0.9	801.4	0..	27,0
EAEU	86583.6	100	83266.2	100	98118.9	100	98529.6	100	105070.6	100	21.4

Notes: * — the country's share in the total volume of EAEU imports to the EU; ** — increase in the volume of imports for the period.
Source: compiled by the authors based on the Eurostat. URL: https://ec.europa.eu/eurostat/data/database (accessed on 01.07.2021).

many years, just like the countries of Central Asia [18].

Let us consider the dynamics of foreign trade over the 5 years of the existence of the integration union (*Table 1*).

Despite fluctuations in exports to the EU countries, the EAEU as a whole celebrated its fifth anniversary with export growth that exceeded the growth of other macroeconomic indicators,[8] although it was inferior to the growth of imports, with the exception of Kazakhstan, which managed to increase exports with a very low increase in imports. Exports in Armenia were more than 2 times higher compared to the largest economies of the EAEU and had an "explosive" character in Kyrgyzstan — an increase of 16.2 times. The experience of Kyrgyzstan deserves special attention, whose exports to the EU in 2015 were 4 times lower than those of Armenia, and in 2019 began to exceed its exports by 2 times.

If the dominant share of Russia in exports to the EU countries during the period of the existence of the EAEU remained approximately at the same level until 2022, then in the dynamics of imports after the recession of 2015, the share even increased by more than 1 p.p. (*Table 2*). At the same time, the volume of imports tends to grow in all countries except Armenia in 2019 (–7.1%), while the share increased by just over 1 p.p. in Russia and similarly declined in Kazakhstan. Over the 5-year period of the functioning of the EAEU, the highest growth rates of imports (%) from the EU countries were in Armenia (127.15) and Kyrgyzstan (123.5), while Russia ranks 3rd (123.0).

Kazakhstan differs in its foreign trade policy from other EAEU countries, since the increase in imports over the same period was only 2.2, in Belarus — 21. Summing up the results of the fifth anniversary of the formation of the EAEU, experts note that although "... the EAEU contributes to the development of the economy of Kyrgyzstan in the framework of international economic cooperation in the post-Soviet space", there is a "parallel cooperation in foreign economic activity ... in the southeast direction, in which China and Turkey are the leaders" [19, p. 62]. Even before the formation of the EAEU, Kazakhstan's exports to the EU grew from 2003 to 2014 by almost 6 times, and imports from the EU — by 4 times, and the EU has become the leading trading partner of Kazakhstan, ahead of Russia and China [20].[9]

[8] GDP growth (USD PPP in 2011) for the EAEU as a whole amounted to 4.8% in 2015–2018, in Russia as the dominant economy in the community — 4.3%, in the fastest growing economies of Armenia and Kyrgyzstan — more than 13%.

[9] These trends may intensify in the coming period due to the 2022 sanctions.

Before proceeding to justify the choice of a research model to identify the impact of free trade agreements (*FTA*)[10] on the foreign trade turnover of countries, it should be noted that the authors share the point of view stated in [21] on the importance of the impact of trade policy on international trade and explore in their work the impact possible changes in the foreign trade policy of the EAEU countries on the dynamics of the foreign trade turnover of these countries.

CHOICE OF RESEARCH MODEL

Simulation modeling based on a modified gravity model of international trade makes it possible to identify the potential contribution of changes in the foreign trade policy of the EAEU countries to international trade and to assess the possibilities for developing foreign trade of the EAEU countries with other countries and the most probable directions of this trade. The model also allows separately testing of the potential impact on the volume of international trade of the EAEU countries of the conclusion of a free trade agreement (FTA) between the EAEU and the EU, between the EAEU and China, as well as on the external trade of Belarus if this country joins the WTO. In addition, an assessment is made of the impact on international trade of the quality of the country's institutions, measured by indicators of the quality of public administration developed by experts from the World Bank (WB) [22]. In addition to these variables, the specification includes a broad set of control variables measuring geographic distance, border influence, the landlocked status of the importing country, and colonial trade linkages, as past colonial status can translate into the current higher levels of trade [23].

The approach proposed by J. Anderson and E. van Wincoop [24] was used as a theoretical basis for the specification of the gravity equation. This approach is based on the constant-elasticity of substitution utility function and complete specialization of production across countries. According to the well-known gravity equation, which includes symmetrical trade costs, the volume of bilateral trade between countries is a function of the level of income in these countries, the vector of transport and trade costs between them, and the level of each country's propensity to trade with other countries. J. Anderson and E. van Wincoop call this level "multilateral trade resistance" [24]. In logarithmic form, the function has the following form:

$$\ln X_{ijt} = \alpha + \beta \ln Y_{it} + \gamma \ln Y_{jt} + \delta \ln D_{ij} + \varsigma C_i + \eta C_j, \quad (1)$$

where X_{ij} denotes the volume of exports from country i to country j; Y_i and Y_j — the GDP of countries i and j, respectively. D_{ij} is a vector of bilateral transport and trade barriers, while C_i and C_j are participants in multilateral trade resistances. In our case, of particular interest is the determination of the coefficients of the vector D_{ij} and the constants C_i and C_j.

The obtained results of the values of the coefficients from equation (1) are used to model the impact that a change in the values of one of the components of the vector D_{ij} will have on the volume of foreign trade for a particular country. In particular, an assessment will be made of the consequences for the international trade of the EAEU countries under a hypothetical scenario in which these countries enter into an FTA with the EU countries or with China. Gravity model estimates make it possible to cover the consequences of the impact on the volume of foreign trade of Belarus in the event of accession of this country to the WTO.

The definitions of the components of the D_{ij} vector and sources of initial data for all variables used in our study are given in the Appendix (*Table A1)*.

The D_{ij} consists of the following components:

geographical distance — the population-weighted distance in kilometers between countries i and j ($DIST_{ij}$);

the border effect — a dummy variable indicating the presence or absence of a

[10] Free trade agreement — free trade agreement, hereinafter referred to as "FTA".

common border between two countries ($COMB_{ij}$);

landlocked — a dummy variable showing whether the importing country is landlocked ($LDLC_j$);

foreign trade policy: measured by the fact that two trade counterparty countries (WTO_{ij}) are members of the WTO at the same time.

In addition, the impact of the fact of concluding an FTA on bilateral trade flows (FTA_{ij}); is taken into account; the quality of institutions, as the arithmetic mean value of three indicators of the quality of public administration, namely: indicators of the rule of law, fight against corruption and government effectiveness ($INST_i$ и $INST_j$); colonial linkages — as the presence or absence in the past of colonial linkages between trading partners (COL_{ij}).

Along with ordinary least squares (OLS) estimates, the paper uses the pseudo-maximum likelihood estimation method, which is Poisson regression, which allows for solving the problem of heteroscedasticity.[11] The coefficients resulting from the Poisson regression estimates can be easily used for simulation modeling due to the absence of Jensen's inequality issues. For the Poisson regression estimate, the underlying model is given in the following exponential form: $y_i = \exp[(x_i'\beta) + v_i]$, ensuring that y_i is not negative. The econometric specification of the complete model proposed by us in exponential form has the following form:

$$\begin{aligned} X_{ijt} = \exp(&\alpha_1 \ln(POP)_{it} + \alpha_2 \ln(POP)_{jt} + \\ &+ \alpha_3 \ln(GDP)_{it} + \alpha_4 \ln(GDP)_{jt} + \alpha_5 INST_{it} + \\ &+ \alpha_6 INST_{jt} + \alpha_7 COMB_{ij} + \alpha_8 COL_{ij} + \\ &+ \alpha_9 \ln(DIST)_{ij} + \alpha_{10} LDLC_j + \alpha_{11} FTA_{ijt} + \\ &+ \alpha_{12} WTO_{ijt} + \alpha_{13} C_i + \alpha_{14} C_j + \varepsilon_{ijt}). \end{aligned} \quad (2)$$

The definition of the variables of this equation is given in the *Appendix* (*Table A1*). It should be noted that the border effects, colonial linkages, distance between countries and access to the sea, characterized by the variables $COMB_{ij}$, COL_{ij}, $DIST_{ij}$, and $LDLC_j$, unlike other variables, are constant over time. Our sample includes, in addition to the 5 EAEU countries, 92 countries: emerging economies and all OECD countries, covering approximately 95% of global GDP and 85% of total international trade flows for 2000–2019.

RESULTS AND DISCUSSION

The results of the estimates obtained on the basis of the application of the model are given in *Table 3*: using the least squares method (columns 1–2) and pseudo-maximum probability (columns 3–5). All submitted specifications, with the exception of columns 1 and 3, are estimated using the fixed effects of importers and exporters.[12] The specification samples of columns 1–2 and 5 do not include cases in which the volume of bilateral trade is 0. The results show that the specification presented in column 4 is preferred (pseudo coefficient of determination is 0.92).

Since there is no a priori relationship between exports and the population of the exporting country, the elasticity coefficient of the population variable introduced into the model to explain the relationship between the size of the exporting country's market and exports can be negative or positive, depending on whether the sample is dominated by countries that export less as their population grows (absorptive capacity) or countries that export more (economies of scale). In our case, the coefficients of the population variables in the preferred specification are negative for both the exporting country and the importing country.

According to the results of the preferred specification (column 4 of *Table 3*), the GDP elasticity coefficients of exporting and importing countries are 0.67 and 0.51, respectively. In addition to these determinants of international trade, which naturally dominate since net exports are a part of GDP,

[11] If the variance of the error in the regression equation changes from observation to observation, the least squares method must be subjected to some modification, otherwise erroneous conclusions are possible.

[12] The applied pool model (1 and 3) for panel data can give conflicting estimates, since in the case of estimates of trade in pairs of countries, the presence of individual characteristics of an object that is stable over time is obvious.

Table 3

Results of regression estimates

Dependent variable:	Bilateral trade volume, X_{ij}				
	OLS		Poisson		
		FE		FE	$X_{ij} > 0$
Independent variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Population, $LnPOP_i$	0.456 (0.038)***	−0.445 (0.106)***	−0.144 (0.068)**	−0.345 (0.119)***	−0.36 (0.121)***
Population, $LnPOP_j$	0.194 (0.029)***	0.06 (0.078)	0.057 (0.031)*	−0.063 (0.029)**	−0.062 (0.034)*
GDP PPP, $LnGDP_i$	0.842 (0.036)***	0.773 (0.048)***	0.997 (0.059)***	0.668 (0.046)***	0.667 (0.046)***
GDP PPP, $LnGDP_j$	0.825 (0.028)***	0.844 (0.044)***	0.801 (0.061)***	0.509 (0.048)***	0.507 (0.048)***
Quality of Institutions, $INST_i$	1.057 (0.032)***	0.221 (0.048)***	0.215 (0.047)***	−0.235 (0.050)***	−0.245 (0.051)***
Quality of Institutions, $INST_j$	0.519 (0.028)***	0.112 (0.044)**	0.431 (0.037)***	0.026 (0.015)*	0.015 (0.08)*
Landlocked Importer, $LDLC_j$	−0.433 (0.056)***		−0.158 (0.081)*		
Common border, $COMB_{ij}$	1.29 (0.107)***	0.601 (0.108)***	0.658 (0.095)***	0.462 (0.064)***	0.461 (0.064)***
Colonial linkages, COL_{ij}	0.809 (0.116)***	0.954 (0.101)***	−0.036 (0.019)*	0.197 (0.091)**	0.193 (0.091)**
Distance between countries, $LnDIST_{ij}$	−1.226 (0.025)***	−1.614 (0.028)***	−0.673 (0.041)***	−0.782 (0.034)***	−0.786 (0.035)***
Participation of two countries in FTA, FTA_{ij}	0.621 (0.047)***	0.563 (0.046)***	0.312 (0.075)***	0.467 (0.051)***	0.457 (0.052)***
Participation of two countries in the WTO, WTO_{ij}	0.287 (0.046)***	0.168 (0.054)***	0.051 (0.067)	0.11 (0.041)***	0.118 (0.041)***
Constant	−9.798 (0.418)***	1.032 (0.561)*	−11.856 (0.739)***	−0.839 (0.425)*	−0.687 (0.527)
Number of observations	162,911	162,911	184,712	184,712	162,911
R^2 or pseudo-R^2	0.69	0.77	0.87	0.92	0.91

Notes: in parentheses are robust standard errors, clustered by country pairs; */**/*** — significance levels: 10/5/1% respectively.
Source: authors' calculations.

the effects of institutional, geographical and trade variables are also important.

The impact of the quality of national institutions on international trade is also statistically significant. At the same time, in the preferred specification, the coefficient for the quality variable of institutions of exporting countries, in contrast to the coefficient for a similar variable of importing countries, takes a small negative value. This may be due to the fact that these indices do not fully reflect the specifics of institutions that affect foreign trade.

The asymmetry between the coefficients of institutional characteristics of exporting and importing countries is of particular interest, but we have no clear explanation for this. One possible reason could be that the quality of institutions matters more to importers than to exporters since trust in the contracting system in the importer's country determines the propensity of suppliers to trade with buyers.

With regard to various trade and transport barriers, we estimate that the presence of a common border and colonial linkages leads to an increase in trade volumes by 46% and 20%, respectively. And geographical distance has a strong negative impact on bilateral trade flows. Thus, an increase in the distance between exporting countries and importing countries by one percent leads to a decrease in trade volumes by about 0.8%. Finally, the coefficient of the landlocked importing country variable has an expected negative sign (a 15% decrease in trade volume[13]), because trade with landlocked countries is associated with higher trade costs.

The results also show that more liberal trade policies lead to better integration. Thus, the volume of trade between two countries — members of the WTO, other things being equal, is more than 12% higher than the volume of trade between countries, at least one of which is not a member of the WTO. And the signing of an FTA between countries leads to an increase in bilateral trade by about 60%, which is lower than the estimates obtained by A. Subramanian and S.-J. Wei [25] about 80%, and K. Jochmans and V. Verardi [26] — from 61 to 117%. However, it is important to note that these estimates may be overestimated due to the issue of trade policy endogeneity. In the case of countries that foresee an increase in mutual trade in the future and enter into an FTA, empirical estimates that do not consider the problem of endogeneity overestimate the impact of the FTA on trade flows.

RESULTS OF POSSIBLE CHANGES IN THE FOREIGN TRADE POLICY OF THE EAEU COUNTRIES

The results obtained became the basis for conducting simulations to identify the potential contribution of changes in the foreign trade policy of the EAEU countries to promoting an increase in their foreign trade, which has not been given sufficient attention, as well as to assess the potential of the EAEU country in trade with countries that are major trading partners. All of these simulations were performed based on the regression results presented in column 4 of the *Table 3*.

First, the impact of a possible signing of an FTA between the EAEU and the EU and between the EAEU and China was considered. *Fig. 2* shows that the share (%) of exports of the EAEU countries to the EU countries in the total exports of these countries is almost 4 times higher (40.1) than the same indicator with China (12.4). The largest share of exports to China in the total exports among the EAEU countries falls on the largest economies — Russia (13.1) and Kazakhstan (13.6), and the smallest share — on Belarus (2), and the largest share is occupied by Kazakhstan in terms of the share of exports to the EU countries (42), which is 0.2 p.p. concedes to Russia (41.8), the least — to Kyrgyzstan (2.6).

The gain from increased trade for the EAEU countries due to the signing of an FTA between the EAEU and the EU, the EAEU and China or for Belarus due to WTO accession was calculated by multiplying the average gain (the value of the coefficient of the corresponding variable) obtained from the regression estimate and the corresponding

[13] 1– (exp (–0.158)) = 0.15.

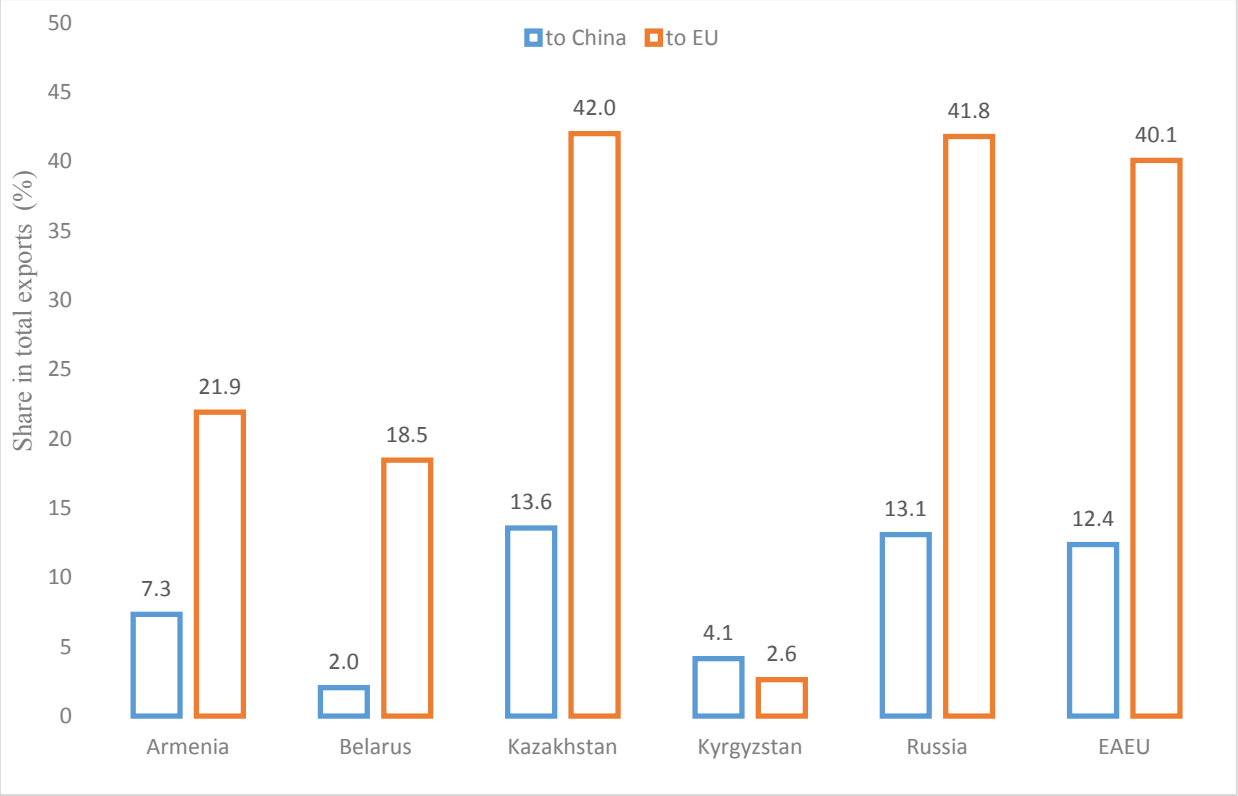

Fig. 2. **Share of export volumes of EAEU countries to China and to EU countries in their total export volume, 2019**

Source: compiled by the authors based on the IMF, Direction of Trade Statistics.

shares of trade volumes. The calculation equation has the following form:

$$TG_{EEU5} = \left(\left(\exp\left(C\,\mathrm{var}_{\mathrm{var}} \times VAR\right) - 1\right) \times 100\right) \frac{\sum_{i=1}^{n}\sum_{j=1}^{m} Tr_i^m}{\sum_{i=1}^{n} Tr_i^{all}},$$

where $EEU5$ — EAEU countries trading with m free trade agreement countries or WTO members in the case of Belarus.

