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The Main Development Trends of Sub-Saharan Africa Financial System

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ABSTRACT

The financial system of sub-Saharan Africa is heavily dependent on foreign and international capital. The external debt of Sub-Saharan Africa is more than 60% of the total GDP, in some countries, that is about 95%. In the last decades, there has been an expansion of the influence of pan-African financial groups and central/national banks in the monetary policy of African states. Sub-Saharan Africa shows exponential growth in electronic mobile payments and the digital currency of central banks and crypto assets depends on distributed ledger technology. Regional financial centers have emerged, shaping the growth and development of African finance. The structure, specifics and main trends in the development of the financial system of sub-Saharan Africa are described in the context of the challenges facing the global financial system. The need for integration processes for the countries of the continent, the role of central banks and Pan-African financial institutions are substantiated. The possibility of implementing the concept of leapfrogging in the transition of the monetary and credit system of the African continent to national digital currencies and the use of distributed register technology are considered. The author considers the credit and monetary system of Sub-Saharan Africa as a place of financial innovations that can identify the development of the global financial system for decades to come.

Keywords: financial system of Sub-Saharan Africa; African financial centers; financial integration in Africa; African financial leapfrogging; fintech; crypto assets; Central Bank Digital Currency; DCCB; DeFi

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INTRODUCTION

The financial system (FS), which is fundamentally based on money in the broadest sense, is the main infrastructural component of the economy. The financial system reflects the state and determines the prospects for the development of the economy of the state, as well as the standard of living and welfare of its citizens.

Institutionally, the financial system consists of central/national/reserve banks, investment/specialized development banks, commercial banks, non-banking credit and financial organizations (microfinance organizations, credit cooperatives, leasing companies, etc.), securities market entities (exchanges, investment and broking companies), investment and non-state funds, insurance companies, payment systems and their operators. An important component of the financial system — state finances and the related subject relations — are not considered in this study.

Currently, the African continent is at the epicenter of a historical acceleration that is lifting millions of people out of poverty, creating a new consumer class, and driving rapid economic growth not only in Africa but also worldwide. The need to study the financial system of Sub-Saharan Africa (FSSA), its directions, and development trends is dictated by Africa's increasingly significant role in the global economy. First of all, this is related to the enormous untapped resource potential of the continent, the shift of the global vector of economic development from West to South [1, p. 3], and the increasing share of Sub-Saharan Africa in the world's young labor force. According to experts and the scientific community, by 2030, approximately half of the world's workforce will be represented by people from Sub-Saharan African countries, which corresponds to an annual increase in jobs by 10–15 million people. The financial system of Sub-Saharan Africa is a global outsider in terms

of its quantitative and qualitative indicators, but at the same time, it is one of the world leaders in the development of decentralized financial assets, central bank digital currencies, electronic payment systems, and fintech as a whole. Sub-Saharan Africa can become a testing ground for financial innovations, ensuring a technological breakthrough in the global digital asset market.

SIZES, SPECIFICS, AND STRUCTURE OF THE FINANCIAL SYSTEM OF AFRICA

The level of development of any financial system is primarily reflected in the indicators of the banking sector, which in monetary terms usually accounts for 60–75% of the entire national financial system. A telling example is the TOP-100 African Banks ranking by the British magazine African Business (Table).[1]

To understand the scale of the banking sector in Africa: the total assets of the banks in Africa and Russia are approximately the same, amounting to about 1.5 trillion USD (according to the Central Bank of Russia, as of January 2024, the assets of the Russian banking sector are 166 816 billion rubles at an assumed exchange rate of 90 rubles per 1 dollar). Sberbank, with assets of approximately $ 530 billion, is just over three times larger than Africa's largest bank, Standard Bank, whose assets amount to around $ 167 billion.

The Table shows that the top ten banks on the continent are consistently held by banks from North Africa and three banks from South Africa. Of the top twenty banks, nine represent the AU, with only Nigeria joining the Republic of South Africa. The top twenty account for about 75% of the total assets of the African banking system.

The specificity of the financial system of the African continent lies primarily in its non-integrated diversity and the differences in the level of development. As in the rest of the world, Africa has its own regional financial centers. There is no single African financial center that represents the continent in the global market. According to the frequently used Global Financial Centers Index (GFCI), published by the British analytical company Z/Yen, the following cities in Africa are included: Casablanca (Morocco), Mauritius, Kigali (Rwanda), Johannesburg (South Africa), Cape Town (South Africa), Lagos (Nigeria), and Nairobi (Kenya).[2] This ranking does not provide a complete picture of the current structure of the financial system of the black continent.

In terms of institutional, currency-monetary, and financial legislation, the African continent is very diverse; each financial conglomerate has its own specifics and characteristics due to national, historical development, and colonial heritage [2]. The African continent can be divided into 8 financial conglomerates due to their unifying factors, geography, and significance for the African economy (Fig.).

1. North Africa with three main players: Morocco, Egypt, and Algeria. It is the only regional financial conglomerate in Africa that is associated with the global financial center of Bahrain. The Western academic school classifies North Africa as a separate region — Middle East and North Africa (MENA), which is not unfounded. The financial system of North Africa is developing mainly within the framework of global trends and is more integrated with the East and Asia. This article examines in more detail the financial system of Sub-Saharan Africa, which represents an interesting and relevant subject for applied research.

Main centers: Casablanca (Morocco), Cairo (Egypt), Algiers (Algeria), Oran (Algeria). There is no unifying regional development institute.

2. The West African CFA franc zone (XOF)[3] with its Central Bank (BCEAO) of the West African Economic and Monetary Union (WAEMU) in Dakar (Senegal). Monetary protectorate of France. The management of the

[1] Pan-African, regional, and national development banks do not participate in the ranking.

[2] URL: https://www.longfinance.net/programmes/financial-centre-futures/global-financial-centres-index/gfci-37-explore-the-data/gfci-37-rank/ (accessed on 03.04.2025).

[3] International currency code.

Table

TOP-20 African Banks 2024 (Million US Dollars)

2024	2023	Name of the bank	Country	Capital	Assets	Net profit
1	1	Standard Bank Group	South Africa	12 547	166 562	2 733
2	2	National Bank of Egypt	Egypt	7 460	154 819	588
3	6	Attijariwafa Bank	Morocco	5 985	66 625	916
4	7	Absa Bank	South Africa	5 267	83 168	455
5	8	Banque Centrale Populaire	Morocco	5 165	52 597	418
6	3	Banque Misr	Egypt	5 091	104 194	1 047
7	5	FirstRand	South Africa	4 470	88 309	1 379
8	4	Nedbank	South Africa	4 585	66 856	641
9	9	Banque Extérieure d'Algérie	Algeria	3 519	34 329	318
10	**11**	**Bank of Africa — BMCE Group**	**Morocco**	**3 158**	**39 245**	**412**
11	10	Banque Nationale d'Algérie	Algeria	2 608	41 094	431
12	15	Investec Bank	South Africa	2 220	33 203	378
13	18	Arab African International Bank	Egypt	2 019	13 169	143
14	16	Commercial International Bank (CIB)	Egypt	1 973	27 000	959
15	14	FBN Holdings (First Bank of Nigeria)	Nigeria	1 948	18 886	346
16	13	Access Bank	Nigeria	1 904	29 500	720
17	12	Zenith bank	Nigeria	1 836	22 771	755
18	new	Crédit Populaire d'Algérie	Algeria	1 743	24 525	273
19	20	QNB Al Ahli	Egypt	1 630	20 334	525
20	22	United Bank of Africa (UBA)	Nigeria	1 597	23 028	678
		TOTAL		76 725	1 110 214	14 115

Source: Compiled by the author based on the TOP-100 banks in Africa ranking for 2024 by the magazine "African Business". URL: https://african.business/2024/09/finance-services/africas-top-100-banks-2024-going-global (accessed on 01.02.2025).

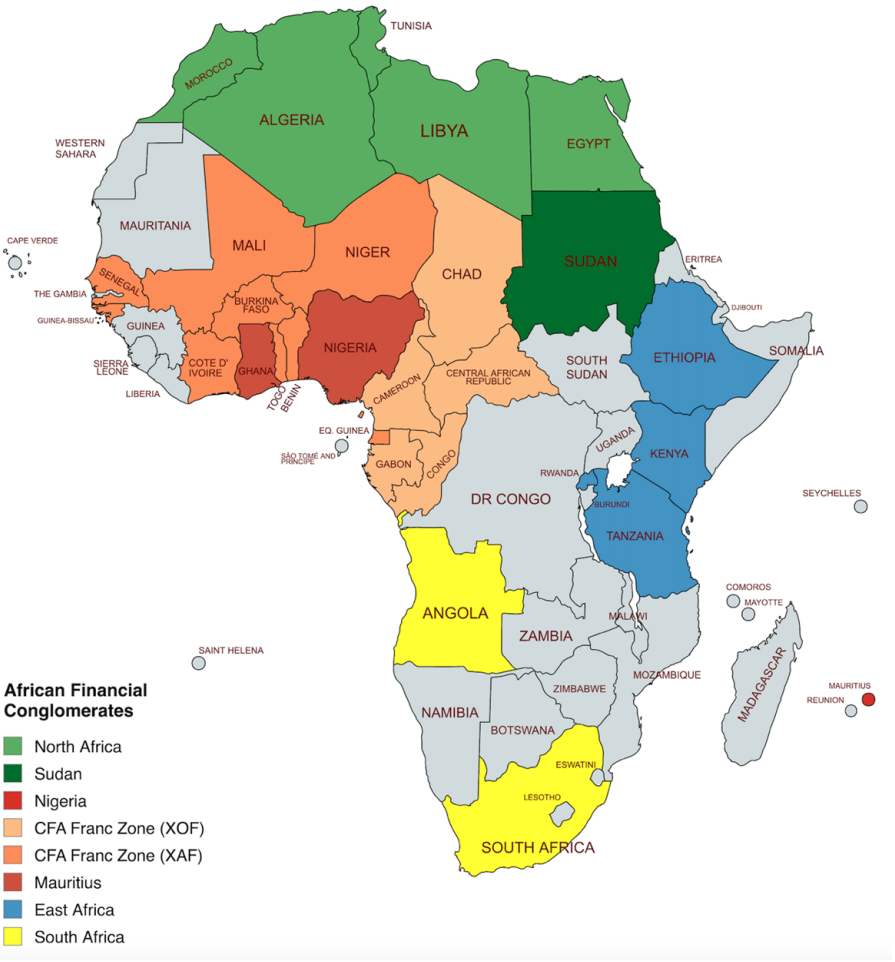

Fig. **African Financial Conglomerates**

Source: Compiled by the author.

monetary policy of the zone is carried out by the French government through the Treasury (part of the Ministry of Economy, Finance, and Industry), which guarantees the exchange rate of the CFA franc to the euro and has the right to veto all decisions of the BCEAO.

Main centers: Dakar, Abidjan (Côte d'Ivoire), Lomé (Togo). Development institution: West African Development Bank (WADB).

This is the most financially seismic zone in West Africa. For decades, it has been constantly shaken by intentions to break away from French protectorate status, the transition to the new Eco currency, protests against the XOF to euro exchange rate, and other events. The instability in the Sahel region adds fuel to the fire, particularly the exit of Mali, Niger, and Burkina Faso from the Economic Community of West African States (ECOWAS) and their formation of the Alliance of Sahel States (ASE) with the intention of issuing their own currency.

3. The Central African CFA franc zone (XAF) with its Bank (BEAC) of Central African States in Yaoundé (Cameroon). Monetary protectorate of France (similar to the West African CFA zone's management of monetary policy). It is a more stable zone compared to the Western financial conglomerate due to the fact that it includes less developed countries that are more in need of the monetary stability provided by the CFA franc.

Main centers: Yaoundé, Brazzaville (Republic of the Congo), Malabo (Equatorial Guinea).

Development institution: Development Bank of Central African States (BDEAC).

4. The East African regional financial center with key players: Ethiopia, Kenya, Tanzania, and Rwanda. It aspires to be the

"African Singapore" (due to its high economic dynamics and government reforms) with ambitions to become the main financial center of East Africa in the next decade [3].

Main centers: Addis Ababa (Ethiopia), Nairobi (Kenya), Dar es Salaam (Tanzania), Dodoma (Tanzania), Kigali (Rwanda).

The second largest financial conglomerate after South Africa, with a sufficiently developed financial infrastructure. One of its main achievements is the highest level of access to financial services for the population due to electronic payment systems. Kenya has the most developed fintech in Africa after Nigeria.

The development institution is the East African Development Bank (EADB).

5. South African financial center with key players: South Africa and Angola.

Main centers: Cape Town (South Africa), Johannesburg (South Africa), Durban and Umhlanga (South Africa), Pretoria (South Africa), Luanda (Angola).

This is Africa's number one financial conglomerate with the most developed banking system: approximately 40 percent of the continent's financial sector income is generated here, mainly due to South Africa. There is a high concentration of international credit and financial institutions. It is the birthplace of pan-African financial expansion: banking, non-banking,[4] electronic payment systems, and fintech. Noteworthy here is the issuance by the Reserve Bank of Zimbabwe in 2024 of the non-fiat currency ZIG, backed by gold, aimed at addressing the financial crisis and the devaluation of the national currency. Here, too, is the largest African borrower from China — Angola (43 billion dollars with the country's external debt of 67 billion dollars as of 2024).