According to our calculations, the largest increase in export volumes since the signing of the FTA between the EAEU countries and the EU will be observed in Kazakhstan and will amount to 25% compared to 24% on average for all EAEU countries. For comparison, the volume of exports of Russia, Armenia, Belarus and Kyrgyzstan will increase by 24.9%, 13%, 11% and 1.6%, respectively. These are quite significant growth volumes, reflecting both the significant impact that the conclusion of an FTA could have on bilateral trade flows between these countries, and the current situation in which the EU traditionally holds a dominant position in the external trade of the EAEU countries.

If an FTA is signed between the EAEU and China, the largest increase (%) in foreign trade among the EAEU countries will be observed in Kazakhstan (8.1) and Russia (7.8). For Armenia, Kyrgyzstan and Belarus, the corresponding increase in trade volumes will be 4.4, 2.5 and 1.2, respectively.

An assessment was made of the impact on the volume of foreign trade of Belarus of its accession to the WTO: it will increase by 11.4%, which significantly exceeds the growth of the EAEU from the conclusion of an FTA with China.

Based on the obtained results of the gravity equation, the trade potential of the EAEU countries was modeled with 40 countries from our sample, the volume of exports of the EAEU countries with which in 2019 amounted to more than 1.7 billion US dollars.

Based on the obtained results of the gravity equation, the trade potential of the EAEU countries was modeled with 40 countries from

Table 4

The ratio of the volumes of actual trade of the EAEU countries with the main trading partners to their potential level, %

	Armenia	Belarus	Kazakhstan	Kyrgyzstan	Russia	EAEU
USA	22	5	9	1	18	16
UAE	115	21	31	24	19	22
Singapore	5	8	21	0	36	32
Sweden	3	8	24	0	37	33
Malaysia	3	45	75	0	29	36
Spain	1	2	194	0	27	41
Brazil	0	192	7	0	46	48
India	6	60	53	3	50	51
Japan	2	3	26	0	59	52
France	10	9	227	1	44	58
Israel	35	54	125	0	51	59
Norway	0	66	3	1	62	59
China	117	31	52	20	69	66
Austria	14	5	1	1	86	72
UK	8	170	26	1824	75	80
Germany	43	47	10	12	93	82
Belgium	115	31	28	36	95	85
Denmark	7	12	8	0	113	96
Ukraine	99	453	173	103	64	96
Hungary	4	38	3	1	123	105
Poland	35	91	81	9	112	108
Estonia	14	97	6	28	115	110
Finland	0	7	51	2	120	112
Czech Republic	19	32	21	2	135	116
Azerbaijan	0	479	97	96	111	119
Switzerland	2508	9	505	32	79	119
Romania	1	26	492	11	92	120
Italy	63	8	522	1	98	130
Slovakia	3	47	1	1	185	156
Korea	2	9	169	0	163	157
Lithuania	53	285	272	625	134	157
Egypt	0	69	4	4	201	171
Greece	2	3	513	9	168	189
Latvia	86	154	49	128	218	205
Turkey	2	21	208	322	221	206
Algeria	0	10	60	0	253	217
Bulgaria	2185	78	219	200	222	224
Uzbekistan	49	323	345	536	258	285
Netherlands	258	84	377	4	400	374
Mongolia	196	497	170	257	667	605

Source: authors' calculations.

our sample, the volume of exports of the EAEU countries with which in 2019 amounted to more than 1.7 billion US dollars.

The trade potential of the EAEU countries was calculated as the ratio of actual to potential (potentially possible) export volumes of these countries. The potential volume of foreign trade (export) was calculated as the sum of linear forecasting indicators by regression coefficients. In this case, the forecast value is calculated for each pair of countries separately. The equation for estimating the potential is the following:

$$TP_{EEU5} = \frac{\sum_{e=1}^{5}\sum_{j=1}^{5} FACT_j^e}{\sum_{e=1}^{5}\sum_{j=1}^{5}\left(\exp\left(\Pr_j^e\right)\right)} \times 100,$$

where e — the EAEU countries; j — trading partners of the EAEU countries. For modeling, the actual values of macroeconomic indicators of these countries for 2019 and statistically significant coefficients of regression variables were used (column 4, *Table 3*).

The results presented in *Table 4* show that the EAEU countries have the greatest potential for increasing trade turnover with the United States,[14] the United Arab Emirates, Singapore, Sweden, Malaysia, Spain and Brazil. According to our calculations, the real volume of trade with these countries is less than 50% of the potential level of trade with them. At the same time, there are significant differences between the EAEU countries in the possibilities of realizing their foreign trade potential. With all of the above countries, with which the EAEU countries have the largest reserve for increasing foreign trade volumes, in three cases (Armenia with the UAE, Kazakhstan with Spain and Belarus with Brazil), not only the trade potential was fully realized, but also its level exceeded from 1.1 to 1.9 times.

CONCLUSIONS

Based on the modeling results, it was concluded that the EAEU countries have a significant untapped trade potential with the United States, the United Arab Emirates, Singapore, Sweden, Malaysia, Spain and Brazil. The realization of this potential requires significant changes in the foreign economic orientation of the EAEU countries. If the CEE countries, in order to become full partners in the single European market, "had to revise the rules of their foreign trade and adopt all the laws and instruments of the EU trade policy towards third countries" [14], then the EAEU countries will conclude free trade agreements with third countries jointly, as was the case with Vietnam in 2016, based on mutual interests.

The analysis carried out, firstly, contributes to the disclosure of the factors necessary for the EAEU countries to most effectively use the opportunities provided by the process of international integration. Secondly, it provides quantitative estimates of the trade potential of these countries, which helps to identify priority areas. Calculations have shown that Belarus' accession to the WTO can give a significant impetus to its foreign trade.

The applied significance of the work lies in the fact that it allows government agencies to make changes in foreign trade policy, including the reorientation of the main country directions of trade, which can help build up foreign trade potential with the same volumes of domestic production and thereby give impetus to their further development.

[14] It should be noted that US imports from Russia (according to the US data) are usually two to three times higher than Russian exports to the US (according to the Federal Customs Service). The fact is that a significant part of Russian oil supplies goes by selling it (mostly) to Dutch traders. Russian statistics include this in exports to the Netherlands, and American statistics in imports from Russia.

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APPENDIX

Table P1

Variables, their definitions and sources

Variable	Definition	Formula	Source
$\text{Ln}X_{ij}$	Logarithm of bilateral trade (volume of exports from country *i* to country *j*), mln USD	–	International Monetary Fund, Direction of Trade Statistics (DOTS)
LnPOP_i	Logarithm of the population of country *i*, million people	–	World Bank, World Development Indicators
LnPOP_j	Logarithm of the population of country *j*, million people	–	Ibid.
LnGDP_i	Logarithm of the GDP of country *i*, mln USD PPP	–	Ibid.
LnGDP_j	Logarithm of the GDP of country *j*, mln USD PPP		Ibid.
INST_i	The arithmetic mean value of three WB governance quality indicators	$\text{INST}_i = (\text{WB}c_i + \text{WB}rl_i + \text{WB}rq_i) / 3$, WB*c* – corruption prevention, WB*rl* – rule of law, WB*rq* – government effectiveness	World Bank, Worldwide Governance Indicators
INST_j	The arithmetic mean value of three WB governance quality indicators	$\text{INST}_j = (\text{WB}c_j + \text{WB}rl_j + \text{WB}rq_j) / 3$	Ibid.
COMB_{ij}	Common border dummy variable	Takes the value 1 if the countries have a common border, and 0 otherwise	Centre d'Etudes Prospectives et d'Informations Internationales (CEPII), GeoDist database
COL_{ij}	Dummy variable for the presence or absence of colonial linkages	Takes the value of 1 if trading partners had colonial linkages, and 0 otherwise	Centre d'Etudes Prospectives et d'Informations Internationales (CEPII)
LnDIST_{ij}	Logarithm of distance between two countries, km	-	Ibid.

Table P1 (continued)

Variable	Definition	Formula	Source
$LDLC_j$	Dummy variable whether or not the importing country is landlocked	Takes the value 1 if the importing country is landlocked, and 0 otherwise	Ibid.
FTA_{ij}	Free trade agreement dummy variable	Takes the value of 1 if there is a bilateral free trade agreement between two countries, and 0 otherwise	URL: WTO.org
WTO_{ij}	WTO participation dummy variable	Takes the value 1 if both countries are members of the WTO and 0 otherwise	Ibid.

Source: compiled by the authors.

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Imperatives for Transformation of the International Monetary System in the Conditions of Multipolarity

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ABSTRACT

The neoliberal model of globalization promoted the outstripping growth of financial assets over the development of the real sector. The functioning of the international monetary system (IMS), based on one key national currency — the US dollar, has led to the financialization of the world economy and the formation of global imbalances. The purpose of the article is to substantiate the need to replace US-centric financial institutions with new institutions at the regional level and to transform the IMS in the direction of monetary polycentrism and regionalization. The paper discusses the mutual responsibility of the core and periphery countries for the formation of global imbalances. The financial and economic indicators of sovereign states, transnational companies and transnational banks are compared according to the "scale" of globalization. The study shows chronic disproportions between the dynamics of global capital growth and economic growth rates, leading to the state's loss of control over the reproduction process. It is substantiated that the current transformation of the IMS in the direction of monetary polycentrism and regionalization is a natural reaction to these imbalances. The article reveals a negative relationship between the implementation of procyclical and anti-crisis monetary policies by the central banks of developed countries and the competitive positions of developing countries in international financial and commodity markets. The factors of using the oligopoly of the Big Three credit rating agencies as a "soft power" to maintain the US global hegemony and the status of the US dollar as a key reserve currency are systematized. The author concludes that in order for developing countries to form their own international liquidity, it is necessary to stimulate the internationalization of their currencies by developing pan-Asian financial institutions and encouraging competition between them and the existing institutions of the IMS.

Keywords: international monetary system; crisis of globalization; monetary polycentrism; regionalization; global imbalances; financialization; developing countries; center-peripheral model; international liquidity; credit rating agencies

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INTRODUCTION

The neoliberal model of financial globalization, sponsored by the United States and Great Britain, has led to the fundamental unreformability of the Bretton Woods institutions. Despite their supervisory status and statutory obligations to act as multilateral financial and macroeconomic regulators, these institutions have effectively become agents of instability in the foreign exchange markets and passive observers of the spontaneous movement of global capital. The inability of global institutions to prevent risks in a timely manner gives rise to new risks, which primarily negatively affects emerging financial markets and the economies of developing countries. Consequently, the existing institutional structure of the IMS forces developing countries to protect their domestic market by introducing protectionist measures in financial policy, which, with their insignificant participation in international financial intermediation, leads to their exclusion from the process of financial globalization. The rejection of emerging markets as equal partners in the global financial system confirmed the financial sanctions imposed on the Russian banking system by the US, EU, UK and other global financial centers in February-March 2022 after the armed conflict in Ukraine. The consequence of the exclusion of emerging markets from the process of financial globalization is the escalation of global imbalances and the afterburner of the unproductive financialization of the world economy. In this regard, it seems relevant to study the objective and subjective factors of the transformation of the IMS in the context of the formation of a multipolar economic world.

SIGNS OF SYSTEM TRANSFORMATIONS

2008–2009 global financial crisis and the COVID-19 pandemic have caused serious damage to the world economic order based on free competition, open markets and respect for the rules of the game [1, p. 5]. During 2009–2021 the largest trading powers were in the lead in the number of new protectionist measures introduced against other countries: in the USA their number increased from 148 to 2554, in China from 245 to 2963, in Germany from 245 to 1991.[1] Since the 2010s there has been a decline in the ratio of growth in world merchandise trade to world GDP.[2] A similar state of affairs was characteristic of the sphere of international investment. Global stock of FDI increased only in 2011, 2015, 2016 and 2019, while it declined in other years.[3] A post-COVID surge in international trade and investment activity in 2021 may have a short-term effect (following the example of 2010), given the sharp aggravation of the geopolitical situation in the world caused by the events in Ukraine.

After the global financial crisis, the development of world trade and investment was accompanied by increased trends in regionalization [2, 3] and transregionalism [4, 5]. During 2009–2022 the number of registered regional trade agreements that violate WTO principles has increased from 287 to 577.[4] Over the past few years, a number of mega-regional trade agreements have come into force, such as the EU — Canada, CCI-11 and RCEP. Such a reaction of market participants to the crisis of globalization can be regarded as a belated response to the ineffectiveness of the IMS, which, after the collapse of its Bretton Woods format, continues de facto to be based on one world currency — the US dollar [6].

As for the second most important currency, the euro, over two decades its global use has remained virtually unchanged or has declined in almost all segments of the global

[1] Global Trade Alert. The 27th Global Trade Alert Report. 2021. P. 71, 79, 127. URL: https://www.globaltradealert.org/reports (accessed on 29.07.2021).

[2] WTO. World Trade Statistical Review. URL: https://www.wto.org/english/res_e/statis_e/wts_e.htm (accessed on 29.07.2021).

[3] UNCTAD. World Investment Report 2021. URL: https://unctad.org/webflyer/world-investment-report-2021 (accessed on 29.07.2021).

[4] WTO. Regional Trade Agreement Database. URL: http://rtais.wto.org/UI/charts.aspx (accessed on 17.03.2022).

financial market.[5] The insufficiently strong position of the euro in the IMS is mainly due to the insignificant scale of the expansion of the eurozone economy and the weakening of the competitive advantages of European TNCs and TNBs in the world market [7]. Nevertheless, it was the introduction of the euro that served as the basis for creating competition for the US dollar and the foundation for the formation of a model of currency polycentrism and regionalization [8, 9].

According to the WTO, in 2018 the share of developing countries in international trade in goods increased to 44%, and in international trade in services — up to 34%,[6] which was largely due to the expansion of trade between the developing countries. A similar trend is also characteristic of the dynamics of international investment processes: in 2020, developing countries accounted for two thirds of incoming and more than half of outgoing foreign direct investment.[7] These data objectively confirm the need to increase the share of developing countries' currencies in the IMS. A new impetus to the development of currency-polycentric trends was given by the creation of Asian-centric international financial institutions [the New Development Bank (NDB) and the Asian Infrastructure Investment Bank (AIIB)] and the inclusion of the Chinese yuan in the Special Drawing Rights (SDR), which marked the recognition by "classic" international financial institutions of the enduring importance of developing countries in the world economy.

Simultaneously with these trends, the dysfunction of the US dollar-centric IMS is increasing in terms of mobilizing world savings for production purposes, proportional distribution of credit resources between developed and dynamically developing countries, regulation of international monetary and financial flows to ensure balance, sustainable and inclusive growth [10]. Consequences of the belated transformation of the IMS towards currency polycentrism and regionalization — the financialization of the world economy and global imbalance.

FINANCIALIZATION OF THE WORLD ECONOMY

The transnationalization of production led to a significant increase in financial capital, which, under the strict rules of the Bretton Woods system, did not find a profitable placement outside the economies of its countries of origin. With the abolition of the basic Bretton Woods principles — the cessation of the exchange of the US dollar for gold, the introduction of a system of floating exchange rates and the removal of restrictions on the free movement of capital — the necessary institutional prerequisites for the transnationalization of financial capital in the IMS have been created.

At the same time, the limited value flow of international trade in goods and services led to the allocation of the financial sector to a separate area of the IMS, not directly related to production processes in the real sector of the economy. In connection with the change in the basic principles of the functioning of the IMS for insurance against sharp changes in exchange rates and prices for goods, manufacturers have increased demand for risk hedging instruments — derivative financial instruments.

Financialization has led to the disequilibrium of the modern world economy, which is determined by the following parameters. Firstly, the money supply has ceased to be determined directly by the state. Secondly, financial markets have learned to profit from both falling and rising prices. Thirdly, financial capital came off directly from operations in the stock market [11, p. 69].

The scale of financialization can be characterized by comparing the performance

[5] ECB. The International role of the euro, June 2021. URL: https://www.ecb.europa.eu/pub/pdf/ire/ecb.ire202106~a058f84c61.en.pdf (accessed on 29.07.2021).

[6] WTO. World Trade Statistical Review 2019. P. 14–15.

[7] UNCTAD. World Investment Report 2021. P. 248.

of world trade, the global stock market and the derivatives market. For example, in 2019, the volume of global exports of goods and services amounted to $ 25.0 trillion, the turnover of the global stock market was $ 60.4 trillion, and the daily turnover in the global derivatives market exceeded $ 6.5 trillion.

As a result of the financialization of the world economy, the bulk of international liquidity began to be formed by banking and non-banking financial institutions outside the national regulatory space — in the offshore segment of the IMS [12, p. 16; 13, p. 8]. The countercyclical mechanism for creating offshore liquidity is regular swap agreements with the participation of six leading central banks — the US Federal Reserve, the European Central Bank, the Bank of Japan, the Bank of England, the Bank of Canada and the National Bank of Switzerland.[8] Through these agreements, each of the offshore participants can create, in addition to US dollars, pounds sterling, Canadian dollars, euros, Swiss francs and yens [14, p. 17]. The volume of liquidity created in the offshore segment of the IMS significantly exceeds the volume of liquidity under official international agreements in the onshore segment of the IMS.

The development of financialization processes has led to the emergence of alternative decentralized forms of money, created using digital technologies in private and not regulated at the state level. In this regard, a number of leading central banks are preparing to launch sovereign digital currencies, which are designed to maintain centralized control over the national currency space.

GLOBAL IMBALANCES

The problem of global imbalances, described, in particular, in the works of G. Soros [15] and B. Eichengreen [16], arises due to the specific configuration of international settlements serving the world economy, consisting of a core and periphery. Global imbalances arise from the core having excessive privileges in issuing the reserve currency. To gain access to international liquidity, the periphery is implementing a strategy of export-oriented growth at the expense of an undervalued national currency. Excess export earnings are placed in assets denominated in the currencies of the core countries, mainly in US dollars. Further, these savings are converted into financial capital and returned to the periphery in the form of loans and investments. While the reserves of the periphery are formed in low-yield assets of the core, financial capital is placed in high-yield debt obligations of the periphery. The interest rate differential resulting from this unequal exchange causes a negative investment income balance in peripheral countries. During crises, there is a sharp outflow of capital from the volatile assets of the periphery to the highly liquid assets of the IMS core. To accumulate reserves to service external debt and stabilize exchange rates, especially during periods of crisis, periphery countries are forced to constantly accumulate a positive balance of payments (in the current account and/or capital account), while the IMS core countries, on the contrary, maintains a negative balance on these accounts. Thus, the existing format of the IMS, based on the national currency of the United States, which performs the functions of world money and a protective asset, inevitably leads to the accumulation and deepening of global imbalances that undermine the stability and increase the dysfunctionality of the IMS. At the same time, both the core countries and the countries of the periphery are responsible for the formation of global imbalances (*Fig. 1*).

The institutional body responsible for the smooth functioning of the center-periphery model is the IMF, which, through the system of official reserves, obliges the periphery countries to place their savings in the

[8] Federal Reserve Bank of New York. Central Bank Swap Agreements. URL: https://www.newyorkfed.org/markets/international-market-operations/central-bank-swap-arrangements (accessed on 29.07.2021).

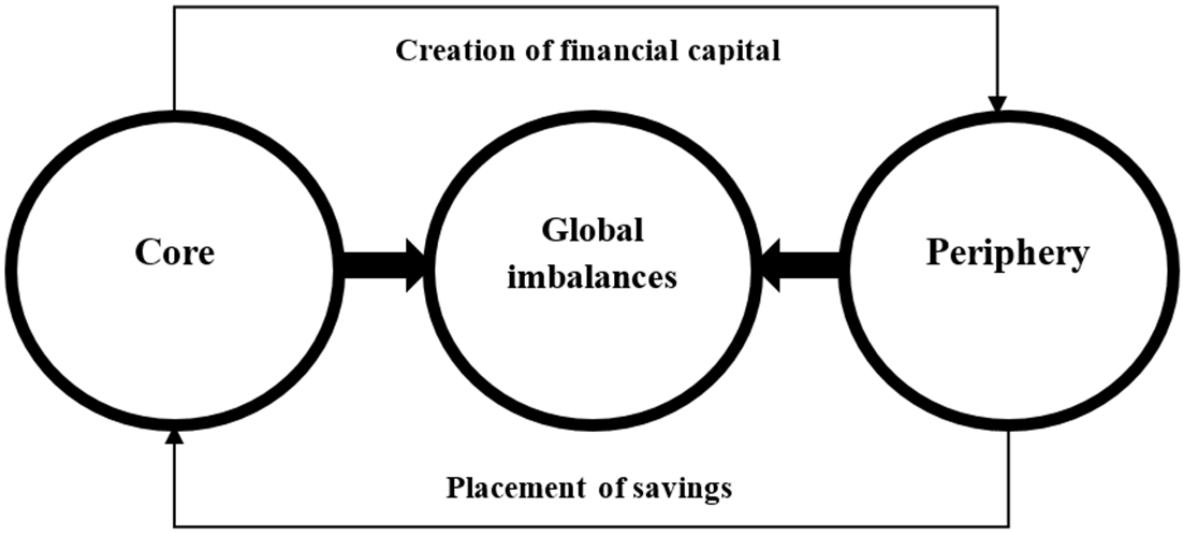

Fig. 1. **Formation of global imbalances in the world economy**
Source: developed by the author.

currencies of the core countries, mainly in the US dollars.

As a result of the COVID-19 pandemic, a sharp increase in global external debt, mainly at the expense of developed countries, has led to a significant expansion of the external financing imbalance. Thus, according to the IMF, in 2020 the size of the total international investment position of all countries amounted to about 22% of GDP in terms of external assets and about 26% in terms of external liabilities, while in 2010 it was 14% of GDP for external assets and 16% for external liabilities.[9]

The increase in the activity of multinational enterprises (MNEs), which are unregulated at the global level, contributes in many respects to the multiplication of global disproportions. According to the authoritative French economist T. Piketty, the main contradiction of capitalism is that in the long run, the return on capital exceeds the rate of economic growth [17]. During the period from 1990 to 2019, the size of the assets of foreign affiliates of MNEs increased from 6 to 112 trillion dollars, and the size of the world GDP during this period increased from 24 to 87 trillion dollars. Thus, the growth rate of assets of foreign affiliates of MNEs was 6.5 times higher than the growth rate of world GDP, despite the fact that foreign affiliates of MNEs employed only about 2.5% of the total number of employed in the world (*Fig. 2*).

At the present stage of globalization, MNEs directly compete with states (integration associations of countries) for access to global resources. According to the conditional "scale" of globalization, the capitalization of the largest MNEs is comparable in size to the economies of the third-tier countries, whose GDP is in the range of $ 1–2 trillion and is very close to the second-tier countries with a GDP of between $ 2 trillion and $ 10 trillion. In turn, the assets of some individual multinational banks (MNB) are already comparable to the size of the GDP of second-tier countries and exceed the total GDP of the largest regional blocks of developing countries (*see Table*).

For nation states, the growth of transnational capital creates significant sovereign risks. In fact, at the present stage of globalization, transnational capital

[9] IMF. World Economic Outlook, April 2021: Managing Divergent Recoveries. URL: https://www.imf.org/en/Publications/WEO/Issues/2021/03/23/world-economic-outlook-april-2021 (accessed on 29.07.2021).

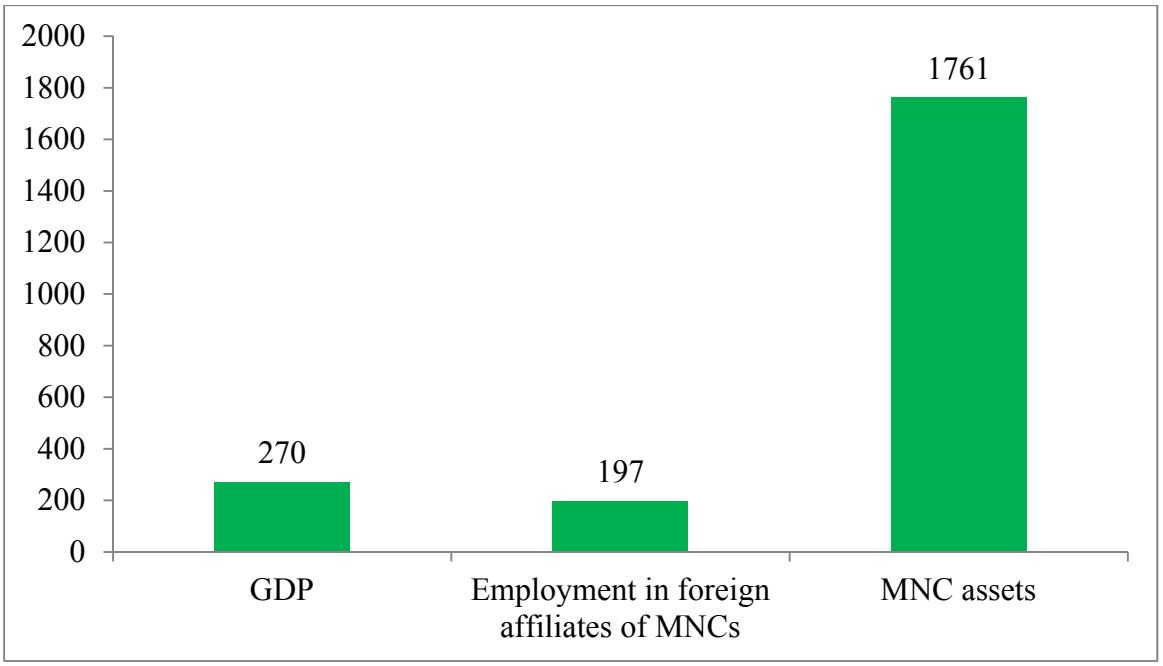

Fig. 2. **Comparative dynamics of world GDP, assets and employment in foreign affiliates of MNEs (1990–2019 growth), %**

Source: compiled based on UNCTAD. World Investment Report 2020. p. 22.

replaces the state everywhere as the main subject of economic relations. Further implementation of the neoliberal model of the world economy (democratic in form, but not equivalent in content) may eventually lead to the elimination of the most important social gains of the 20th century and a loss of control and regulation of the reproductive process by the state. A peculiar response to this challenge is the modern transformation of the IMS towards currency polycentrism and regionalization.

FINANCIAL INSTABILITY IN DEVELOPING COUNTRIES

Due to the implementation of market reforms and outpacing economic growth over the past two decades, the importance of the most dynamically developing countries in the world economy has been steadily increasing. By 2030, China may overtake the United States as the world's largest economy, and the share of developing countries in global GDP may reach 50% [18, p. 17–18].

However, the COVID crisis resulted in a 3.3% decline in global GDP in 2020, a deeper drop than during the 2009 global financial crisis, which was 0.4%. In a global recession, attracting resources from the global financial market is an important source of financing for developing countries, most of which are experiencing acute budget deficits. At the same time, according to IMF experts, the uneven recovery of the world economy is an obstacle to the full return of developing countries to capital markets. The situation may be aggravated by the tightening of monetary policy by the central banks of developed countries. A sharp rise in interest rates in developed countries could jeopardize the significant external financing needs of developing countries (*Fig. 3*).

It should be emphasized that, as part of the implementation of anti-crisis stimulus measures, the debt of the G7 countries increased from 85% of GDP in 2005 to 140% in 2020, while the cost of servicing it decreased from 2 to 1.5% of GDP.[10] The

[10] The Covid-19 Pandemic Has Added $ 19.5 Trillion to Global Debt. Bloomberg, 27 January 2021. URL: https://www.bloomberg.com/graphics/2021-coronavirus-global-debt/ (accessed on 29.07.2021).

Table

Comparison of sovereign states, multinational enterprises and multinational banks by the main financial and economic indicators

	Comparative scale, USD	Sovereign states (nominal GDP), 2020	MNE (market capitalization), 2020	MNB (assets), 2019	Regional blocks of countries (nominal GDP), 2020
Tier 1	More 10 trillion	US (20.8) China (14.7) – ***2***	–	–	USMCA (23.5) – ***3*** EU (14.9) – ***27***
Tier 2	2-10 trillion	Japan (4.9) Germany (3.8) UK (2.6) India (2.6) France (2.6) – ***5***	Apple (2.1)	ICBC (4.3), CCBC (3.7), Agricultural Bank of China (3.6), Bank of China (3.3), Mitsubishi (2.9), HSBC (2.7), JPMorgan (2.7), Bank of America (2.4), BNP Paribas (2.4), Credit Agricole (2.3) – ***10***	ASEAN (3.1) – ***10*** African Union (2.3) – ***55***
Tier 3	1-2 trillion	Italy, Canada, Korea, Russia, Brazil, Australia, Spain, Indonesia, Mexico – ***9***	Microsoft (1.6) Amazon (1.6) Alphabet (1.2) – ***3***	19	MERCOSUR (1.8) – ***4*** EAEU (1.7) – ***5*** GCC (1.4) – ***6***
Tier 4	0.5-1 trillion	Netherlands, Switzerland, Saudi Arabia, Turkey, Taiwan, Iran, Poland, Sweden, Thailand, Belgium – ***10***	Facebook (0.8) Tencent (0.7) Alibaba (0.7) Berkshire Hethaway (0.5) Tesla (0.5) – ***5***	18	–
Tier 5	Less 0.5 trillion	169	493	953	–
	Total (qty)	83.9 trillion ***(195)***	50.0 trillion ***(500)***	123 trillion ***(1000)***	48.7 trillion ***(7)***

Source: compiled based on IMF World Economic Outlook Batabase. URL: https://www.imf.org/en/Publications/WEO/weo-database/2020/October; Forbes. The World's Largest Public Companies. URL: https://www.forbes.com/global2000/list/; The Banker. Top 1000 World Banks. URL: https://www.thebankerdatabase.com/index.cfm/search/ranking; 2020 Hurun Global 500. URL: https://www.hurun.net/en-US/Info/Detail?num=E 6VM7L8L4I15; The world's 100 largest banks, 2020. S&P Global. URL: https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/the-world-s-100-largest-banks-2020–57854079 (accessed on 18.03.2021).

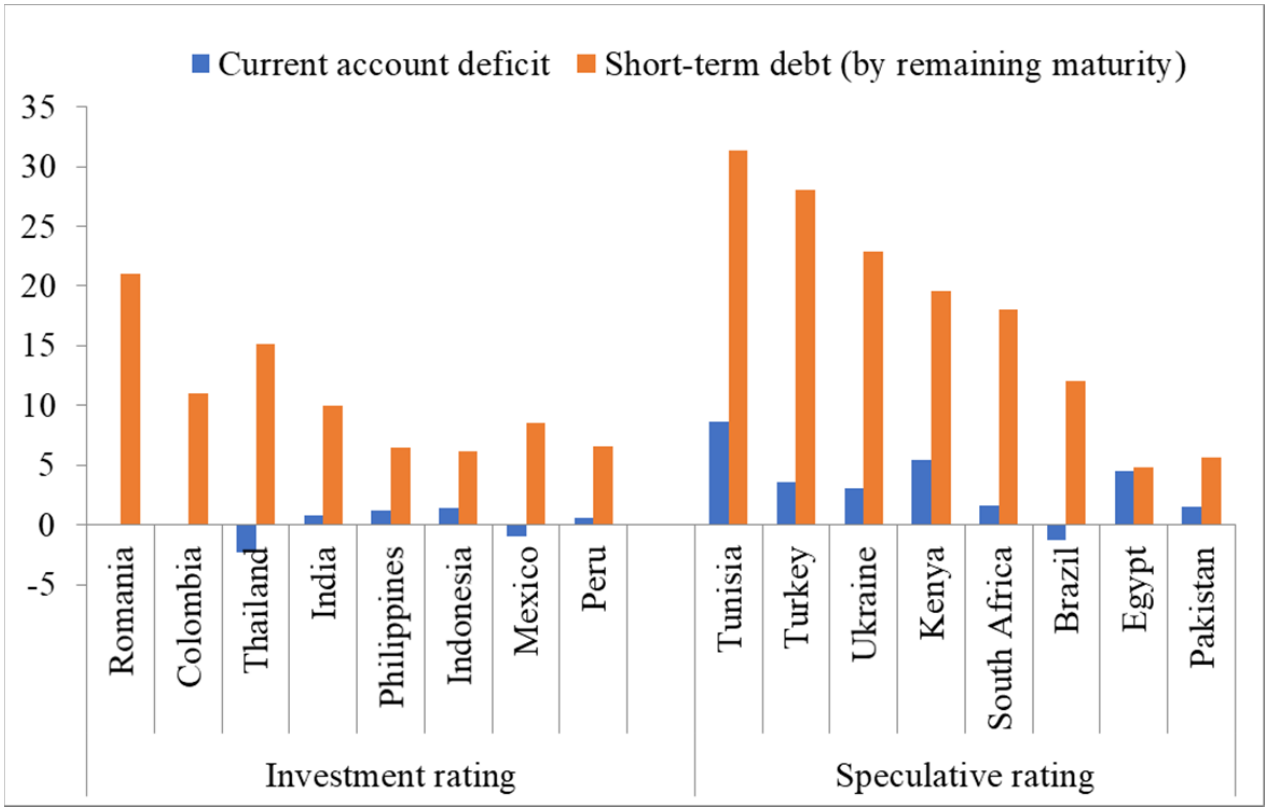

Fig. 3. **Gross external financing needs of some developing countries in 2021, % of GDP**

Source: Global Financial Stability Report Update, January 2021. IMF. URL: https://www.imf.org/en/Publications/GFSR/Issues/2021/01/27/global-financial-stability-report-january-2021-update (accessed on 18.03.2021).

fall in the yields of debt securities of advanced economies increased the demand for bonds in emerging markets. According to *The Economist*, on average, the share of developing countries' external public debt owed to multilateral institutions fell from 43% in 2008 to 34% in 2019, while the share of commercial creditors (mostly bondholders, not banks) increased from 29% to 45%.[11] Thus, as a result of the pandemic, interest rates on external debt obligations rose by 0.124% in India, by 1.5–2% in Indonesia, Mexico and Russia, and by 3.1% in Brazil, although before the crisis their level had already averaged about 6% [19]. Due to the inability to service external debt obligations in 2020, Zambia, Argentina, Belize, Ecuador, Lebanon and Suriname defaulted.