Development Institute — Development Bank of Southern Africa (DBSA).

6. Nigeria and Ghana.

Main centers: Lagos (Nigeria), Abuja (Nigeria), Accra (Ghana).

Nigeria is the leading economy in Sub-Saharan Africa by GDP (tied for first place in all of Africa with Egypt). The largest financial market, leading in Central and West Africa, Nigeria is the most advanced country in Sub-Saharan Africa in terms of fintech, CBDCs, and cryptocurrency operations. The first country in Africa (one of the few in the world) to issue and use the central bank digital currency E-Naira in transactions. The model of Ghana's financial system (historically the second country in Africa, after South Africa, to gain access to international capital markets) is similar to Nigeria's, but economically significantly smaller.

The Development Institute — Nigerian Trust Fund (NTF), part of the African Development Bank Group (AfDB).

7. Sudan as the center of Islamic finance in Africa.

The only country in the world,[5] where the entire financial system is fully Islamized at the state level. At present, it would not be entirely correct to characterize this conglomerate due to the statehood and economy being destroyed by civil war. The topic of the development of Islamic financing in Sub-Saharan Africa is not considered here, as its share is insignificant. As of early 2025, this is approximately 1.7% of the global financial volume of Islamic finance and amounts to about $ 55 billion (around 3.7% of the assets of the African banking system). In our opinion, Islamic financing has great development potential in Sub-Saharan Africa, as it is in demand among African Muslims and is more humanitarian compared to conventional finance. It will be in demand after increasing the population's access to banking services and the development of Islamic fintech.

The Development Institute — Islamic Development Bank (IDB), an international financial organization headquartered in Jeddah (Saudi Arabia).

[4] Banks that do not have physical offices, serving their customers exclusively online.

[5] At the state level, financial systems are Islamized in Iran and Pakistan, but not 100%, as in the Republic of Sudan; their structure includes some products based not only on Sharia law, particularly in the insurance sector.

8. Mauritius as an African offshore center.

A financial, customs, and tax offshore for many countries around the world. As of the end of 2024, agreements on the absence of double taxation have been signed with 18 African countries. The Mauritians themselves call their country the "gateway to Africa", and it has the highest Human Development Index (HDI) on the continent — 0.796 as of 2023/2024.[6] For comparison, in Russia for the same period — 0.821. In the import structure of many countries in the Sub-Saharan Africa (especially East Africa), Mauritius with its agricultural economy can be found as a supplier of metals, equipment, and other products not produced on the island.

The Development Institute — the Central Bank of Mauritius (Bank of Mauritius) represented by its subsidiary, the Mauritius Investment Corporation (MIC).

FINANCIAL INTEGRATION IN AFRICA

Financial integration is manifested in multilateral development institutions and pan-African financial groups. Such institutions include the African Development Bank (AfDB) with assets of approximately $ 44 billion as of 1 January 2025, and the African Export-Import Bank (Afreximbank), with assets of $ 37 billion on the same date. The Russian Federation, represented by the Russian Export Centre (REC), has been a shareholder of Afreximbank since December 2017 [4]. Both credit organizations are affiliated with Western capital and are dependent on it. The largest regional multilateral development institutions are the Trade and Development Bank (TDB), which operates in East and Southern Africa (as of 1 January 2025, its assets are $ 10 billion), the public-private African Finance Corporation (AFC) with assets of $ 12.34 billion as of 1 January 2023, and the Arab Bank for African Economic Development (BADEA) with assets of approximately $ 5.5 billion.[7]

In terms of territorial coverage, the largest pan-African financial groups are Standard Bank Group (South Africa), United Bank for Africa (Nigeria), Ecobank Transnational (Togo), BCP Group (Morocco), Attijariwafa Bank (Morocco), Bank of Africa Group (Morocco), Absa Group (South Africa), Guarantee Trust Bank (Nigeria), Access Bank Group (Nigeria), Equity Bank (Kenya), FirstRand Group (South Africa), Nedbank Group (South Africa), and KCB Group (Kenya). The expert community considers Vista Group and Coris Bank International, with jurisdictions in Burkina Faso, as the new most dynamically developing financial groups, notable for their transactions with Societe Generale Group (France) for the acquisition of its African banks [5].

In Africa, multinational (MNC) and foreign capital are significantly represented. The main players here and now: Societe Generale Group (France), Crédit Lyonnais (France), BNP Paribas S.A. (France), Barclays PLC (United Kingdom), Standard Chartered PLC (United Kingdom), Barclays plc (United Kingdom), Citigroup Inc (USA), JPMorgan Chase (USA), HSBC Group (United Kingdom), China Construction Bank (China), Bank of China (China), Deutsche Bank AG (Germany), State Bank of India (India) [6].

Over the past decade, there has been a territorial expansion of pan-African financial corporations within the continent and a gradual displacement of multinational and foreign banks by them [7]. At the current moment, this is becoming a trend in the Sub-Saharan Africa, the main reason for which is the higher ability of local financial groups to adapt to the rapidly changing economic conditions in Africa and their determination to take on higher risks than those that Western financial institutions are accustomed.

The share of loans provided by pan-African credit institutions is constantly increasing in

[6] Human Development Report Office (HDRO) of the United Nations. URL: https://hdr.undp.org/system/files/documents/global-report-document/hdr2023–24reporten.pdf (accessed on 22.02.2025).

[7] The data on asset sizes is taken from the websites of the respective banks.

the overall structure of the credit portfolio of Sub-Saharan African countries, leading to intensified competition with foreign banks. One of the key points here is the struggle for the status of a preferred creditor (PCS), which has always been held by the IMF, the World Bank, and the International Monetary Fund by default, but now is actively being claimed by pan-African credit institutions and multilateral African development banks [8].

Currently, the **global financial system is facing a number of serious challenges,** caused both by deglobalization [9] and restructuring as objective factors, as well as by subjective moments in its development, primarily due to the consequences of financial globalization [10] and the advancement of information technologies. Globalization banking products include tools for the worldwide unification of capital and risk requirements for financial organizations (primarily banks), expressed in the tightening of supervisory requirements by the Basel Committee (Basel II and Basel III) and in the strengthening of control over client activities. One example is the "Know Your Customer" (KYC) system. Such prudential supervision measures reflect the needs of the European financial system with a stable euro, low rates, declining yields and profitability of operations, weak growth dynamics, and high financial integration. The West sees this as a means of protection against global economic crises.