Capital outflow caused by the COVID-19 pandemic, lower commodity prices and falling external demand have weighed heavily on emerging market currencies. In February 2021, the decline in the value of currencies against the US dollar in annual terms was 19.3% in Brazil, 15.1% in Turkey, 11.3% in Russia and 6.5% in Mexico. The US rescue plan, approved by the US Congress on March 11, 2021, provided for an additional injection of $ 1.9 trillion into the US economy. This step, on the one hand, led to some depreciation of the US dollar, and, on the other hand, to a surge in commodity price inflation, to combat which the central banks of developing countries raised interest rates. Initiated by the United States and supported by other Western countries, a new package of anti-Russian sanctions in connection with the armed conflict in Ukraine, including unprecedented freezing of foreign exchange reserves of the Bank of Russia and the disconnection of a number of Russian credit institutions from *SWIFT*, led to a sharp increase in prices for energy

[11] Debt diplomacy: Here we go again. The Economist, March 6th 2021. p. 57.

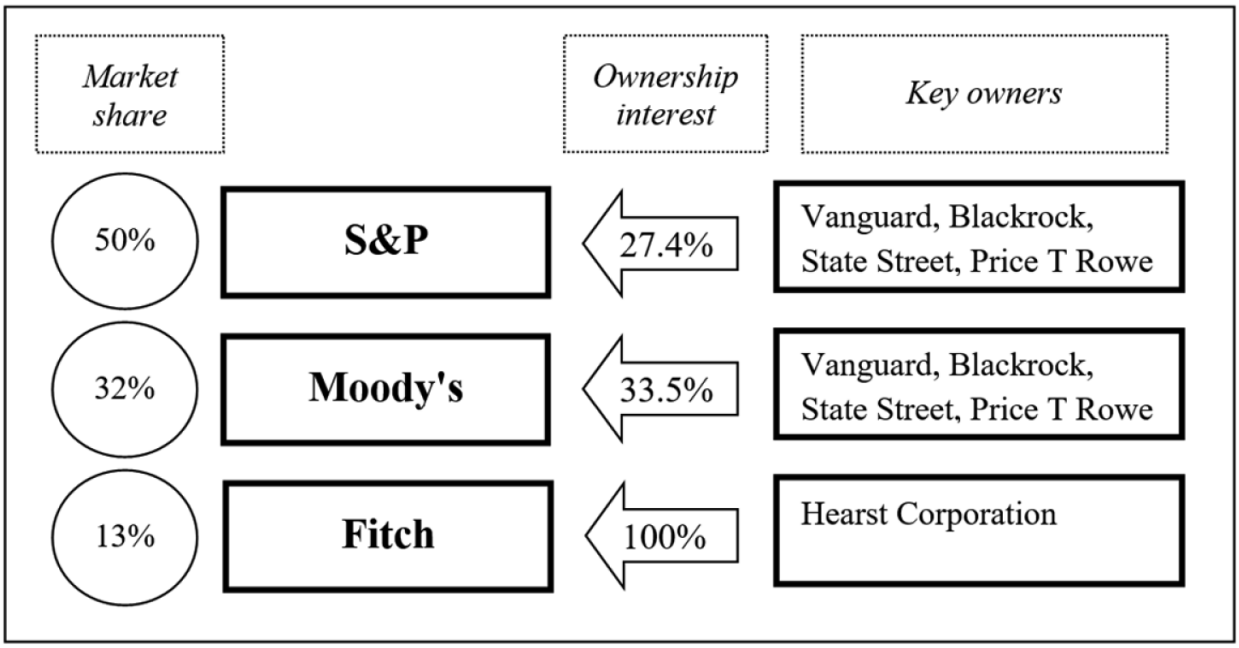

Fig. 4. **Market shares of US rating agencies (as of 31.12.2019) and their key owners (as of 14.03.2021)**

Source: compiled based on Annual Report on Nationally Recognized Statistical Rating Organizations. U.S. Securities and Exchange Commission, December 2020. URL: https://www.sec.gov/files/2020-annual-report-on-nrsros.pdf; S&P Global Common Stock. NASDAQ. URL: https://www.nasdaq.com/market-activity/stocks/spgi/institutional-holdings; Moody's Corporation Common Stock. URL: https://www.nasdaq.com/market-activity/stocks/mco/institutional-holdings; Fitch Ratings. URL: https://www.fitchratings.com/about-us#company-history (accessed on 14.03.2021).

resources and other goods and the need to introduce protective measures of financial regulators. The obvious consequences of this policy have been a further devaluation of currencies, downgrading of credit ratings, higher risk premiums, capital outflows and destabilization of the stock markets of developing countries.

Thus, in the post-COVID recovery of the global economy, developing countries continue to be exposed to external shocks emanating from the issuer of the key global currency. In addition to the problems of financialization and global imbalances, the functioning of the IMS in the interests of developing countries is complicated by the current rules for access to international liquidity. We will consider this question in more detail.

OLIGOPOLY OF CREDIT RATING AGENCIES

Characteristically, the modern Jamaican IMS inherited its institutional framework from the Bretton Woods system, the central elements of which are the IMF and the World Bank. These specialized UN agencies are called upon to ensure international monetary and financial cooperation between member states. However, in the context of the removal of restrictions on the international movement of capital, the bulk of international liquidity is formed in the global financial market, the rules and standards of access to which are determined by credit rating agencies (CRAs), which are outside the direct control of international organizations and governments of sovereign states. The functioning of the CRA is not bound by obligations under intergovernmental agreements, and their activities are characterized by a high degree of anonymity and non-transparency. Let us analyze how the activities of US rating agencies — S&P, Moody's and Fitch (the Big Three) — affect the competitive positions of developing countries in the IMS.

Despite the abundance of rating agencies around the world, only the "Big Three" have a truly global reach — together they control 95% of the credit rating market. All three agencies are headquartered in New York (Fitch is the only agency with two headquarters in New York and London). In 1975, the US federal government designated these agencies as Nationally Recognized Statistical Rating Organizations (NRSRO), whereby only ratings from these agencies are legitimate for determining the level of credit risk and investment grade securities to include, for example, in portfolio of insurance companies or pension funds. Despite the quasi-state status of these agencies, they are all controlled by the largest private US investment holdings (*Fig. 4*).

Credit rating agencies are an integral part of modern financial markets. Their ratings affect the cost of borrowing for issuers of corporate and government bonds, and the ability to manage financial flows. The international financial market is theoretically open to all subjects of the world economy. However, with virtually no ratings from the Big Three, sovereign borrowers and private sector companies are deprived of access to the international financial market — such is the essence of the US rating oligopoly. A higher rating means a lower cost of borrowing, which enhances the borrower's financial superiority and ability to use borrowed resources to take over competitors. It should be noted that since the beginning of the rating, the US has been in the highest investment category from all three agencies. Interesting fact: the rating agencies have never downgraded the US ratings, except for two one-stage sovereign downgrades in 2011 by S&P and Egan-Jones. The US government's response to these actions was quite harsh: within 18 months, the Egan-Jones rating agency was stripped of its status as a nationally recognized statistical rating organization, and the US Treasury threatened S&P with liability for a "huge disservice" to their country. Such actions by the US government motivate rating agencies to assign their country a higher rating than the corresponding macroeconomic and political indicators allow.

Due to the existence of a rating oligopoly, a differential in interest rates is formed between the yield of US debt securities and the yield of debt obligations of other countries, primarily developing countries, which demonstrate an increased demand for reserve assets. For example, despite being the world's largest net debtor, this interest rate differential allows the US to earn about $ 200 billion in annual net investment income. This income often arises from the deteriorating economic situation of developing countries. As the well-known US journalist Thomas Friedman put it, "Moody's can destroy a country by downgrading its bonds" [20]. Thus, the US uses rating agencies as "soft power" to maintain US global hegemony and the US dollar's status as a key reserve currency. Despite being directly involved in creating the crisis in the subprime mortgage market in 2008–2009 and the related criticism, the Big Three's global influence has not changed.

The bias and subjective nature of the work of the Big Three rating agencies is confirmed by the following facts.

First, the United States, as well as those countries with which the United States has close economic and military relations, receive significantly higher credit ratings compared to other countries [21, p. 690].

Second, the Big Three fail to anticipate economic crises and also contribute to deepening existing crises through sudden rating downgrades. In this regard, the most striking example is the history of downgrading the credit rating of Greece in 2010 [22, p. 291–292].

Third, the conflict of interest in the activities of the Big Three arises from the fact that the latter seek to increase profits and market share in the interests of issuers, and not investors. Current US law encourages conflicts of interest by offering a potential issuer a choice between three agencies. Until one of the Big Three agencies is actually

hired to assign the final credit rating, they all first provide the potential issuer with provisional ratings as close as possible to its requirements. This conflict of interest leads to deterioration in the accuracy of the ratings and the reliability of the investment choice of market participants [23, p. 2].

Fourth, empirical studies also confirm the presence of a statistically and economically significant bias of the Big Three towards international financial centers. For example, issuers from cities included in the Global Financial Centers Index (GFCI) are actually assigned a higher rating category than is justified by fundamental factors [24, p. 14].

Fifth, US rating agencies give preference to countries that have strong trade relations with the United States, as well as those countries whose positions on certain issues coincide with the position of the United States when voting in the UN General Assembly [25].

Sixth, the most dynamically developing countries receive relatively low ratings and very frequent downgrades. In particular, this is confirmed by the many cases of multi-stage downgrades in very short periods in East Asian countries during the Asian financial crisis, despite the fact that economic and political imbalances in these countries were not so severe as to justify multiple downgrades of sovereign ratings.

The imperfection of the activities of the Big Three can be summarized as follows:

- the method of assessing the CRA is not transparent enough;
- there is no competition in the CRA market;
- a conflict of interest arises from the current income model of CRA;
- CRAs are not able to foresee a crisis and often condone its further deepening;
- CRAs assign their country a higher rating compared to foreign countries;
- CRAs give preference to politically close countries;
- CRAs underestimate developing countries.

Many investors follow the advice of rating agencies. Therefore, an incorrect rating and especially underestimation of a country due to a biased attitude towards it can have serious consequences for capital inflows, which, in particular, negatively affects the internationalization of developing countries' currencies as part of the creation of a regional monetary and financial center. To address this problem, governments in developing countries need to encourage the development of national rating agencies, including by stimulating competition between local rating agencies and the Big Three.

China has been the most successful in this regard, ranking third in the world in terms of the volume of the bond market after the United States and Japan. Over the past decade, local Chinese agencies have competed quite effectively with the Big Three in the domestic market. An analysis of the partially owned Big Three CRA ratings in China's government debt market found that while Big Three-rated bonds have lower placement yields than CRA-rated Chinese domestic bonds, the Big Three ratings do not have greater predictive power for a future loan issuer performance than local Chinese CRA ratings. There was also no material relationship confirmed between the Big Three ratings and the credit risk of expected default. In addition, there were no significant differences between the reaction of stock and bond prices to the Big Three rating review and to the local CRA rating review. This finding confirms that the Big Three have no private information unknown to market investors [26, p. 16].

CONCLUSIONS

The modern IMS is unable to fulfill its functions of providing countries (primarily developing countries) with uninterrupted access to international liquidity, financing the balance of payments, and stabilizing foreign exchange and commodity markets. Some recovery of world economic development after the global financial crisis

of 2008–2009 was largely offset by the COVID-19 pandemic and the armed conflict in Ukraine, which exposed the entire complex of accumulated unresolved problems of the inability of the IMS.

The uncontrolled saturation of the IMS with huge volumes of foreign exchange, primarily US dollar, liquidity as part of the policy of quantitative easing and anti-crisis swap lines of central banks, the ongoing anti-Russian sanctions are causing an increase in prices for raw materials in the world commodity and financial markets. Rising prices for raw materials predetermine the inefficiency and, ultimately, the unprofitability of world production. With such a development paradigm, the imbalance between the financial and real sectors will rapidly deepen, and confidence in all reserve currencies will decline due to a permanent decline in their purchasing power. The difficult access of developing countries to international liquidity during crises, caused by the limited capacity of the Bretton Woods institutions, the bias of US rating agencies and the political involvement of the world's leading financial market operators, leads to the displacement of these institutions at the regional level. Thus, the transformation of the IMS towards currency polycentrism and regionalization seems inevitable.

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Multivariate Asymmetric GARCH Model with Dynamic Correlation Matrix

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ABSTRACT

This study examines the problem of modeling the joint dynamics of conditional volatility of several financial assets under an asymmetric relationship between volatility and shocks in returns (leverage effect). We propose a new multivariate asymmetric conditional heteroskedasticity model with a dynamic conditional correlation matrix (DCC-EGARCH). The proposed method allows modelling the joint dynamics of several financial assets taking into account the leverage effect in the financial markets. DCC-EGARCH model has two main advantages over previously proposed multivariate asymmetric specifications. It involves a substantially simpler optimization problem and does away with the assumption of conditional correlation time invariance. These features make the model more suitable for practical applications. To study the properties of the obtained estimators, we conducted a simulated data analysis. As a result, we found statistical evidence in favor of the developed DCC-EGARCH model compared with the symmetric DCC-GARCH process in case of considering data with the presence of the leverage effect. Further, we applied the proposed method to analyze the joint volatility of Rosneft stock returns and Brent oil prices. By estimating the DCC-EGARCH model, we found statistical evidence for both the presence of the leverage effect in the oil price data and the presence of the dynamic correlation structure between the time series, which motivates the practical application of the proposed method.

Keywords: financial markets; financial assets; volatility modelling; EGARCH; DCC-GARCH; leverage effect; conditional correlation; multivariate GARCH models; joint volatility dynamics

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INTRODUCTION

Volatility is one of the main indicators characterizing the behavior of assets in financial markets. This indicator is expressed as a standard deviation of the return of the considered financial instruments and is an indicator of the level of risk of assets or a portfolio of securities in the aggregate [1, 2]. For this reason, various financial market participants are interested in volatility modeling in order to conduct an effective risk management policy [3]. One of the most well-known methods for modeling conditional volatility is the family of GARCH processes. However, in the modern world, the hedging process is closely related to modeling the variety of assets included in a portfolio of securities, while one-dimensional GARCH processes allow us to consider the dynamics of assets only separately [4]. This reason served as a stimulus for the development of a class of multivariate GARCH models, which task is to jointly model the dynamics of the volatility of several financial instruments.

Since the main area of application of GARCH processes is modeling the dynamics of financial time series, as various modifications of GARCH models were developed, researchers set themselves the goal of integrating the behavior of financial assets into the methods being developed. One of the most interesting and widely studied stylized facts in financial markets is the asymmetric relationship between the return of assets and their volatility, also known in the literature as the leverage effect [5]. The essence of this feature is that the market reacts more inertially to negative shocks in returns than to positive ones [5, 6]. In the literature, there are several approaches explaining the causes of the leverage effect [6]. For example, according to [7, 8], negative shocks in returns lead to an increase in the financial leverage of issuing companies, which increases the risk level of issued shares

and, as a result, leads to an increase in their volatility. In addition, the leverage effect may arise as a result of the cognitive characteristics of investors in accordance with the prospect theory of Kahneman and Tversky [9], people tend to perceive losses more critically, due to which, in the event of negative shocks to profitability, investors may resort to the mass asset disposal, thereby causing an increase in volatility.

Due to the fact that the standard GARCH model is a symmetric model and does not consider the leverage effect, over time, the authors developed asymmetric modifications of the GARCH models, the main contribution to the development of which was successfully made in studies [6, 10, 11].

However, the stratum devoted to the development of multivariate asymmetric GARCH processes is little studied in the modern literature, which is the subject of this study.

Existing methods include the asymmetric BEKK model[1] [12], the GJR[2]-BEKK [13] specification, as well as generalizations of the asymmetric EGARCH process to the multivariate case proposed in [14, 15]. However, these models are characterized by the presence of the "curse of dimensionality" phenomenon, since they require the simultaneous estimation of a large number of unknown parameters. In turn, the proposed multivariate EGARCH specifications [14, 15] contain a strict unrealistic assumption that the correlation matrix is constant over time, which makes it difficult to apply them to real data.

This study proposes an alternative asymmetric multivariate conditional heteroskedasticity model with a dynamic correlation matrix over time, hereinafter referred to as the DCC-EGARCH model. The proposed specification allows modeling the joint dynamics of the conditional volatilities of several assets with the possibility of considering the leverage effect. The developed method is implemented by adapting the asymmetric EGARCH process [6] to the multivariate case, using the DCC-GARCH specification [16] as the basis. The advantage of the proposed DCC-EGARCH model compared to analogs is the significantly lower complexity of the optimization problem due to the possibility of estimating the parameters using the two-step procedure of Engle [16], Newey and McFadden [17], which avoids the "curse of dimensionality". In addition, due to the use of the DCC specification, the proposed method weakens the assumption about the invariance of the conditional correlation matrix with respect to time, which is typical for earlier generalizations of the EGARCH processes to the multivariate case proposed in [14, 15].

To study the properties of the proposed method, this paper uses the simulated data analysis. As a result, statistical evidence was found for the advantage of using the DCC-EGARCH model over the symmetrical DCC-GARCH process when considering leveraged data. In particular, based on the analysis of simulations, the developed specification was able to provide more efficient estimators compared to the classical DCC-GARCH model. In addition, the proposed DCC-EGARCH specification is being used to study real data, which are Rosneft stocks returns and the time series of changes in Brent oil prices. Based on the results of the analysis, statistical evidence was found both in favor of the presence of a significant effect of asymmetry in the case of considering the time series of oil prices and in favor of the presence of a dynamic correlation structure between assets, which justifies the use of the proposed method on real data.