For emerging markets, such as Sub-Saharan Africa, instability in inflation and exchange rate indicators and rates is characteristic, along with a high growth rate of liabilities, which forces management to take on more risks in conducting active operations; otherwise, competitiveness and profitability will decline. In particular, this explains that in Sub-Saharan African countries, against the backdrop of high stated supervisory requirements, there is a justified lenient attitude towards the use of Western regulatory standards. On the one hand, this certainly increases credit risks, but on the other hand, it provides opportunities for development and does not significantly affect the financial result, as actual and potential loan losses are compensated and will continue to cover losses through extensive revenue growth.[8]

The tightening of centralized global financial supervision requirements has been one of the main drivers for the development of the decentralized finance (DeFi) sector [11] and its payment surrogates — mobile money transaction systems (fintech). It must be acknowledged that a significant role in this was played by the reduction of client transaction privacy and the endowment of financial organizations with the function of combating money laundering and financing of terrorism (AML/CFT). Considering that fiscal and investigative activities are not the functions of financial organizations, AML/CFT is formalized within them in the form of provisions with signs and criteria of suspicious offences. Often, this slows down the movement of legal capital and hinders normal transactions and the development of legitimate businesses.

Traditional financial organizations are finding it increasingly difficult to compete with fintech. The main reason for this is the rapid pace of information technology development. Regulated and established banking and non-banking financial organizations find it significantly more challenging to restructure and adapt their automated systems to changing market conditions than it is for an entrepreneur to create a payment platform or crypto exchange from scratch in a nascent legal environment. Furthermore, the strengthening of supervisory requirements for capital adequacy constantly demands significant investments (capital increases) from the owners of traditional financial organizations, leading to a shortage of investments in fintech and digital financial assets.

[8] A similar situation was observed in the early 2000s in the rapidly growing banking system of Russia.

HARACTERISTICS OF THE FINANCIAL SYSTEM OF SUB-SAHARAN AFRICA

Against the backdrop of current global problems and trends, a unique situation has developed in Sub-Saharan Africa. The influence of global financial markets is reflected to some extent in the development of the financial system of Sub-Saharan Africa. In particular, credit and financial institutions, in order to operate in global investment and payment markets (primarily correspondent relationships and payment information transfer systems), have to "adhere to Basel", follow common rules for combating terrorism and money laundering, comply with sanctions against countries unfriendly to the European Union and the United States, and so on. Also, financing public debt through sovereign bonds requires the country's budget policy to comply with the listing requirements of global stock exchanges. Demonstrating a high level of global integration of the Sub-Saharan financial system, it is necessary to note the challenges unique to Sub-Saharan Africa on the path of financial development, the main ones being four factors.

The first factor is the low coverage of banking services among the population of Sub-Saharan Africa (on average no more than 22%, for comparison — in North Africa approximately 42%). At the same time, according to various estimates, about 60% of the population in Sub-Saharan Africa use electronic money in their transactions in one form or another (in some countries, this figure is significantly higher). According to a McKinsey study [12], the volume of electronic transactions in Africa is growing by approximately 10% per year. According to the forecast by the analytical agency Statista, by 2027 the total value of transactions in the African electronic payments market will reach $ 303.10 billion. The opinion that Sub-Saharan Africa has already achieved financial leapfrogging[9] and skipped over traditional banking to digital futures is not entirely correct. One of the main reasons for the rapid development of non-bank electronic payment systems in Sub-Saharan Africa are the following:

- low income levels of the population, which are often outside the scope of government fiscal control;
- poorly developed telecommunications infrastructure and insufficient internet access in Sub-Saharan Africa;
- the emergence of inexpensive smartphones and cheap feature phones, which through USSD (Unstructured Supplementary Service Data) technology allow for payment transactions.

In other words, fintech has fallen on fertile African soil. The problem is that electronic money is exclusively a means of payment and does not possess such a fundamental function of money as a store of value. That is, from the perspective of the financial system, they do not serve as a resource base for forming long-term liabilities (in banking terminology, the funds of payment system operators in bank accounts are "demand deposits", the use of which in active operations is strictly regulated and limited by the regulator). In addition, the specifics of using the API (Application Programming Interface) require payment systems to distribute and reserve financial resources among several credit organizations, especially in cross-border transfers.

The entities of the financial system serve as instruments for financing the economy, mobilizing monetary resources from the population and SMEs, redistributing formed capital among economic sectors, and directing it towards priority industries. When faced with limited opportunities for mobilizing internal savings and the task of financing economic growth, there are only three paths: internal and external borrowing, which forms public debt, foreign investments, and state development financing. This is exactly what most Sub-Saharan African countries demonstrate to us: a large public debt comparable to GDP, dependence on foreign and international

[9] Literally "leapfrogging". A theory according to which the rapid implementation of innovations allows skipping the evolutionary stage of system development, jumping straight to the next one.

capital, and a high share of public funding in the economy.

The second factor is the high share of the shadow economy (estimated at around 50% of GDP) and the inefficient fiscal policy. This is a broad topic for a separate study, related to the public finance sector and its corrupt component, which are not addressed in this article.

The third factor is low industrialization: the African Development Bank's study "Africa Industrialization. Index 2022"[10] shows that countries with a higher industrialization index demonstrate greater resilience and opportunities in their financial systems, relying on industrial assets.

The fourth factor is the demographic factor influencing the population's engagement in financial operations: the median age of the African population in 2024 is 19.17416 years, with a forecast for 2030 being 20.1929 years. In Sub-Saharan Africa, this figure is significantly lower — approximately 42% of the population here are children under 15 years old.[11] North Africa does not significantly influence the median age of Africa, as its population share ranges from 23% to 25% of the entire continent. For comparison, in Russia, the median age in 2020 was 38.692 years.

The foundation of the concept of "self-reliance" (SR) and its modern adaptation — "collective self-reliance" (CSR) [13], which is beginning to return and transform in Africa, is the effective use of the country's internal potential. This fully applies to the financial system, the basis of which is internal savings, direct and portfolio investments, tax revenues, and treasury support for public financial operations.

The development of these areas is a strategic task facing the Sub-Saharan African countries. Solving these tasks will allow:

- reduce public debt;
- increase budget revenues;
- reduce the state's share in domestic investments, as state loans suppress private ones, which cannot compete with them in terms of rates and terms;
- expand lending to SMEs, corporate, and consumer sectors.

The most important factor in the development of the financial system of each conglomerate and all of Africa as a whole is financial integration, which is developing very slowly due to the opposition of the collective West, which has been using the old Roman rule "divide and conquer" in its economic activities on the continent for the past 400 years. Breakthrough steps in this direction included the establishment by the African Union in 2018 and the commencement of operations on 1 January 2021, of the African Continental Free Trade Area (AfCFTA), as well as the launch on 13 January 2022, of the Pan-African Payment and Settlement System (PAPSS) based on the African Export-Import Bank (Afreximbank).

A global trend is the development of digital financial assets (DFA) and digital currencies [14] issued by national central banks (NCB). And here, the financial system of Sub-Saharan Africa has significant advantages over the rest of the world, as demonstrated by the E-Naira, the digital currency of the Central Bank of Nigeria, one of three countries in the world (plus the Bahamas and Jamaica) that have introduced a CBDC into their national monetary circulation. The main problems of implementing digital national currencies lie in the realm of legal regulation, monetary policy, and financial stability. According to an analytical report by the Association of Russian Banks,[12] countries with emerging markets and developing countries show higher activity in promoting CBDC projects. Developed countries,

[10] African Development Bank. URL: https://www.afdb.org/en/documents/africa-industrialization-index-2022 (accessed on 01.12.2024).

[11] URL: https://database.earth/population/africa/median-age (accessed on 01.12.2024).

[12] Association of Banks of Russia "Central Bank Digital Currency (CBDC): Russia in the Context of Global Practice", Moscow, June 2021. URL: https://asros.ru/analytics/asros/doklad-assotsiatsii-bankov-rossii-tsifrovaya-valyuta-tsentralnogo-banka-tsvtsb-rossiya-v-kontekste-m/ (accessed on 18.04.2025).

on the contrary, have slowed down the pace of advancing CBDC projects in recent years. The number of requests to the IMF regarding CBDCs from 2020 to February 2023 accounted for 23% from Africa and only 2% from Europe of the total number of requests [14].

Countries whose currency is considered reserve or close to it (partially convertible) find the digitalization of the state financial system less advantageous than less developed and developing countries with their unstable economies, high public debt, and dependence on fluctuations in the exchange rates of reserve currencies and global prices for raw materials and food.

For example, in the USA, the development of CBDCs is suspended at the state level, as it poses a direct threat to the dollar as a reserve currency. But they are actively involved in studying CBDCs through the IMF and in the "field tests" of the digital currency JAM-DEX launched by the Central Bank of Jamaica in 2022. In Russia, this topic is developing according to the Roadmap of the Central Bank of the Russian Federation. As part of the implementation of the instruction from President V.V. Putin from 02.08.2024 No.1528, an experiment on the use of the digital ruble for payments made from the federal budget appropriations will begin in August 2025, and a wallet of the Federal Treasury (FT) in the form of the Interregional Operational Treasury (IOT) will be opened on the Bank of Russia's digital ruble platform.

According to the IMF's position [14], the issuance of digital currency by countries with low coverage of traditional banking services and high penetration of electronic payment systems can achieve leapfrogging with the help of CBDCs and quickly attract a large part of the population into the banking sector. Therefore, the issuance of central bank digital currencies in Sub-Saharan Africa could play a stabilizing role for their financial systems and solve the main problem —mobilizing savings that are currently in cash and electronic forms. The use of distributed ledger technology would allow for the future abandonment of the pegging of national currencies to the dollar and euro. The most promising regions in this regard are the CFA franc zones, where institutional monetary centralization and second-level currency functioning technologies already exist.

The stability and efficiency of any financial system is ensured by the central bank (CB) of the country, which determines the price (inflation) and monetary policy of the state. According to economic theory, methods of monetary regulation can be divided into two main groups — those that have quantitative and qualitative effects on monetary aggregates in the economy. The level and degree of the CB's involvement in state economic regulation is determined by the mandate[13] issued to it by the country's government. In developing economies, an important function of central banks is managing the exchange rate of the national currency against the dollar and euro, as this directly affects the structure of the foreign trade balance.

Until the beginning of the 21st century, the mandate and **regulation of monetary policy by the central banks of Sub-Saharan African** countries were mainly aimed at financing budget deficits and external debt, implementing selective financial policies focused on investments, and subsidizing interest rates on loans for selected government-designated sectors and companies. Inflation management was carried out through direct methods of influencing interest rates and regulating the money supply in the economy by restricting or issuing additional money. At the beginning of the 21st century, when progressive African economic growth occurred and the associated increase in the size of foreign and international investments in the Sub-Saharan Africa, the regulation of monetary policy shifted from direct methods to indirect ones based on inflation targeting [15].

At present, due to the ongoing growth of most Sub-Saharan African economies and

[13] Mandate refers to specific monetary regulatory measures authorised and provided for in existing legislation.

the processes of financial deglobalization, the role of central banks in Africa as the main tool for ensuring financial stability is constantly increasing [16]. The use of modern monetary management methods is beginning to prevail, including the transition to floating exchange rates of national currencies. Nevertheless, in Sub-Saharan Africa (especially in underdeveloped countries), the inflationary practice of financing government debt by central banks and fixing the exchange rate continues. This is explained by the difficult conditions in which the central banks of these countries are currently operating: a decrease in external financing, which in turn leads to a reduction in foreign exchange reserves, global price fluctuations, underdeveloped financial markets, a weak regulatory framework, and politicians' uncertainty in transferring independence to central banks in conducting monetary policy.

The Director of the African Department of the IMF, Abebe Aemro Selassie, in his speech on the occasion of the 60th anniversary of the National Bank of Rwanda on 7 June 2024, in Kigali, identified four key challenges for the central banks of Sub-Saharan African countries in the current conditions of uncertainty and volatility in the global environment: floating exchange rates, tackling high public debt, managing risks in the financial sector, and the growing importance of financial innovations (fintech, CBDCs, and stablecoins). In his opinion, to address these tasks, it is necessary to have a coordinated macroeconomic approach that takes into account the interrelationship between monetary, fiscal-budgetary policies, and exchange rate policy. These policies must strike a balance between exchange rate stability, inflation control, and external competitiveness, while simultaneously promoting sustainable growth, said Abebe Aemro Selassie. This truly reflects the state and requirement of regulation and supervision of the financial system in Sub-Saharan Africa.

CONCLUSION

The main trends in the development of the financial system of sub-Saharan Africa can be summarized as follows:

1. De-globalization (as a general global trend) [9], which primarily manifests in the restriction and slowdown of cross-border movement of foreign capital and the decrease in the activity of MNEs in Africa. According to R. V. Shkhagoshev and other authors of the article, "the key trend in changes in capital flows is ... the overall slowdown in the growth rate of transnational investments, ... globalization is being replaced by the division of the global market into large segments united by economic and political interests, which leads to the localization of capital flows within certain unions and associations" [17]. In Sub-Saharan Africa, this primarily leads to a concentration on internal and collective resources of economic growth.

2. Pan-African integration, further development of intergovernmental African payment banking, electronic, and digital systems. Increase in trade volumes and the number of transactions within the framework of the African Continental Free Trade Area (AfCFTA) and the Pan-African Payment and Settlement System (PAPSS).

3. Continuing work on the establishment of multilateral pan-African financial organizations, as provided for in Article 19 of the African Union Constitution and the continent's development program "Agenda 2063" — the African Central Bank (ACB), the African Investment Bank (AIB), and the African Monetary Fund (AMF) [18].