1. LITERATURE REVIEW

1.1. Exponential Generalized Autoregressive Conditional Heteroskedasticity Model (EGARCH)

One of the best known asymmetric GARCH processes is the exponential generalized autoregressive conditional heteroskedasticity (EGARCH) model proposed by Nelson [6]. Let ε_t be a random shock in the return of the asset under consideration. Assume that σ_t^2 is the conditional variance of ε_t, and therefore cannot be negative. A similar constraint in the GARCH model was met by defining the unconditional variance as a linear combination of positive random variables using positive coefficients.

[1] The abbreviation BECK consists of the first letters of the names of its authors: Baba, Engel, Kraft and Kroner [21].

[2] Similarly to BEKK, the model is designated by the names of the authors: Glosten, Jagannathan and Runkle [10].

When developing the EGARCH model, Nelson [6] proposed another elementary transformation to fulfill this condition: representing the logarithm of the conditional variance as a linear function of time and previous values of independent, equally distributed random shocks z_t. The application of this specification provides non-negative conditional variance values without the need to impose any restrictions on the process parameters. Further, in order to be able to consider the asymmetric relationship between the returns and volatility of a financial asset in the model, it became necessary to set the dependence of the conditional variance logarithm in such a way that its value depended both on the magnitude of the shock z_t, and on its sign [6]. As an appropriate specification, Nelson [6] proposed that the logarithm of the conditional variance be given as a linear combination of z_t and $|z_t|$. Then the final specification of the EGARCH process can be written using the following system of equations:

$$\varepsilon_t \,|\, \psi_{t-1} \sim N\left(0, \sigma_t^2\right), \quad (1)$$

$$y_t = \mu + \varepsilon_t, \quad (2)$$

$$\varepsilon_t = z_t \sigma_t, \quad (3)$$

$$\ln\left(\sigma_t^2\right) = \omega + \alpha\,|\, z_{t-1}\,| + \gamma z_{t-1} + \beta \ln\left(\sigma_{t-1}^2\right), \quad (4)$$

where ψ_t denotes the information available in the period t, where $t \in N$. Random shocks z_t are independent and identically distributed standard normal random variables. The estimated parameters are μ, ω, α, γ and β. In this case, the coefficients ω, α, γ and β, which are responsible for the dynamics of the conditional variance, are of the greatest interest.

A feature of the model is the presence of a coefficient γ, responsible for the leverage effect, which allows the specification of the conditional variance process to react asymmetrically to positive and negative shocks in financial asset returns [6]. Thus, if $\gamma > 0$, then the increase of $ln\left(\sigma_{t+1}^2\right)$ is positive when the return value is higher than its expected value; and vice versa — if the return value turned out to be lower than the expected value, then the increase in volatility will be less than in the first case. Similarly, if $\gamma < 0$, then the increase in conditional variance will be more significant in the case of negative shocks of return and weaker if the return value exceeds the expected value [6].

Similar to other GARCH family models, the unknown parameters in the EGARCH specification are usually estimated using the maximum likelihood method under the assumption of a normal distribution of random shocks. Then the likelihood function to be maximized takes the following form:

$$L\left(\mu, \omega, \alpha, \beta, \varepsilon\right) = \prod_{t=1}^{T} \frac{1}{\sqrt{2\pi}\sigma_t} \exp\left(-\frac{\varepsilon_t^2}{2\sigma_t^2}\right),$$

where variance σ_t^2 is described by equation (4) of the EGARCH model, and T is the number of time periods present in the data.

1.2. Dynamic Conditional Correlation Model (DCC-GARCH)

A significant contribution to the development of multivariate GARCH processes was made by Engle's study [16], in which he proposed a generalized model of conditional heteroskedasticity with a dynamic correlation matrix (DCC[3]-GARCH). This specification is a generalization of the CCC[4]-GARCH [18], weakening the premise of the invariance of correlation over time, which, according to [4, 16, 19], is rigid and may often not agree with real data.

Let us denote the returns N of different assets as a vector y_t. Then the DCC-GARCH process has the following specification:

$$y_t = \mu + \varepsilon_t,\ \varepsilon_t \sim N\left(0, H_t\right),$$

$$\varepsilon_t = H_t^{1/2} z_t,$$

$$H_t = D_t R_t D_t,$$

where H_t is the $N \times N$ conditional covariance matrix of ε_t at time t. D_t is the $N \times N$ diagonal matrix of conditional standard deviations ε_t at

[3] Dynamic Conditional Correlation.
[4] Constant Conditional Correlation.

time t. The matrix R_t is a time-dynamic $N \times N$ correlation matrix of standardized residuals at time t, and z_t — a vector of independent, identically distributed, standard normal random variables [16].

Also note that the elements of the diagonal matrix D_t — conditional standard deviations determined by univariate GARCH processes:

$$\sigma_{ti}^2 = \omega_i + \alpha_i \varepsilon_{(t-1)i}^2 + \beta_i \sigma_{(t-1)i}^2,$$

where the index i denotes the number of assets, $i \in \{1,...,m\}$. The parameters α and β denote the contribution of the ARCH and GARCH parts to the formation of the conditional variance, respectively.

Note that the matrix R_t is a conditional correlation matrix of standardized residuals ϵ_t, which implies [16]:

$$\epsilon_t = D_t^{-1}\varepsilon_t \sim N(0, R_t).$$

To comply with the condition of strict positive definiteness of the covariance matrix and ensure correlation values that do not exceed one in absolute value, Engel [16] proposed to specify the matrix R_t as follows:

$$R_t = Q_t^{*-1} Q_t Q_t^{*-1},$$

$$Q_t = (1-a-b)\bar{Q} + a\epsilon_{t-1}\epsilon_{t-1}^T + bQ_{t-1},$$

where $\bar{Q}$ is the unconditional covariance matrix of standardized residuals ϵ_t,[5] a and b are the estimated parameters, and Q_t^* — is the diagonal matrix consisting of the square roots of the diagonal elements of the matrix Q_t:

$$Q_t^* = \begin{pmatrix} \sqrt{q_{1,1,t}} & 0 & \cdots & 0 \\ 0 & \sqrt{q_{2,2,t}} & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ 0 & \cdots & 0 & \sqrt{q_{n,n,t}} \end{pmatrix}.$$

Also note that in order to fulfill the condition of positive definiteness of the conditional covariance matrix H_t the following restrictions are imposed on the parameters a and b [16]:

$$a \geq 0, \quad b \geq 0,$$

$$a + b < 1.$$

As a rule, the parameters of the DCC-GARCH model are estimated via the maximum likelihood method under the assumption of a joint normal distribution of random shocks. Then the logarithm of the maximized likelihood function can be written as follows:

$$\ln L = -\frac{1}{2}\sum_{t=1}^{T}\begin{pmatrix} n \times \ln(2\pi) + 2\ln(|D_t|) + \\ + \varepsilon_t^T D_t^{-1} D_t^{-1} \varepsilon_t - \epsilon_t^T \epsilon_t + \ln(|R_t|) + \\ + \epsilon_t^T R_t^{-1} \epsilon_t \end{pmatrix}.$$

It is easy to see that in the case of a large covariance matrix; the direct maximization of the likelihood function becomes a difficult task [16]. As an alternative method for obtaining parameter estimates, the two-step procedure proposed by Newey and McFadden [17] is used. The use of this method makes it possible to significantly simplify the optimization problem while maintaining the consistency of the estimators.

Let us designate the vector of estimated parameters of the matrix D as θ, and the vector of matrix parameters R as Δ: i.e. $\theta = (\mu, \omega, \alpha, \beta)$, $\Delta = (a, b)$. Then the logarithm of the likelihood function can be represented as the sum of the contributions of volatility and correlation [16, 20]:

$$\ln L(\theta, \Delta) = \ln L_V(\theta) + \ln L_C(\theta, \Delta).$$

The first step of the procedure is to maximize the part of the likelihood function that reflects the contribution of volatility, i.e. $\hat{\theta} = \operatorname{argmax}\{\ln L_V(\theta)\}$. At the same time, we note that maximization $\ln L_V(\theta)$ implies a separate estimation of the parameters of univariate GARCH processes for each of the assets. At the second step of the procedure, the second part of the likelihood function is maximized, due to which estimates of the parameters a and b, which are responsible for the dynamics of the change in the conditional

[5] An estimate of the unconditional covariance matrix may be obtained as $\bar{Q} = \frac{1}{T}\sum_{t=1}^{T}\epsilon_t\epsilon_t^T$.

correlation, can be obtained. In this case, instead of the vector of true parameters θ, its estimate found at the first step is substituted: $max \ln L_C\left(\theta,\Delta\right)$. Note that under certain regularity conditions [16, 17], obtaining consistent estimators at the first step ensures that consistent estimates are also obtained at the second step of the method.

1.3. Asymmetric Multivariate GARCH models

Due to the presence of a stylized fact about an asymmetric relationship between the volatility of assets and returns in financial markets [5], the development of multivariate GARCH models entailed the need to integrate them into account for asymmetric dependence by extending asymmetric univariate GARCH models to the multivariate case.

One of the first such generalizations was the asymmetric BEKK model proposed by Kroner and Ng [12]. This specification repeats the BEKK model [21], except that the conditional covariance matrix dynamics equation also includes an additional quadratic form that determines the asymmetry effect. This element depends on the pairwise product of vectors that reflect negative shocks in returns:

$$H_t = CC^T + A^T\varepsilon_{t-1}\varepsilon_{t-1}^T A + B^T H_{t-1} B + G^T \eta_{t-1}\eta_{t-1}^T G,$$

where $\eta_{it} = max[0,-\varepsilon_{it}]$, and $\eta_t = [\eta_{1t},\ldots,\eta_{Nt}]^T$, matrices C, A, B and G are $N \times N$ matrices of estimated parameters that satisfy the following conditions:

- C — the lower triangular matrix;
- A, B and G — diagonal matrices,

where the matrix G reflects the effect of the asymmetric response of variance to shocks in returns.

Note that the imposed restriction on the diagonal form of the matrices under consideration gives rise to the premise that the variances depend only on the eigen squares of the residuals, and the covariances depend solely on the past values of the cross products of the residuals, which may not agree with the real data [21–23]. However, if this assumption is weakened, the method suffers from the "curse of dimensionality" phenomenon. That is, in the case of considering a large number of time series, the optimization problem is characterized by high complexity due to the large number of estimated parameters, which is a disadvantage of this type of model in comparison with the DCC specification. In addition to the presented asymmetric BEKK model [12], its modification GJR-BEKK [13] was subsequently developed, which contains a binary switch variable that reflects the impact of positive and negative shocks on conditional volatility. However, using the GJR-BEKK specification in a similar way to the asymmetric BEKK model leads to the "curse of dimensionality" problem.

Alternative specifications adapting univariate asymmetric GARCH models to the multivariate case have been proposed by Koutmos and Booth [14] and Jane and Ding [15]. In these studies, generalizations of the asymmetric EGARCH process to the multivariate case were presented. At the same time, both the model [14] and [15] require the fulfillment of a rigid premise that the conditional correlation matrix is invariant with respect to time. This premise may often be inconsistent with real data [4, 16], which is a significant limitation of the proposed methods. For example, statistical evidence was found in favor of a difference in the correlation between the US S&P 500 and the Japanese Nikkei 225 in the periods before and after the global financial crisis, since the correlation between these financial time series before the crisis was determined by normal market conditions, while after the crisis these conditions were violated [4].

This study proposes a generalization of the EGARCH model to the multivariate case using the DCC specification. The advantage of the developed method in comparison with analogs lies in the possibility of taking into account the leverage effect, weakening the premise of the invariance of the correlation structure with respect to time. At the same time, the use of a two-step procedure for estimating the parameters of the DCC specification makes it possible to provide a significantly lower complexity of the optimization problem without imposing additional restrictions, in contrast to the previously proposed asymmetric BEKK specifications.

2. METHODOLOGY

2.1. The data generating process in the DCC-EGARCH model

Let the logarithmic return of each of the considered N assets at the moment of time t be denoted as a vector y_t. Then the equation of return takes the form:

$$y_t = \mu + \varepsilon_t, \varepsilon_t \sim N(0, H_t).$$

Specifying random shocks based on the classical GARCH process [24] and applying the DCC specification [16] to pass to the multivariate case, we obtain:

$$\varepsilon_t = H_t^{1/2} z_t,$$

$$H_t = D_t R_t D_t,$$

$$R_t = Q_t^{*-1} Q_t Q_t^{*-1},$$

$$Q_t = (1-\alpha-\beta)\bar{Q} + \alpha \epsilon_{t-1} \epsilon_{t-1}^T + \beta Q_{t-1},$$

where all notations are similar to the DCC-GARCH process.

A feature of the DCC-EGARCH model presented in this paper is that the D_t matrix elements are generated not by using univariate symmetric GARCH processes, but by using an asymmetric EGARCH model [6], i.e.

$$\sigma_t = \sqrt{\exp\left(\omega + \alpha | z_{t-1} | + \gamma z_{t-1} + \beta \ln\left(\sigma_{t-1}^2\right)\right)},$$

where the parameter γ reflects the effect of asymmetry.

In view of the fact that maximizing the total likelihood function is a complex optimization problem due to a large number of estimated parameters, the current study uses a two-step estimation procedure proposed in [16, 17]. Due to its implementation, an increase in the number of estimated parameters because of considering the asymmetric effect of variance on shocks in returns does not lead to even higher computational complexity. This feature of the proposed method is an advantage relative to asymmetric BEKK models [12, 13], which are characterized by high optimization complexity due to a large number of estimated parameters.

2.2. Two-Step Estimation Procedure for the DCC-EGARCH Model

According to [16], the first step in the estimation procedure for a model with dynamic correlation is to maximize the logarithm of the likelihood function, which reflects the contribution of volatilities. Note that in this study, the EGARCH model is adapted to the bivariate[6] case. Then the first step is to evaluate two univariate EGARCH processes, assuming a normal distribution of random shocks:

$$\ln L_V(\theta) = -\frac{1}{2}\sum_{t=1}^{T}\sum_{i=1}^{N}\left(\ln(2\pi) + \ln\left(\sigma_{i,t}^2\right) + \frac{\varepsilon_{i,t}^2}{\sigma_{i,t}^2}\right),$$

where $\sigma_{i,t}^2 = \exp\left(\omega + \alpha | z_{t-1} | + \gamma z_{t-1} + \beta \ln\left(\sigma_{t-1}^2\right)\right)$, and θ is the vector of estimated parameters of the EGARCH process: $\theta = (\mu, \omega, \alpha, \beta, \gamma)$.

The second step of the estimation procedure for the DCC model [16] involves maximizing the part of the likelihood function that reflects the contribution of the correlation, assuming a joint normal distribution of random shocks, i.e.:

$$\ln L_C(\theta, \Delta) = -\frac{1}{2}\sum_{t=1}^{T}\left(-\epsilon_t^T \epsilon_t + \ln(| R_t |) + \epsilon_t^T R_t^{-1} \epsilon_t\right),$$

where Δ is the vector of parameters responsible for the changes in the correlation matrix over time: $\Delta = (a, b)$.

Note that in the case of adapting the EGARCH model to the multivariate case using the DCC specification, the changes relative to the symmetric DCC-GARCH model concern only the implementation of the first step of the procedure. Thus, at the first step, the parameters of each of the univariate EGARCH processes are estimated, including the coefficient γ, which is responsible for the leverage effect. By finding these estimates in the first step, matrices of estimated standard deviations D_t, a matrix of estimated values of standardized residuals, as well as an estimate of the unconditional covariance matrix $\bar{Q} = E(\epsilon_t \epsilon_t^T)$ may be calculated [16]. Then the second step of the procedure for estimating the asymmetric

[6] This study focuses on the analysis of a bivariate specification. In this case, the specifications of N-dimensional models and the corresponding likelihood functions are similar to the two-dimensional case.

DCC-EGARCH model is to maximize the likelihood function with the substitution of the estimates found in the first step, due to which estimates of the parameters a and b, which determine the change in the conditional correlation matrix over time, may be found.

3. ANALYSIS OF THE SIMULATED DATA

3.1. Description of the simulated data

In order to study the properties of obtained estimators using the developed DCC-EGARCH method, this study uses the analysis of simulated data. The generated data is a bivariate sample consisting of 300 observations,[7] and the true simulation parameters are given in *Table 1*. Note that the first five parameters are different for each of the two processes, since they determine the dynamics of the conditional variance for each equation, following the specification of EGARCH processes. At the same time, the parameters a and b are given for the entire process as a whole, since they determine the change in the correlation matrix of shocks over time. The values of the true parameters were chosen in compliance with the stationarity conditions of the process [6, 16, 24]. The parameters responsible for the leverage effect and the dynamics of the correlation matrix were determined to be sufficiently large in absolute value in order to ensure their significant effect on the generated process, while the stationarity conditions were also met.

For the purpose of preliminary analysis of the generated data according to the DCC-EGARCH process, the following is a graphical analysis of the dynamics of the true conditional variance and the time-varying correlation between random shocks. *Fig. 1* shows the dependence of volatility on the previous value of random shocks for each of the two considered time series.

Note that the asymmetry effect is clearly present on the graph in accordance with the data generation process of the DCC-EGARCH model. Volatility increases more inertially with negative shocks in returns than with positive ones. Accordingly, it is expected that by applying the proposed DCC-EGARCH model, the leverage effect present in the data can be captured.

Fig. 2 shows the dynamics of changes in the correlation over time between the series under consideration. Note that for the chosen true values of the parameters a and b the range of correlation change is quite large,[8] while the dynamics of its change are very intense.

Table 1

True simulation parameters

Parameter	First process	Second process
μ	0.5	0.3
α	0.15	0.25
β	0.7	0.5
ω	0.001	0.005
γ	−0.4	−0.3
a	0.5	
b	0.2	

Source: compiled by the authors.