At the 46th session of the African Union in 2025, the year was declared as "Justice through Reparations for Africans and People of African Descent". The establishment of a Reparations Fund is planned, which in essence should become another development tool for the black continent.

4. A slow but consistently stable trend of the displacement of Western banks by pan-African financial institutions, replacing Western

beneficial owners of financial companies with national owners.

5. Further development of electronic payment systems and mobile banking. According to forecasts by the analytical agency McKinsey, by 2025, Ghana and Francophone West Africa are expected to demonstrate the fastest growth rates of 15% and 13% per year, respectively. Following them are Nigeria and Egypt, with an expected growth rate of 12% per year over the same period. McKinsey predicts the main growth of fintech in 11 key markets: Cameroon, Côte d'Ivoire, Egypt, Ghana, Kenya, Morocco, Nigeria, Senegal, South Africa, Tanzania, and Uganda, which together account for 70% of Africa's GDP and half of its population.

6. Development of the banking market and increased coverage of the population with banking services. Currently, the African banking market is the second fastest-growing and most profitable among all regions in the world after the Asian market, with enormous potential due to the unbanked population, cash savings, credit products, and fintech. There is a development of neobanking as an alternative to mobile banking and an increase in the number and quality of regional financial marketplaces.

7. Increasing the number of non-bank credit organizations, especially in rural areas, in the interests of low-income populations. Primarily, these are credit consumer cooperatives and microfinance organizations.

8. Digitization of finance, expansion of CFA issuance, including those operating on the use of distributed ledgers, and the introduction of central bank digital currencies (CBDCs), which can make a real leapfrog in creating technology for converting electronic money into digital currency.

9. Increasing financial literacy (especially among the youth) and growing trust in financial institutions. Many countries in Sub-Saharan Africa include the establishment of financial literacy institutions in their economic development strategies.

10. The transition of African central banks from quantitative easing policies to interest rate-based monetary policies and the management of floating exchange rates of national currencies.

11. Improving the efficiency of public debt management, including the abandonment of the detrimental practice of financing government expenditures by central banks in most underdeveloped economies of Africa.

The Russian Federation should not remain on the sidelines of these events, having long-standing economic and friendly relations with most African countries and being one of the main actors in the restructuring of the global financial system [19]. Financial cooperation between Africa and Russia is primarily developing institutionally along the lines of BRICS (South Africa, Egypt, Ethiopia — BRICS members; Algeria, Nigeria, Uganda, Zimbabwe, Morocco, Senegal, Chad, Equatorial Guinea, Eritrea, and South Sudan — candidates, invitees, and confirmed intentions). In the context of sanctions pressure on Russia, the participation of African banks in the BRICS Pay International Payment System, based on transactions in national currencies, including their digital forms, is important.

It is advisable to establish Russian private payment infrastructure (cryptocurrency exchanges, electronic money platforms, microfinance organizations) in Sub-Saharan African countries and to activate cooperation with African multilateral and national development financial institutions.

Russia could participate in the promotion and dissemination of Islamic finance; in Sub-Saharan Africa, about 63% of the population practices Islam. Russia already has three years of experience in developing Sharia-compliant finance (in a secular sense, "partnership financing") under Federal Law No. 417.[14]

[14] Federal Law 'On Conducting an Experiment to Establish Special Regulation for the Purpose of Creating the Necessary Conditions for Partnership Financing Activities in Certain Constituent Entities of the Russian Federation and on Amendments to Certain Legislative Acts of the Russian

In the field of interstate cooperation within the framework of bilateral intergovernmental commissions (IGCs) on economics, the transfer of Russian economic and financial technologies in the areas of budgetary relations, public debt management, information technologies in public services, tax administration, and information security is necessary [20]. Currently, Africa is collaborating in these areas with international financial institutions and the Government of France (CFA franc zone). It is necessary to develop scientific and expert cooperation on priority areas of economic and financial development in the countries of the African continent.

The development of the financial system of the black continent, as well as the socio-economic development of Africa as a whole, is primarily linked to the liberation from colonial thinking and the gaining of confidence in implementing the concept of "collective reliance on one's own strength". A strategic priority should be the implementation of the African Union's plans to create pan-African financial institutions independent of Western influence, in accordance with Article 19 of the Afro-Union Constitution and the economic realization of the theme of the African Union Summit 2025 — "Justice for Africans and people of African descent through reparations".

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State Financial Support Measures and Risk Factors Affecting the Cost of Investment Projects for the Introduction of Industrial Robotic Complex

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ABSTRACT

The **object** of the study is the cost of an investment project for the introduction of an industrial robotics complex (hereinafter referred to as the RTC implementation project). The **subject** of the study is the factors affecting the cost and effectiveness of the RTC implementation project, including measures of state financial support and the risks of its implementation. The **relevance** of the study is due to the government's interest in ensuring the competitiveness and technological independence of the Russian industry based on the development of the robotics industry to achieve the goal set by the President of the Russian Federation of Russia's entry into the top 25 countries in terms of robotics density by 2030, which requires an assessment of the cost and effectiveness of RTC implementation projects, taking into account government financial support measures and specific risks. The **purpose** of the study is to determine the impact of government financial support measures and risk factors for the implementation of the RTK project on its investment value and effectiveness. The study employs methods of classification, investment management, risk management, and valuation. The measures of financial state support and risk factors for the implementation of the RTK project are analyzed and their impact on the investment value and effectiveness of the project is characterized. The classification of factors influencing the investment cost of the RTK implementation project is considered. The impact of government financial support measures and tax incentives on the cash flows and financial results of the project is described. A model for calculating the discount rate of the RTK implementation project is proposed, taking into account the risk factors of its implementation (technological, personnel, regulatory, environmental). It is **concluded** that in order to make a decision on the feasibility of introducing RTK into industrial production, the company must determine the investment cost and basic performance indicators of the project, taking into account the factors considered.

Keywords: investment project; investment value; discount rate; risk factors; government financial support; financial results; robotic complex

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INTRODUCTION

The relevance of the study is due to the necessity of ensuring the accelerated growth of the Russian economy and achieving national technological sovereignty in the current sanctions realities. In his Address to the Federal Assembly of the Russian Federation on 29 February 2024, the President of Russia set an ambitious task: to enter the top 25 countries in terms of the number of industrial robots by 2030, including with the aim of increasing labor productivity in the face of existing demographic challenges.

The competitiveness of Russian industry is impossible without the digital transformation of production processes, in which the key role is played by the robotization of domestic industrial companies. The scale of global robotization is constantly growing. According to the latest report by the International Federation of Robotics (IFR), from 2018 to 2023, the number of industrial robots in the world increased annually by an average of 12% and reached 4 281 585 units in 2023 (*Fig. 1*). At the same time, more than 51% of all industrial robots installed in 2023 are in China, 17% in Europe, and 10% in North and South America, with the share of the USA accounting for 68% or 37 567 units.