3.2. Comparison of DCC-EGARCH with symmetric DCC-GARCH model

To analyze the advantage of the proposed DCC-EGARCH model, this section compares the symmetric DCC-GARCH specification and the asymmetric DCC-EGARCH specification. The purpose of this analysis is to identify the advantages of considering the asymmetry effect in the case of applying models on data characterized by the presence of a leverage effect. That is, it is important to find out how critical it is to apply a symmetric model to data with asymmetric effects and, therefore, whether there is a need to develop and apply asymmetric specifications for multivariate GARCH models.

Table 2 shows the average estimates of the unknown parameters over 100 simulations

[7] Such a sample size is due to the approximation to the real conditions that arise when evaluating financial time series, which, as a rule, have a large number of structural breaks in their structure, which often does not allow using larger samples.

[8] $\rho \in [-0.80; 0.94]$.

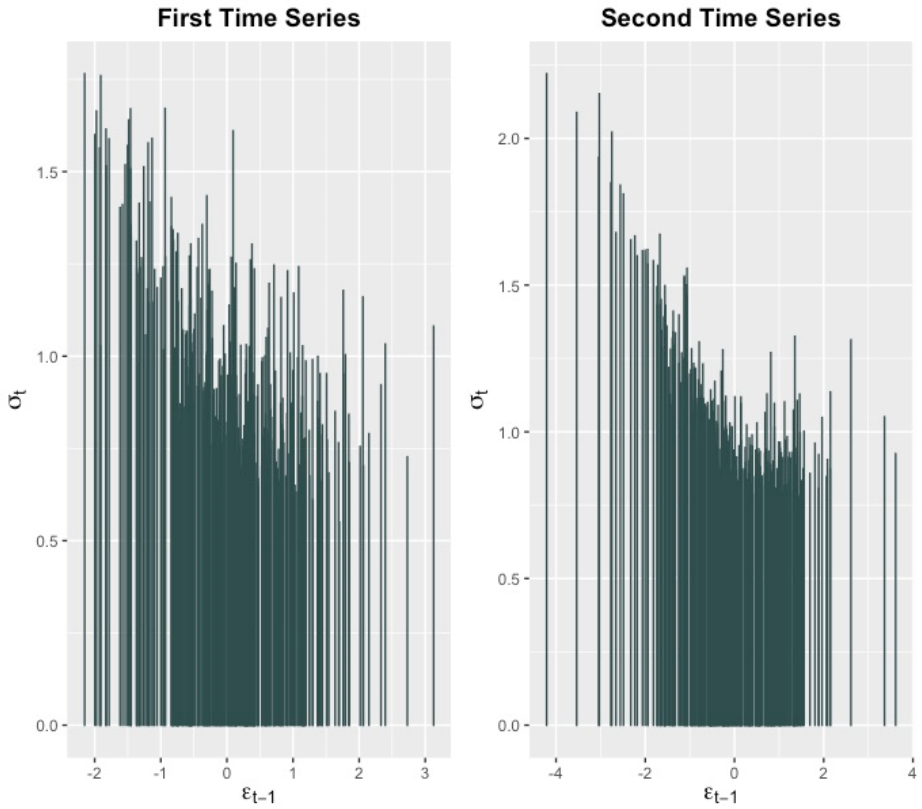

Fig. 1. **Volatility response to shocks in returns**

Source: compiled by the authors.

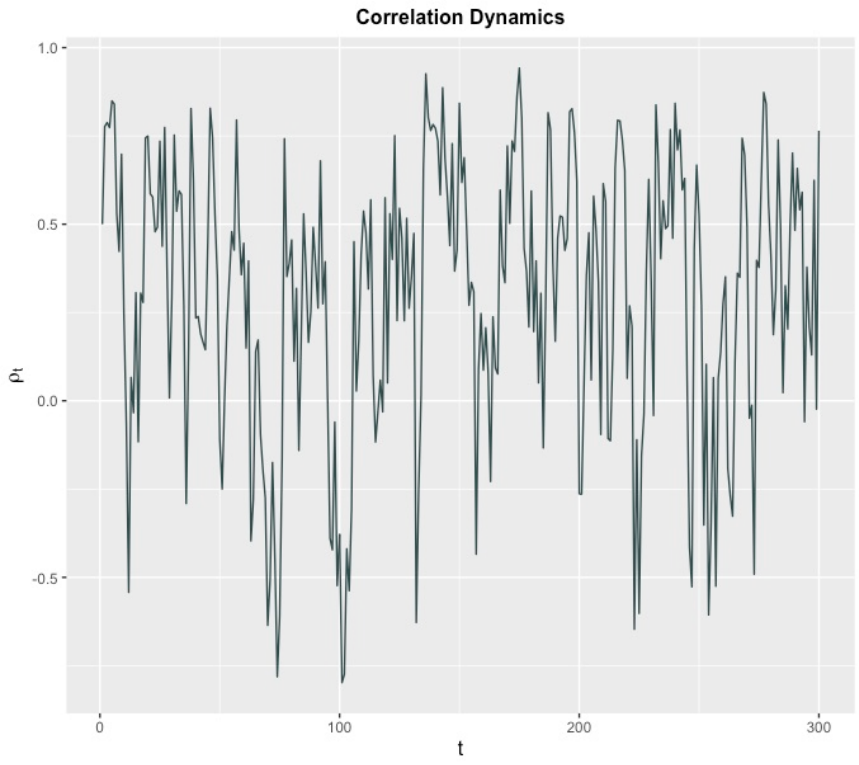

Fig. 2. **Dynamics of correlation over time**

Source: compiled by the authors.

Table 2

The comparison of DCC-EGARCH and DCC-GARCH models

	DCC-EGARCH	RMSE	DCC–GARCH	RMSE
$\widehat{\mu_1}$	0.50043	0.00989	0.57556	0.07616
$\widehat{\alpha_1}$	0.15650	0.01949	0.23909	0.09160
$\widehat{\beta_1}$	0.69698	0.01449	0.41665	0.28679
$\widehat{\omega_1}$	0.00422	0.00775	0.42178	0.42301
$\widehat{\gamma_1}$	–0.38740	0.01844	–	–
$\widehat{\mu_2}$	0.30147	0.01049	0.34372	0.04506
$\widehat{\alpha_2}$	0.24293	0.02145	0.19880	0.05745
$\widehat{\beta_2}$	0.49663	0.02966	0.27136	0.24751
$\widehat{\omega_2}$	0.00680	0.00894	0.58725	0.58823
$\widehat{\gamma_2}$	–0.29459	0.01483	–	–
$\hat{a}$	0.50096	0.01049	0.46280	0.03975
$\hat{b}$	0.20832	0.01703	0.24197	0.04593
AIC	54 513.010	–	56 382.13	–
BIC	54 599.534	–	56 454.239	–

Out-of-sample forecast quality						
	DCC-EGARCH			DCC-GARCH		
Period	$RMSE_{\sigma_1}$	$RMSE_{\sigma_2}$	$RMSE_{\rho}$	$RMSE_{\sigma_1}$	$RMSE_{\sigma_2}$	$RMSE_{\rho}$
h = 1	0.03634 (0.88)	0.02700 (0.78)	0.01979 (0.74)	0.18460 (0.12)	0.12051 (0.22)	0.05066 (0.26)
h = 5	0.22242 (0.56)	0.17189 (0.43)	0.26866 (0.52)	0.24088 (0.44)	0.17434 (0.57)	0.30764 (0.48)

Note: in parentheses are the proportions of simulations in which the model was characterized by a lower value of the RMSE criterion relative to the alternative model.

Source: compiled by the authors.

obtained using both the proposed DCC-EGARCH model and the symmetric DCC-GARCH model, and the average values of the information criteria AIC and BIC for each of the assumed technical characteristics. Simulation averaged RMSE values are also presented separately to assess the quality of the out-of-sample forecast of conditional volatilities and correlations in each of the models. In addition, simulation averages of RMSE are also given for all coefficient estimates.

Based on the *Table 2*, it can be concluded that the asymmetric DCC-EGARCH model has a significant advantage over the symmetric specification. The leverage effect captured by the presented method provides a significantly higher accuracy of the coefficient estimates compared to the DCC-GARCH specification, which shows a significant bias of the estimates from the true parameters. In addition, the significant advantage of the DCC-EGARCH model is also evidenced by the values of the information criteria AIC and BIC, which are significantly lower compared to the DCC-GARCH method.

Based on the average values of the RMSE criterion calculated from coefficient estimates, we note that it is significantly lower in the case of considering an asymmetric model, which indicates in favor of obtaining more efficient estimators by the DCC-EGARCH method compared to a symmetrical specification. It is also important to note the significantly higher predictive power of the asymmetric model.

In particular, the analysis considered out-of-sample forecasts of conditional volatility and correlation for 1 and 5 steps ahead. The RMSE criterion was used as an indicator of the quality of forecasts. Additionally, in parentheses are the proportions of simulations for which the RMSE value of the considered model turned out to be less than the alternative specification. *Table 2* shows that the DCC-EGARCH model has a higher predictive power, as evidenced by the lower average value of the RMSE criterion relative to the DCC-GARCH model for each of the periods. In particular, it is worth highlighting the significant superiority of the quality of the asymmetric model in the case of considering one-period forecasts. Thus, based on the RMSE, the symmetric model is several times inferior to DCC-EGARCH in the case of considering a one-period forecast of conditional volatilities for each series. The advantage of the DCC-EGARCH model is also evidenced by the proportion of simulations for which the RMSE value turned out to be lower in the asymmetric model compared to the DCC-GARCH specification. Thus, for the asymmetric model, this share is in most cases much higher, which testifies in favor of the greater accuracy of the out-of-sample forecast of conditional volatilities. It is important to note that the presented method also has a higher quality of conditional correlation prediction, as evidenced by the lower corresponding values of the RMSE criterion, and the proportion of simulations for which this indicator turned out to be lower in the case of considering an asymmetric specification.

Based on the results of the analysis, it can be concluded that the asymmetric multivariate DCC-EGARCH model has a significant advantage over the DCC-GARCH model when considering data characterized by the presence of a leverage effect. By providing less biased and more efficient estimators, the developed method is characterized by both a higher quality of predictive power and the quality of the model itself, as evidenced by lower values of information criteria. Based on this, the development and application of the presented asymmetric multivariate DCC-EGARCH model is justified, since the presence of the leverage effect introduces significant changes to the data generation process, which causes the lack of stability of the symmetric DCC-EGARCH model estimates for the presence of the effect of asymmetry.

4. APPLICATION TO REAL DATA

After examining the properties of estimators and comparing methods using simulated data, this section applies the proposed DCC-EGARCH model to real data analysis. The main task of the analysis is to study time series for the presence of the effect of an asymmetric response of variance to shocks in returns, and to evaluate the conditional correlation between them.

4.1. Data Description

As a sample, the stock returns of Rosneft Oil Company PJSC are used, and time series of changes in prices for Brent crude oil.[9] The considered time period covers the interval from 05.01.2016 to 13.03.2018.[10] The prices under consideration are the daily closing prices, due to which the sample size is 550 observations. The database source for each time series is Investing.com.[11]

Based on *Fig. 3*, we can conclude that the dynamics of changes in the studied series are similar. For this reason, it can be assumed that the considered time series are correlated with each other, which requires the use of multivariate GARCH models to assess the joint dynamics of their conditional volatility. The assumption of a correlation between the considered time series is due to the fact that the financial results of oil companies are highly dependent on oil prices. At the same time, the correlation structure may change over time due to changes in various market conditions.

4.2. Econometric analysis

To study the considered series of returns for the presence of leverage effect, and estimates of

[9] The oil prices are the prices of futures contracts with the nearest expiration period.

[10] The considered interval was chosen due to the lack of structural breaks on it.

[11] Investing.com. URL: https://www.investing.com/commodities/brent-oil-historical-data.

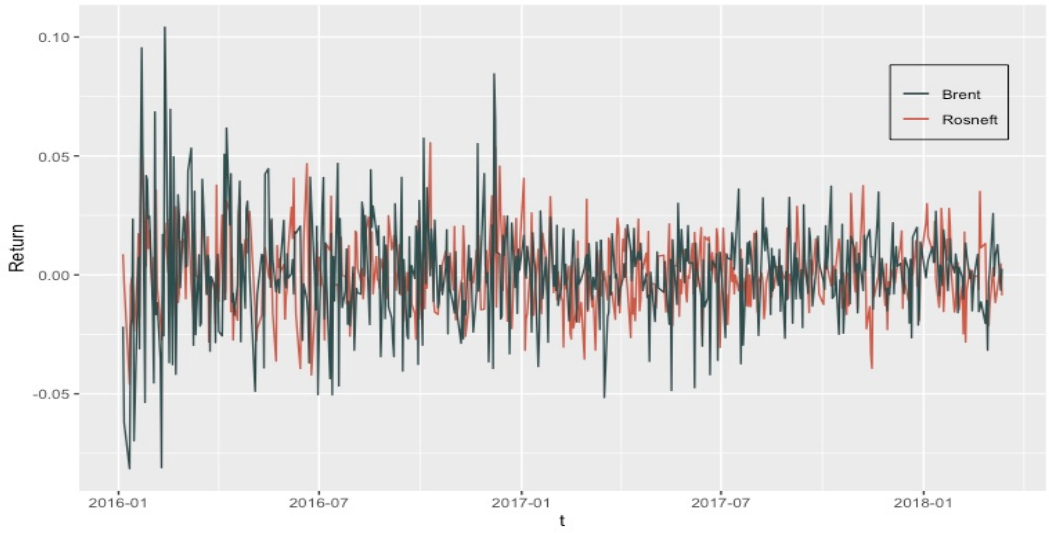

Fig. 3. **Dynamics of Rosneft stock returns and changes in Brent oil prices**

Source: compiled by the authors.

the conditional correlation between assets, in this study two different models were evaluated: the asymmetric DCC-EGARCH model with the possibility of considering the leverage effect, and its limited symmetrical version, hereinafter referred to as the DCC-EGARCH-R model. Note that the limited version differs from the presented DCC-EGARCH model by the lack of a coefficient reflecting the contribution of the leverage effect to the conditional variance equation for each of the assets, while the functional form remains similar to the DCC-EGARCH. Thus, the conditional variance equation in the DCC-EGARCH-R specification takes the following form:

$$\sigma_t = \sqrt{\exp\left(\omega + \alpha\left|z_{t-1}\right| + \gamma z_{t-1} + \beta \ln\left(\sigma_{t-1}^2\right)\right)}.$$

Note that DCC-EGARCH-R is nested within the DCC-EGARCH model, which allows directly evaluating the contribution of the leverage effect when comparing these two specifications.[12] The results of the evaluation of each of the models are presented in *Table 3*.

First of all, we note that, according to the results of the evaluation of the DCC-EGARCH model, a significant negative estimate of the coefficient $\hat{\gamma}_{Brent}$, responsible for the leverage effect was obtained. This result argues for the presence of an asymmetric effect of dispersion on shocks in returns in the case of considering the time series of oil prices. Note that the estimate of the coefficient $\hat{\gamma}_{Brent}$ is negative, which agrees with the ideas of [5–8]. This observation means that the variance reacts more inertially to negative shocks in returns than to positive ones since financial market participants tend to perceive negative shocks as more critical [5]. At the same time, we note that in the case of considering the time series of the Rosneft stock returns, no statistical evidence was found in favor of the asymmetry effect. This conclusion is due to the insignificance of the coefficient estimate $\hat{\gamma}_{Rosneft}$, obtained by applying the DCC-EGARCH model, which indicates in favor of the same change in conditional volatility under positive and negative shocks. In other words, financial market participants tend to equally perceive multidirectional shocks in returns of the asset under consideration. Thus, according to the results of the evaluation of the asymmetric DCC-EGARCH model, the presence of the leverage effect was statistically revealed when considering the time series of prices for Brent oil and its absence in the data of Rosneft.

It is also interesting to compare the evaluation results of the symmetric DCC-EGARCH-R model with the presented asymmetric DCC-EGARCH specification. Despite the fact that a significant

[12] The DCC-EGARCH-R specification was chosen instead of the DCC-GARCH model to highlight the leverage effect on real data since the DCC-EGARCH-R model has the same functional form as the proposed DCC-EGARCH method.

Table 3

Real data model estimation results

	DCC-EGARCH	DCC-EGARCH-R
$\hat{\mu}_{Rosneft}$	0.00073 (0.00065)	0.00070 (0.00062)
$\hat{\alpha}_{Rosneft}$	0.50200*** (0.13114)	0.50951*** (0.13285)
$\hat{\beta}_{Rosneft}$	0.79592*** (0.09335)	0.79121*** (0.09612)
$\hat{\omega}_{Rosneft}$	−1.67902** (0.76465)	−1.71758** (0.78732)
$\hat{\gamma}_{Rosneft}$	−0.01354 (0.05421)	–
$\hat{\mu}_{Brent}$	0.00038 (0.00077)	0.00077 (0.00075)
$\hat{\alpha}_{Brent}$	0.36179*** (0.05603)	0.38123*** (0.05822)
$\hat{\beta}_{Brent}$	0.91751*** (0.02163)	0.91282*** (0.02289)
$\hat{\omega}_{Brent}$	−0.64092*** (0.16855)	−0.67710*** (0.17811)
$\hat{\gamma}_{Brent}$	−0.07114* (0.04075)	–
$\hat{a}$	0.01929 (0.01253)	0.01875 (0.01193)
$\hat{b}$	0.96243*** (0.02802)	0.96389*** (0.02593)
AIC	– 5,707.344	– 5,708.454
BIC	– 5,655.625	– 5,665.355

Note: *** – p < 0.01, ** – p < 0.05, *– p < 0.1, estimates of standard errors are in parentheses.

Source: compiled by the authors.

leverage effect was obtained, the symmetric DCC-EGARCH-R model turned out to be better than the asymmetric counterpart, as evidenced by slightly lower values of the AIC and BIC information criteria in the case of considering the symmetric model. This result is unexpected due to the presence of a significant estimate of the coefficient $\hat{\gamma}_{Brent}$, which is responsible for the leverage effect in the DCC-EGARCH model. However, it is important to note the rather small absolute value of the obtained coefficient estimate compared to the contributions of the ARCH and GARCH parts.[13] Other things being equal, a relatively small value of this coefficient can lead to a negligible influence of the leverage effect on the dynamics of the conditional variance compared to the parts of ARCH and GARCH.

The next important step in the analysis is to consider the estimates of the parameters responsible for the change in the conditional correlation matrix over time between the studied time series. Table 3 shows that in both the asymmetric DCC-EGARCH model and the DCC-EGARCH-R specification, the parameter estimate b is statistically significant at any reasonable level, while the coefficient estimate a is negligible. To test the hypothesis about the presence of a dynamic correlation between the time series under consideration, a likelihood ratio (LR) test was carried out for the joint significance of the

[13] Estimates of the coefficients α and β.

parameters that determine the dynamics of the change in the conditional correlation. As a result of the verification, the null hypothesis was rejected at a significance level of 5%, which indicates in favor of the presence of a correlation structure dynamic in time between the assets under study. This conclusion justifies the feasibility of using the multivariate DCC-EGARCH specification to be able to take into account the dynamic conditional correlation between assets.

To test the hypothesis of a normal distribution of shocks, following [25, 26], the Kolmogorov-Smirnov test and the Shapiro-Wilk test were applied to estimates of standardized shocks. For both series, in both models under consideration, the hypothesis of a normal distribution was rejected at a significance level of 1%. Evidence that the marginal distributions of shocks (separately for each series) deviate from normal also suggests that the assumption of a multivariate normal distribution of shocks is likely not to hold. However, there is evidence in the literature in favor of the stability of the GARCH model estimates against the violation of the normal distribution assumption [27]. To test the stability of the results obtained in the study, each of the two series was evaluated using a univariate EGARCH model under different assumptions about the distribution of random shocks. Student's *t*-distribution, non-centered Student's *t*-distribution and generalized normal distribution (GED) were used. The values and signs of the coefficients remained the same, which indicates the stability of the result obtained against the violation of the assumption of normality. Checking the stability of the estimates a and b requires weakening the assumption not only about the marginal normality of shocks but also about the fact that the relationship between shocks is described using a Gaussian copula. The implementation of the corresponding model is potentially interesting, but technically difficult, which remains for further research.

CONCLUSIONS

In this study, a multivariate asymmetric DCC-EGARCH model was proposed. The developed method makes it possible to evaluate the joint dynamics of conditional volatility and correlation of several assets with the possibility of taking into account the influence of leverage effect in financial markets. The proposed method is implemented by generalizing the asymmetric EGARCH model to the multivariate case using the multivariate DCC-GARCH specification as the basis. The advantages of this approach lie in the weakening of the assumption about the invariance of the correlation matrix with respect to time, and in the significant simplification of the optimization problem due to the use of a two-step estimation procedure. These features justify the development of the considered model since the previous multivariate asymmetric BEKK-GARCH models [12, 13] were characterized by the "curse of dimensionality" phenomenon, and the existing adaptations of the EGARCH process to the multivariate case [14, 15] assumed that the correlation matrix is constant in time.

It is important to note that the properties of the estimators of the proposed method were studied using the simulated data analysis. As a result, statistical data were found in favor of the DCC-EGARCH method, which provides more efficient estimators compared to the symmetric DCC-GARCH model when considering the data generation process with leverage effect. In addition, the proposed method was able to provide a higher quality of out-of-sample forecasts for 1 and 5 periods ahead.

After analyzing the simulated data using the DCC-EGARCH method, we studied the joint dynamics of conditional volatility and the correlation of the Rosneft stocks and Brent oil prices. As a result of the analysis, statistical evidence was found in favor of the asymmetry effect in the data presented by oil prices, which justifies the use of the asymmetric DCC-EGARCH specification. However, despite the significance of the leverage effect, the use of a symmetrical analog showed slightly lower values of information criteria compared to the presented method, which may be due to the weak influence of asymmetric perception of shocks on the volatility of the assets under consideration. Finally, it is important to note that statistical evidence was found in favor of a significant dynamic correlation structure between the considered time series, which justifies the use of multivariate specifications with a dynamic

correlation matrix to model the joint dynamics of the considered assets.

In conclusion, we note that based on the analysis of simulated data, the proposed DCC-EGARCH model has a significant advantage over the classical DCC-GARCH specification due to the possibility of taking into account the leverage effect. However, in further studies, it is of interest to apply the developed specification to data characterized by the presence of a more pronounced leverage effect, due to which the asymmetric multivariate DCC-EGARCH model can demonstrate a serious advantage over symmetrical counterparts.

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Compliance with International Standards on Auditing (ISAs): Evidence from Kosovo* for the Financial Reporting Period 2015–2019

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ABSTRACT

The **aim** of this empirical study is to determine the compliance of the audit reports of the financial statements of large companies in Kosovo for 2015–2019 with the requirements of the International Standards on Auditing (ISA). The relevance of the study is due to the fact that many countries are now actively moving to the application of the International Standards on Auditing while feeling the lack of detailed methodological materials, which makes it difficult to effectively apply these standards in countries that do not have experience in this area. The basis for the study is a random sample of published audit reports of large companies in Kosovo, about 37% of the total population, which can be considered sufficient. The authors analyze the misstatements (errors) made by the auditors of domestic audit firms in Kosovo when preparing audit reports on the financial statements of large companies in Kosovo in 2015–2019. Based on the analysis, the authors **conclude** that the quality of the audit in Kosovo is insufficient. The level of non-compliance with ISAs remains high, and licensed auditors and audit firms are not adequately trained to satisfactorily fulfill their legal obligations. The results of this study have implications for national audit regulatory bodies (ARBs) and professional accountancy organizations (PAOs) that want to improve overall audit quality.

Keyword: audit report; Kosovo; International Standards on Auditing; compliance

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1. INTRODUCTION

1.1. Accounting and auditing requirements in Kosovo

The requirements for the auditing and reporting of the financial statements of entities in Kosovo are set out in Article 3, 4, 5, 9 and 11 of *Law no. 04 / L-014 on Accounting, Financial Reporting and Auditing*. The law was in force until December 31, 2018. From January 1, 2019 the *Law no. 06 / L-032 on Accounting, Financial Reporting and Auditing*[1] superseded *the Law No. 04/ L-014* promulgated in 2011.

According to Article 4 of the current law, all entities in Kosovo, depending on the number of employees, total assets and total annual turnover, are classified as micro, SME and large entities. This classification serves as the basis for determining the appropriate financial reporting framework, audit requirement, and disclosure requirement for the Kosovo Council for Financial Reporting (KCFR).

1.1.1. Large entities

A business organization is classified as large if it meets two of the following three conditions: (i) Annual (net) turnover: over €4 million; (ii) Gross assets: over €2 million; (iii) Average number of employees during the year: over 50.

According to the requirements of the law, a large business organization (entity) applies International Financial Reporting Standards (IFRSs) and International Accounting Standards (IASs) which are published by the International

[1] Official Gazette of the Kosovo. URL: https://gzk.rks-gov.net/ActDetail.aspx? ActID= 16268

* This designation is without prejudice to positions on status, and is in line with UNSC 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.

** Это название не наносит ущерба позициям в отношении статуса и соответствует резолюции 1244 СБ ООН и заключению Международного суда по Декларации независимости Косово.

Accounting Standards Board (IASB) and approved by the Kosovo Council for Financial Reporting (KCFR).[2] As required by law, these financial statements must be audited by a statutory firm licensed by Kosovo Council for Financial Reporting, and submitted for publication by KCFR no later than April 30 of the following year, respectively June 30 of the following year for consolidated financial statements. The audit should be carried out in accordance with International Standards on Auditing (ISAs) published by IFAC's International Audit and Assurance Standard Board and approved by KCFR. It is emphasized that despite the obligation to audit financial statements by statutory audit firms, the Law and administrative instructions oblige this category of entities to hire certified accountants to certify financial statements in accordance with IFRS.

1.1.2. Small and Medium entities

A business organization is considered medium if it meets two of the following three conditions: (i) Annual (net) turnover: €2 million — €4 million; (ii) Total assets: €1 million — €2 million; (iii) Average number of employees during the year: from 10 to 50.

A business organization is considered medium if it meets two of the following three conditions: from €50 thousand to €2 million; (ii) Total assets: €25 thousand to €1 million; (iii) Average number of employees during the year: up to 10.

All SMEs as classified in Article 4 of the Law, as of 01.01.2015 shall apply the IFRS for SMEs standard published by the IASB and approved by the KCFR. According to Article 4 of the law, the definition of entities includes all types of entities *(Individual, Partnership, Limited Liability Companies, etc.),* so all these types of entities should have a reporting framework, which for SMEs is IFRS for SMEs. The financial statements of medium-sized entities should be audited by an audit firm or a statutory auditor licensed by KCFR, whereas for small entities the audit is not mandatory. Also, submission and publication of financial statements for SMEs is not mandatory. The Law and administrative instructions oblige this category of entities to hire certified accountants to certify financial statements in accordance with IFRS / IFRS for SMEs.

1.1.3. Micro-entities

A business organization is considered micro entity if it meets two of the following three conditions: (i) Annual turnover: less than €50 thousand; (ii) Total assets: less than €25 thousand; (iii) Average number of employees: < 10. The financial reporting of this category is not yet regulated by law, as the law empowers the KCFR to issue an administrative instruction to determine the appropriate financial reporting framework for this category of entities. KFRC has not yet issued any reporting framework for this category of entities.

2. REVIEW OF THE LITERATURE

ISAs are professional standards for the audit of financial statements. The standards are issued by IFAC through IAASB board. The International Federation of Accountants (IFAC) serves the public interest by contributing to the development of strong and sustainable organizations, markets, and economies. It advocates for transparency, accountability, and comparability of financial reporting; helps develop the accountancy profession; and communicates the importance and value of accountants to the global financial infrastructure. International Standard on Auditing deals with the auditor's responsibility to form an opinion on the financial statements. It also deals with the form and content of the auditor's report issued as a result of an audit of financial statements. This ISA promotes consistency in the auditor's report. Consistency in the auditor's report, when the audit has been conducted in accordance with ISAs, promotes credibility in the global marketplace by making more readily identifiable those audits that have been conducted in accordance with globally recognized standards. It also helps to promote the user's understanding and to identify unusual circumstances when they occur."[3]

[2] KCFR is an independent professional body, part of separate division of Ministry of Finance of Kosovo.

[3] IAASB 2018 Edition, Volume 1. Handbook of International Quality Control, Auditing, Review, Other Assurance, and Related Services Pronouncements.

ISAs on audit conclusions and reporting have had an important part in harmonization of the audit opinions. "Such harmonization is important because the audit report is a primary tool auditor's use to communicate with financial statement users" [1]. Information asymmetry between users of financial statements can be eliminated through audit reports harmonization.

It is of high importance to prepare an audit opinion in compliance with ISAs requirement. Without absolute compliance with standards on audit conclusion and reporting (standards ISAs 700–799) users of financial statements could not clearly understand the audit reports prepared by independent and licensed auditors.

"The analysis of the elements concerning the form and the content of audit reports determines the principles followed by the professionals and verify the conformity degree of independent auditors with ISAs" [1]. "The object of the harmonization of the different national practices dealing with audit report is to reach the uniformity of the professional rules" [2].

Similar research performed by M.E. Hyssein, V. Bavishi et al. in [3], compared and analyzed the audit reports issued by statutory auditors in 27 countries who were members of the International Federation of Accountants (IFAC). They compared if these audit reports complied with auditing standards of that time. This research was based on prior research work performed by different researchers [4, 5]. Research performed by Hyssein [3] categorized countries into 5 different groups: US, UK, Europe, Group 4 and Group 5.

- The U.S. Group is composed of Brazil, Canada, Japan, Mexico, Philippines, Taiwan, Thailand, and USA.
- The U.K. Group is composed of Australia, India, Ireland, Malaysia, Netherlands, Singapore, South Africa, and UK.
- The Europe Group is composed of Belgium, Denmark, Finland, France, Norway, Sweden, and Switzerland.
- The Group Four is comprised of Italy and Spain.
- The Group Five is comprised of Austria and Germany.

The results obtained from the research showed that the U.S. and U.K. were fully compliant with the international acceptable audit standards, while the third category showed moderate compliance with standards. The fourth and fifth groups showed very weak compliance with IFAC audit standards.

On the other hand, authors such as De-Angelo [6], Sockley and Holt [7], Balvers et al. [8], Feltham et al. [9], Knap [10] and Hogan [11] find that the size of a statutory firm is an indicator of audit work quality. Their hypothesis stated that the large audit firms are of interest to provide and perform an auditing services of enhanced qualty in order to attract and maintain relations with the clients. Other authors, Raffournier [12], Haniffa and Cooke [13], Choon et al. [14], Coulton et al. [15], consider the correlation between the size of the audit firm and the quality of work. They conclude that in order to achieve quality work, full compliance with auditing standards must be maintained at all times.

Even though mixed results have been reported in regard to the correlation between audit firm size and full compliance with auditing standards, the research has provided evidence that larger firm employees are more skilled and compliant than the employees of small audit firms. It has been argued that larger firms employ skilled employees and provide continuous development training, which in turn increases the quality of their work [16, 17]. "Except for compliance with professional standards of auditing, larger audit firms are capable of issuing a more accurate audit opinion because of their ability to detect more errors and omissions in the financial statements, but also due to their highly developed and structured audit approach" [18–20].

Fakfakh et al. [21, 22] evaluated the influence of the revised International Standard on Auditing No. 700 on the linguistic characteristics of Tunisian auditors' reports. It was found that the audit reports examined did not fully comply with all of the components contained in the updated standard of the International Federation of Accountants (IFAC). Zubek Fathi [23] also tried to investigate the degree of conformity of Qatari auditing companies with the international standard ISA 700. The research found that investigation yielded significant results, such as auditing firms operating in Qatar are, to some degree, complying with the main formalities of

the auditors' report. However, auditors were not fully compliant with the contents of the auditors' report in certain paragraphs as required by the new ISA 700.

3. RESEARCH METHODOLOGY

3.1. Research objective

To review the compliance with ISAs of audited financial statements, we have reviewed the quality of audited statements of large entities which were obliged to submit them for publication in the Kosovo Council for Financial Reporting (KCFR). The reviewed financial statements relate to the accounting period of 2015, 2016, 2017, 2018 and 2019. The aim of this research is to analyze whether the financial statements of large entities have been prepared in compliance with the requirements of IFRS/IAS and whether the auditor's report (audit opinion) has been prepared in accordance with requirements set forth in ISAs

3.2. Sample selection and population

Large entities that submitted audited financial statements for publication in KCFR for reporting years 2015–2019 were 240 per year on average or 1,200 for all five reporting periods. The sample was selected on a random basis approach and for reporting years 2015–2019, 450 audited financial reports were selected for review (analysis) or 37.5% of the total population.

3.3. Methodology and applicable standards of the profession

The analysis of audited financial statements is based on the specific requirements of the relevant standards (ISA). Based on the relevant standards, a list of questions was prepared as to whether the report issued by the auditor complies with the requirements of these standards and based on this analysis the final results for the entire sample were derived.

In order to carry out the analysis of the compliance of the auditor's report with the relevant ISAs, ISAs which cover the issue of the auditor's report have been selected. The ISAs considered for this part of the analysis are detailed as follows:

(i) *International Auditing Standard 700 — Opinion Forming an Opinion and Reporting on Financial Statements & International Auditing Standard 700 (Revised).*[4] This standard contains requirements that the auditor must adhere to regarding the form and content of a standard audit report. An auditor must comply with all the requirements of this Standard if in its opinion the financial statements are fully in compliance with IFRS/IAS, where the auditor issues an unqualified opinion. For the reporting year 2015 the auditor had to apply SNA 700, whereas, for the reporting year 2016, 2017, 2018 and 2019 the auditor had to apply SNA 700 (revised). Requirements taken into account during the analysis are paragraphs 20 to 42 as well as illustrations 1 and 3 of ISA 700 for reporting year 2014, 2015, while paragraphs 20 to 49 as well as illustrations 1 and 3 of ISA 700 (revised) for reporting year 2016, 2017, 2018 and 2019.

(ii) *International Standard on Auditing 705 — 'Modified Opinion in Auditor's Report' & International Auditing Standard 705 (revised)*[5] This standard contains requirements that the auditor must comply with regarding the form and content of a modified audit opinion report. An auditor should comply with all the requirements of this Standard if in its opinion the financial statements are not fully in compliance with IFRS/IAS, where the auditor issues a modified opinion. According to this standard, there are 3 types of opinions that need to be modified: *'qualified opinion', 'adverse opinion' and 'disclaimer of opinion'*. So when the auditor in his report gives one of these three types of opinion, then he should take into account the requirements of this standard. For the reporting year 2015, the auditor had to apply ISA 705, whereas for the reporting year 2016 the auditor had to apply ISA 705 (revised). Requirements taken into account during the analysis are paragraphs 6 to 28 as well as illustration 1 to 6 of ISA 705 for reporting year 2015, while paragraphs 16 to 29 and illustration 1 to 5 of ISA 705 (revised) for reporting year 2016, 2017, 2018 and 2019.

[4] International Federation of Accountants (IFAC) — ISA 700. URL: https://www.ifac.org/system/files/publications/files/ISA-700-Revised_8.pdf

[5] IFAC–ISA 705. URL: https://www.ifac.org/system/files/publications/files/Proposed%20ISA%20705%20%28Revised%29-final.pdf

Table 1

Audit Opinions issued

	2015	2016	2017	2018	2019
Type of opinion	#	#	#	#	#
Unqualified	35	49	62	66	61
Unqualified with emphasis of matter	10	4	12	1	4
Qualified	27	22	26	31	18
Qualified with emphasis of matter	4	4	3	1	2
Adverse	0	0	0	0	0
Adverse with emphasis of matter	0	0	0	0	0
Disclaimer	4	2	0	1	0
Total Audit Reports (sample)	80	85	100	100	85
Total Audit Reports published	262	255	232	220	232
Total Audit Reports (sample in %)	31	33	43	45	37

Source: author's calculations.