In Russia, by the end of 2023, 12 800 industrial robots had been implemented. Today, this figure is around 13,500 units. The level of robotization in Russia is extremely low — only 19 robots per 10,000 workers, compared to the global average of 160 units per 10 000 people. For comparison, in South Korea, this figure is 1 012 units per 10 000 people, in Singapore — 770, in China — 470, in Germany — 429, and in Japan — 419.[1]

According to calculations by the Ministry of Industry and Trade of Russia, to enter the top 25 countries in terms of industrial robot density by 2030 and achieve a rate of 145 units per 10 000 people, it is necessary to increase the robot fleet almost eightfold — to 100 000 units.

Understanding the necessity to eliminate Russia's lag behind the global level of robotization, the Government of the Russian Federation announced in July 2024 the implementation of the national project "Means of Production and Automation", which included the Federal Project "Development of Industrial Robotics and Production Automation". The total amount of declared funding for its implementation until 2030 is over 300 billion rubles. At the same time, 7.12 billion rubles will be allocated in 2025, 12.73 billion rubles in 2026, and 17.11 billion rubles in 2027.[2]

The measures of financial government support should stimulate industrial companies to implement robotics projects in their production. At the same time, the final conclusion about the feasibility of investing in such a project should be made by the company only based on the results of a comprehensive analysis of all the basic elements of its evaluation: cost, economic efficiency, timelines, and risks included in the discount rate.

Thus, the purpose of the study is to determine the impact of state financial support measures and risk factors on the cost and economic efficiency of implementing the IRC project for making an investment decision by an industrial company. To achieve this aim, the following tasks need to:

- describe the specifics of the investment project for the implementation of a robotic complex;
- identify the key factors influencing the economic feasibility of implementing the IRC project;
- analyze the existing measures of state financial support for IRC implementation projects and assess their impact on cash flows and financial parameters of the project;

[1] Assessment of the level and prospects of industrial robotization in Russia. URL: https://issek.hse.ru/news/932892785.html (accessed on 03.04.2025).

[2] Federal Law "On the Federal Budget for 2025 and the Planning Period of 2026 and 2027" from 30.11.2024 No. 419. URL: https://www.consultant.ru/document/cons_doc_LAW_491969/ (accessed on 03.04.2025).

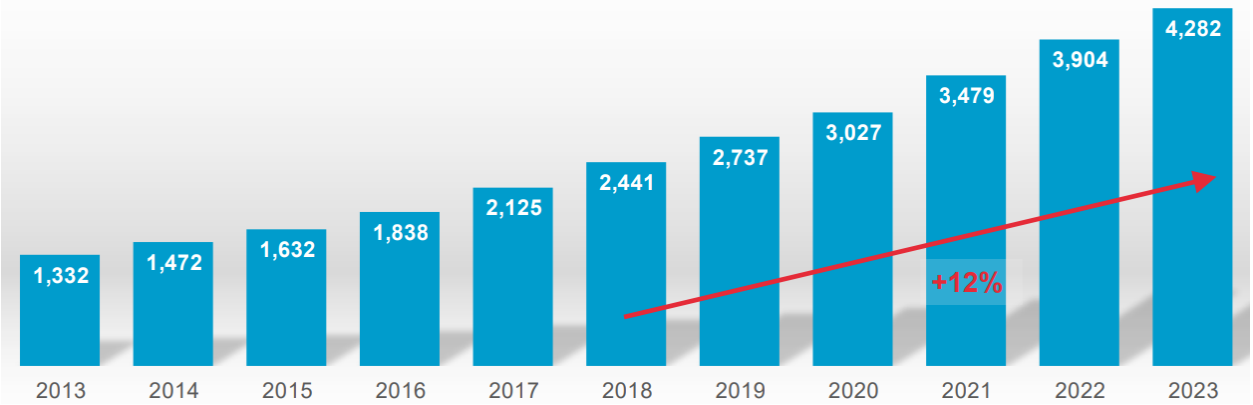

Fig. **Dynamics of the Number of Industrial Robots in the World, Thousand Units**

Source: Data from the International Federation of Robotics. URL: https://ifr.org/ifr-press-releases/news/record-of-4-million-robots-working-in-factories-worldwide (accessed on 03.04.2025).

• propose a model for calculating the discount rate of an IRC implementation project, taking into account the risk factors of its execution.

MATERIALS AND METHODS OF RESEARCH

The informational basis for writing the article consists of the results of the author's own research conducted in 2025 within the framework of the scientific fund of the Financial University on the topic "Methodological Recommendations for Evaluating the Economic Efficiency of Projects for Implementing Robotic Systems in Industrial Enterprises", as well as the works of domestic and foreign scientists on the relevant topic, regulatory legal acts regulating investment activities and the evaluation of investment projects, including in the field of robotization, national standards of the Russian Federation related to the thematic group "Robots and Robotic Devices", data from open sources and specialized websites, including the International Federation of Robotics, the Ministry of Industry and Trade, the Federal Tax Service, and the websites of companies engaged in the development and implementation of robotic systems, etc.

The prospects of robotization technological processes in companies have been studied by many Russian [1, 2] and foreign [3, 4] researchers. Particular emphasis is placed on various aspects of human-robot interaction [5, 6]. Practically all scientists acknowledge that the potential of robotization has not yet been fully realized. In this regard, innovative investment projects, including those in the robotics industry, are becoming increasingly significant, with their effectiveness proposed to be assessed using traditional indicators such as NPV, ROI, and IRR [7, 8], while improving the approaches to their calculation by considering additional factors and risks [9, 10].

Specifically, the studies on the effects of the implementation of robots and robotic systems, as well as the efficiency of this process, are dedicated to domestic and foreign works [11–14]. In some papers, the risks of innovative investment projects are analyzed [15–17].

At the same time, the scientific papers of Russian and foreign authors practically do not address the issues of the impact of state financial support measures on the economic efficiency of investment projects for the implementation of IRC, particularly on cash flows and financial results. Additionally, the specific risks of implementing these projects and the methods of accounting for them in the discount rate are insufficiently studied.

From our perspective, these factors can fundamentally influence the company's decision on the feasibility of investing in the

IRC implementation project, increasing the objectivity and accuracy of the assessment. This will enable the expansion of the investor pool and accelerate the processes of robotization in Russia.

When studying the factors affecting the cost and performance indicators of the IRC implementation project, methods of comparative analysis, classification, investment management, risk management, and cost estimation were used.