(iii) *International Standard on Auditing 706 — 'Emphasis of Matter Paragraph and Other Matters Paragraphs in the Auditor's Report' & International Standard on Auditing 706 (revised).*[6] This standard contains special requirements where auditors wish to draw the attention of readers of the financial statements regarding the matters presented or disclosed in the financial statements. It also contains special requirements when auditors wish to draw the attention of readers of financial statements in relation to matters that are not presented or disclosed in the financial statements but which are important to disclose in the auditor's report. This standard applies only when auditors after the opinion paragraph wish to add the following paragraphs: 'Emphasis of matter', 'Other matters'. For the reporting year 2015, the auditor had to apply ISA 706, whereas for the reporting year 2016 the auditor had to apply ISA 706 (revised). Requirements that were taken into consideration during the analysis are paragraphs 6 to 9, application and other explanatory material A1 to A12 as well as illustration 1 of ISA 706 for the reporting year 2015, whereas paragraphs 8 to 12, application and other explanatory material A1 to A12 as well as appendix 3 and 4 of ISA 706 (revised) for the reporting year 2016, 2017, 2018 and 2019.

[6] IFAC–ISA 706.

The report issued by the auditor should be prepared in compliance with the above ISAs, depending on the opinion of the auditor. When analyzing audit reports the following seven alternatives can be presented:

1) *Unqualified Opinion*. In this case the auditor must apply the requirements of ISA 700, respectively ISA 700 (revised).

2) *Unqualified Opinion with an Emphasis of Matter Paragraph*. In this case the auditor must comply with the requirements of ISA 700 and ISA 706, respectively the revised ISA 700 and ISA 706.

3) *Qualified Opinion*. In this case the auditor must comply with the requirements of ISA 705, respectively ISA 705 (revised).

4) *Qualified Opinion with a paragraph of Emphasis of Matter*. In this case the auditor must comply with the requirements of ISA 705 and ISA 706, respectively ISA 705 (revised) and ISA 706 (revised).

5) *Adverse Opinion.* In this case the auditor must comply with the requirements of ISA 705, respectively ISA 705 (revised).

6) *Adverse Opinion with a paragraph of emphasis of matter.* In this case the auditor must apply the requirements of ISA 705 and ISA 706, respectively ISA 705 (revised) and ISA 706 (revised).

7) *Disclaimer opinion.* In this case the auditor must adhere to the requirements of ISA 705, respectively ISA 705 (revised).

4. RESEARCH RESULTS

Table 1 presents the results of the type of audit opinion issued by the auditors. Based on the data in *Table 1*, it is shown that in 2015, from the analyzed sample, 45 audit reports or 56% of the sample had an unqualified opinion, the number of qualified opinions was 31 (39%), and 4 (5%) disclaimer opinions. In 2016, from the analyzed sample, 53 audit reports or 62% of the sample had an unqualified opinion, the number of qualified opinions was 26 (31%), and 2 (2%) disclaimer opinions. In 2017, from the analyzed sample, 74 audit reports or 74% of the sample had an unqualified opinion, the number of qualified opinions was 29 (29%), and 0 (0%) disclaimer opinions. In 2018, from the analyzed sample, 67 audit reports or 67% of the sample had an unqualified opinion, the number of qualified opinions was 32 (32%), and 1 (1%) disclaimer opinions. In 2019, from the analyzed sample, 65 audit reports or 76% of the sample had an unqualified opinion, the number of qualified opinions was 20 (24%), and 0 (0%) disclaimer opinions.

Table 2 presents the results of the analysis of whether the auditor's report complies with all ISA requirements. Therefore, for *'unqualified opinions'* we have analyzed whether the auditor's report complies with the requirements of ISA 700, respectively ISA 700 (revised). For *'qualified opinions', 'adverse opinions'* and *'disclaimer opinion',* we have analyzed whether the auditor's report is in compliance with the requirements of ISA 705, respectively ISA 705 (revised), and for cases where auditors have added the paragraph *'emphasis of matter'* or '*other matters'* we have analyzed whether the paragraph is in compliance with the requirements of ISA 706, respectively ISA 706 (revised).

The results of the analysis for the years 2015–2019 are presented in *Table 2*. Based on these results, for 2015, only 31% of the analyzed reports contain misstatements (errors) in the auditor's report, while 69% are free from misstatements, or deviations from ISA requirements. During the analysis, we divided the misstatements into auditor reports issued by domestic (local) firms or foreign firms. The results of the analysis show that out of 25 audit reports with misstatements, 100% are from domestic audit firms. Out of 80 audit reports, 85 misstatements were identified, with an average of 1.1 errors per audit report reviewed in the sample.

For 2016 and 2017, only 26% and 42% respectively, of the analyzed reports contain misstatements (errors) in the auditor's report. The results of the analysis show that out of 22 (2016) and 42 (2017) audit reports with misstatements, 100% are from domestic audit firms. Out of 85 (2016) and 100 (2017) audit reports, 81 and 106 deviations from ISAs were identified, with an average of 1.0 (2016) and 1.1 (2017) errors per audit report reviewed in the sample.

For 2018 and 2019, only 44% and 31% respectively, of the analyzed reports contain misstatements (errors) in the auditor's report. Again, all the reports containing misstatements (errors) are from the domestic (local) audit firms. Out of 100 (2018) and 85 (2019) audit reports, 101 and 68 deviations from ISAs were identified, with an average of 1.0 (2018) and 0.8 (2019) errors per audit report reviewed in the sample.

The results of the research show that the total percentage of the number of audit reports with misstatements increased from 2016 and on, mainly due to changes in ISA 700, 705 and 706 that have entered into force in this reporting year. From this research, we can conclude that domestic (local) statutory auditors who are partners in domestic audit firms did not correctly apply the amendments of ISA 700, 705 and 706 as compared to foreign statutory auditors.

Such a high number of misstatements may be due to the lack of external quality control by the Regulatory Body in Kosovo (KCFR),[7] of the work of auditors that has existed since the establishment of the audit profession in Kosovo. Also, the fact that the number of errors is zero in the case of foreign audit firms, compared to domestic audit firms, indicates that foreign firms have implemented an effective internal quality control system and this guarantees the quality of their audit reports.

Table 3 presents the results of the analysis of the nature of misstatements, encountered in the auditors' reports. We have classified all

[7] Regulatory body for audit profession in Kosovo is KCFR.

Table 2

Misstatements (errors) in Auditor Reports by audit firms — 2015–2019

	2015				
Domestic / foreign audit firm	**Total number of audit reports analyzed**	**Total number of opinions with misstatements (errors) (b)**	**Total number of opinions without errors (misstatement)**	**Number of misstatements in opinion**	**Average misstatement for an opinion**
	(a)		**(c) = (a) — (b)**	**(d)**	**(e) = (d) / (a)**
Domestic firm	41	25	16	85	2.1
Foreign firm	39	0	39	0	0
Total	80	25	55	85	1.1
Total in %	100	31	69		
	2016				
Domestic / foreign audit firm	**Total number of audit report analyzed (a)**	**Total number of opinions with misstatements (errors) (b)**	**Total number of opinions without errors (misstatement) (c) = (a) — (b)**	**Number of misstatements in opinion (d)**	**Average misstatement for an opinion (e) = (d) / (a)**
Domestic firm	50	22	28	81	1.6
Foreign firm	35	0	35	0	0
Total	85	22	63	81	1.0
Total in %	100	26	74		
	2017				
Domestic / foreign audit firm	**Total number of audit report analyzed (a)**	**Total number of opinions with misstatements (errors) (b)**	**Total number of opinions without errors (misstatement) (c) = (a) — (b)**	**Number of misstatements in opinion (d)**	**Average misstatement for an opinion (e) = (d) / (a)**
Domestic firm	66	42	24	106	1.6
Foreign firm	34	0	34	0	0
Total	100	42	58	106	1.1
Total in %	100	42	58		
	2018				
Domestic / foreign audit firm	**Total number of audit report analyzed (a)**	**Total number of opinions with misstatements (errors) (b)**	**Total number of opinions without errors (misstatement) (c) = (a) — (b)**	**Number of misstatements in opinion (d)**	**Average misstatement for an opinion (e) = (d) / (a)**
Domestic firm	61	44	17	101	1.7
Foreign firm	39	0	39	0	0
Total	100	44	56	101	1.0
Total in %	100	44	56		

Table 2 (continued)

Domestic / foreign audit firm	2019				
	Total number of audit report analyzed (a)	Total number of opinions with misstatements (errors) (b)	Total number of opinions without errors (misstatement) (c) = (a) – (b)	Number of misstatements in opinion (d)	Average misstatement for an opinion (e) = (d) / (a)
Domestic firm	59	26	33	68	1.2
Foreign firm	26	0	26	0	0
Total	85	26	59	68	0.8
Total in %	100	31	69		

Source: author's calculations.

misstatements encountered during the 2015–2019 reports in the categories listed as in the table.

As can be seen from the results table, the following categories had the most errors:

1) *'Lack of specification of financial statements, accounting policies and notes to the financial statements in the first paragraph of the audit opinion'*.

Based on the requirements of the revised ISA 700 and ISA 700 (revised), each audit report, in its first paragraph, must specify which financial statements have been audited and for what reporting period.

2) *'Missing or error in naming paragraphs'*.

Subject to the requirements of ISA 700, ISA 705 and ISA 706 each paragraph of the report issued by the auditor must have the paragraph designations specified. For an unqualified report, the following paragraph headings should exist: (1) *management's responsibility for the financial statements, (2) auditor's responsibility, (3) basis for opinion, (4) opinion*. For a qualified report, the following paragraph headings should exist: *(1a) management's responsibility for the financial statements, (2a) auditor's responsibility, (3a) basis for qualified opinion, (4a) qualified opinion*. When auditors also add the paragraph of *emphasis of matter* or *other matters paragraph*, this paragraph should be after the opinion paragraph and should have a clear written designation.

• Based on the requirements of ISA700 (revised), ISA705 (revised) and ISA706 (revised), each paragraph of the auditor's report must have the paragraph designations specified. For an unqualified audit report, the following paragraph headings should exist: (1) *opinion, (2) basis for opinion, (3) management responsibility for the financial statements, (4) auditor's responsibility*. For a qualified report, the following paragraph headings should exist: (1a) *qualified opinion, (2a) basis for qualified opinion, (3a) management responsibility for the financial statements, (4a) 'auditor responsibility'*. Where auditors add the paragraph *'emphasis of matter'* or *'other matters'*, this paragraph should be after the paragraph of basis for opinion and should have the title clearly written.

3) *'Lack of disclosure that the management of the entity has prepared the financial statements in compliance with IFRSs'*. Based on the requirements of ISA 700 and ISA 700 (revised) in *paragraph management's responsibility for the financial statements,* it should be specified that the financial statements have been prepared in compliance with IFRS/IAS. In 2015, out of 60 analyzed reports, 9 cases were identified where auditors did not include this requirement of ISA 700 in the reports issued by the auditors.

4) *'Lack of written auditor responsibilities'*. Based on the requirements of ISA 700 and ISA 700 (revised) in paragraph *'auditor responsibility'* the auditor's responsibilities should be specified in compliance with ISA.

ISA 700 (revised) requires the auditor to specify some responsibilities:

• 'Identifying and assessing the risk of material misstatement of FS',

• 'Obtaining an understanding of those internal controls relevant to the audit process.'

Table 3

Misstatements in Audit Report by nature of misstatement — 2015–2019

	2015	2016	2017	2018	2019
Nature of misstatement	# of errors	# of errors	# of errors	# of errors	# of errors
Absence or error in naming paragraphs	7	4	6	5	4
Lack of specification of ISA requirements in the first paragraph of the opinion issued by the auditor	10	5	9	8	5
Lack of disclosure that the management of the entity has prepared the financial statements in compliance with IFRSs/IASs	9	3	5	3	3
Lack of disclosure that the auditor has audited the financial statements in accordance with ISAs	8	2	6	9	4
Lack of written auditor responsibilities	3	35	30	35	25
Lack of written management responsibilities	4	3	6	5	4
Non-placement of certain sentences in adequate paragraphs	12	2	6	5	2
Emphasis of matter written after the auditor has signed the opinion	3	1	5	4	3
Non-declaration of compliance with IFRSs in the auditor's opinion paragraph	9	3	6	3	2
Absence or misstatement in presenting the status of the entity in the auditor's opinion paragraph	6	–	2	3	–
Non-presentation of the value of the account for which the auditor gives a qualified opinion in the paragraph 'Basis for Qualification of Opinion'	2	6	6	3	5
Other	12	17	19	18	11
Total misstatements (errors)	85	81	106	101	68

Source: author's calculations.

- 'Evaluate the appropriateness of accounting policies used..,'
- 'Conclude on the appropriateness of management's use of the going concern basis of accounting..,'
- 'Evaluate the overall presentation of the financial statements..,'

5) *'Non-disclosure of IFRS compliance in the auditor's opinion paragraph'*. Based on the requirements of ISA 700 in the *'opinion'* paragraph, the auditor should note that the FS presents fairly in all material respects ... *in accordance with IFRS/IAS*. In 2015, out of 60 analyzed reports, 5 cases were identified where auditors did not emphasize this requirement of ISA 700. In cases of misstatement, auditors often mentioned these words: *'Kosovo Accounting Standards', 'Kosovo Laws', 'International Standards on Auditing'* etc.

6) *'Absence or error in presenting the status of the entity in the auditor's opinion paragraph'*. Based on the requirements of ISA 700, respectively ISA 700 (revised) in the 'opinion' paragraph the auditor should note that the financial statements fairly present in all material respects the *'financial position of the ABC Company at 31 December 20XX, financial performance financial and cash flow for the year ended December 31, 20XX'*, in accordance with International Financial Reporting Standards.

7) *'Non-presentation of the value of the account for which the auditor gives a qualified opinion, in the paragraph Basis for a qualified opinion'*. Based on the requirements of ISA 705, respectively ISA 705 (revised) if there is a material misstatement in the financial statements that relates to a specific item of the financial statements, the auditor should disclose in the *'basis for qualified opinion'* description of the material misstatement and quantifying the financial effect of the misstatement. If it is impossible to quantify the financial effect, then this fact should be disclosed in the *'Basis for Qualified Opinion'* paragraph.

8) 'Other'. The following are some of the other misstatements:

- The auditor report was not signed.
- The absence of the date when the auditor's report was issued, or the date of issue of the auditor's report was not complete.
- Incorrect ordering of paragraphs (i.e., the paragraph emphasis of the matter is placed before the opinion paragraph).
- Absence of opinion paragraph.
- In the auditor's responsibility paragraph two paragraphs are written which are required to be mentioned only for listed entities.
- In the Audit Report there is no need to state the scope of the audit, objectives of the audit, evidence collected and tests performed, and assessment of internal controls and the accounting system.

5. CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

5.1. Conclusions and recommendations

Results of the research for *the compliance of the auditor's report with the relevant ISAs,* indicate that the level of compliance with ISAs is still unsatisfactory. Licensed auditors of Kosovo are required to adhere to all ISAs requirements when auditing financial statements. The results of the study indicate a situation where auditors and audit firms are not sufficiently prepared to satisfy their legal obligation to a satisfactory level. The findings of this study confirm the results achieved by other researchers such as Fakhfakht [21, 22], Fathi [23] and Williams [24].

The findings of this study have implications for national audit regulatory bodies (ARBs) and professional accounting organizations (PAOs) wishing to improve the overall quality of audits. Moreover, regulators of the audit profession can also benefit from the results and strengthen their quality assurance function. The results of this research add to the literature on the discussion of the implementation of new ISAs issued by IFAC and complement the work of other studies in the field of external auditing.

In this regard, concrete steps should be taken by ARBs and PAOs to increase the quality of the audited financial statements in Kosovo. In order to achieve better quality results, the findings of this research can be used to form recommendations that must be implemented as soon as possible by regulatory bodies and professional accounting associations in Kosovo. The same recommendations can be considered by all audit regulatory bodies of EU and Western Balkans countries.

- Implementation of an effective quality control system by the Kosovo Financial Reporting Council (KCFR)/Public Oversight Board (PBC) for statutory auditors and statutory audit firms.
- Implementation of an effective quality control system by local Professional Accounting Organizations (PAOs) for certified auditors and accountants who provide services to the public.
- Implementation of training system according to the output-based approach which is preferable to the International Education Standard 7 (IES 7) and which is based on the verification/testing of the knowledge gained by the candidates.
- Better cooperation between PAOs and KCFR in the field of quality assurance of auditors' work.
- Creation of a platform by KCFR for electronic submission of audited financial statements, in which access would be more effective.
- Training topics should be based on findings from regular reviews of the quality of the audited FS.
- Obligation for the financial statements of entities to be prepared by certified accountants who are members of any professional accounting and auditing organization licensed by KCFR.

5.2. Research limitation

The current research has several limitations which should be taken into account by the users of this paper when evaluating the findings and considering the recommendations:

- The International Auditing Standards (ISAs) used for this research were only those that deal with the audit opinion (ISA 700, 705 and 706). Other ISAs that deal with the different phases of the audit process were not taken into account. Therefore, if other ISAs would have been used to assess the quality of the audited financial statements, the results of the research and recommendation could have been different.
- The research period is limited to only five fiscal years. However, if more fiscal years would have been taken into account, the findings would have been more powerful from the statistical point of view.
- The sample size of audited financial statements selected in this research was around 37% of the total population and was selected on a random basis approach. If a larger proportion of audited financial statements were to be selected, and also a different selection approach, the findings of this research might have been different.
- The research was conducted only for the audited financial statements of large private entities operating in Kosovo. Therefore, the results and recommendations of this study might be applicable only to Kosovo's economy.

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