RESEARCH RESULTS

Factors Influencing the Investment Cost and Economic Efficiency of the IRC Implementation Project

An investment project for the implementation of an IRC will be understood as a time-limited and resource-limited set of activities for making investments (business plan), involving the implementation (or modernization) and subsequent operation of a robotic complex with justification of economic feasibility, scope, and timing of capital investments.

(Industrial) robot complex — a system consisting of an industrial robot, a working tool (or tools), sensors on the working tool, and equipment necessary for performing tasks as intended, as well as a task execution program.[3]

The implementation of the IRC deployment project should take into account the stages of the industrial robot's life cycle, defined by a set of sequential interconnected processes, starting from the justification of the need for development and direct industrial operation, and ending with the disposal and recycling of components. In accordance with the provisions of GOST,[4] the life cycle of an IRC consists of ten stages (development justification, initial requirements formation, design, manufacturing, control, operation, maintenance, repair, modernization, and disposal), differing in the set of tasks performed and the results obtained. Throughout the first five stages of the IRC life cycle, the company's cash flow in the context of project implementation is represented by the costs of creating IRC elements. At the control stage, the process of manufacturing robotic products is completed, acceptance tests are conducted, and delivery to the customer is carried out. Subsequently, the installation and industrial operation of the IRC begin.

To maintain the operability of the IRC during operation, technical maintenance, repair, and modernization are carried out. To identify the need for repair or replacement of individual components, the enterprise conducts diagnostics of the robotic system's performance. Repair or replacement of units (modules) is carried out in accordance with the manufacturer's documentation, based on which tests of the updated IRC and quality control of the produced products are conducted. For these types of work, the company regularly allocates certain funds in the budget, based on the technical documentation of the IRC and its individual modules. The specified expenses in constructing the net cash flow model adjust its amount for operating activities downward.

The development of technology, changes in consumer preferences, and the obsolescence of individual modules lead to the need for the modernization of robotic products. As a result, there are expenses for the acquisition and replacement of individual robots and their components (modules) with improved properties. These expenses increase the value of fixed assets and are accounted for as investment outflows.

[3] GOST R 60.0.0.4–2023/ISO 8373:2021. National Standard of the Russian Federation. Robots and robotic devices. Terms and definitions (approved and put into effect by the Order of Rosstandart from 20.04.2023 No. 255).

[4] GOST R 60.0.0.16–2024. National Standard of the Russian Federation. Robots and Robotic Devices. Life Cycle. Terms and Definitions (approved and put into effect by the Order Rosstandart from 15.11.2024 No. 1682). URL: https://meganorm.ru/mega_doc/norm_update_01032025/gost-r_gosudarstvennyj-standart/0/gost_r_60_0_0_16–2024_natsionalnyy_standart_rossiyskoy.html (accessed on 03.04.2025).

Within the final stage of the IRC lifecycle, the disassembly of units (modules) occurs, the identification of structures suitable for further use, and the identification of waste to be disposed of. The final cash flow is associated with the costs of component disposal, the income from the sale of units and modules suitable for further use.

In the implementation of individual stages (a set of stages) of the IRC life cycle, enterprises and organizations are involved, which, as a rule, either develop, manufacture (within the first five stages of the robot's life cycle), or operate the IRC. In our study, the focus is on investment projects for the implementation of ready-made IRCs in production (without the development stage).

Robotic complexes, in terms of technical solutions, applied control algorithms, the degree of integration into neural network and computer vision projects, differ in their level of innovation, uniqueness, and the scale of the tasks being solved, which directly affects the duration of the life cycle, the cost of projects, and the level of technological risks. At the same time, the assessment of all costs associated with owning an IRC over its lifecycle can be evaluated using the Total Cost of Ownership (TCO) method.

The volumes of investment in IRC implementation projects also depend on the scale of the robotization of production processes. Moreover, comprehensive robotization projects involve medium- and long-term implementation horizons for robotic complexes and robotic cells, while the installation of individual industrial robots and robotic devices can be carried out within a short- and medium-term timeframe (within a year). "Most often, for an enterprise, the payback period for IRC on average ranges from 24 to 36 months; sometimes the payback period can extend to 6–7 years" [11].

To choose the optimal implementation option for IRC by industrial companies, in addition to the total cost of ownership of IRC, the calculation of potential economic benefits is carried out, including cost reduction, increased labor productivity, and improved product quality, as well as the social and environmental effects generated by the project.

In making the final decision about the feasibility of investing in the IRC implementation project, the key role is played by the *investment cost of the project*, which is traditionally understood as the amount of money that an investor is willing to invest in the project, based on its potential income, risks, and other factors affecting future cash flows. In other words, it is the sum of the company's investments at all stages of the project's implementation, discounted to the present time. Provided that all investments are made at the beginning of the project, we will obtain the traditional indicator for assessing the economic efficiency of investments in the project — the net present value (NPV), which should be greater than zero. When selecting alternative projects, the company can additionally apply the return on investment (ROI), internal rate of return (IRR), and discounted payback period (DPP) indicators.

Overall, the set of factors influencing the investment cost of the IRC implementation project can be classified into the following groups (*Table 1*): a) strategic and organizational; b) technological; c) infrastructural and operational; d) personnel and organizational; e) financial and market.

The size of the NPV is primarily influenced by the amount of cash flows and the discount rate. The positive cash flow balance at all stages of IRC operation may directly depend on measures of financial government support and tax incentives for robotization processes, which are currently being actively implemented by the Government of the Russian Federation. When determining the discount rate, accounting for the specific risks of implementing the IRC project can play a significant role. In this regard, we will further examine the financial factors affecting the

Table 1

Factors Influencing the Investment Cost of the RTC Implementation Project

Factor	Explanation
Strategic and organizational	
Project goals	Automation, cost reduction, quality improvement — different goals require different solutions.
Scale of implementation	One IRC or an entire robotic line — a radical difference in the volume of investments
Planning horizon	Long-term projects require a larger budget reserve for updates and modernization
Selected implementation model	Purchase, rental, leasing, outsourcing (e.g., RaaS — Robot-as-a-Service)
Sustainable development and ESG indicators	Additional income from reducing emissions, waste, and increasing energy efficiency when implementing IRC
Technological	
Type and characteristics of IRC	Complexity, precision, load capacity, functionality, versatility
The need for additional equipment	Conveyors, CNC machines, sensors, cameras, enclosures
Level of adaptation to the existing infrastructure	Integration into the current IT infrastructure and production environment can be costly.
Complexity of management systems and software	Software development, interfaces with production management systems ERP, MES, SCADA
Infrastructural and operational	
Site preparation	Re-equipping work areas, reinforcing floors, laying communications
Modernization of electrical networks and safety	Mandatory requirements for high-power IRC
Engineering and design work	Design development, 3D modelling, technical documentation
Installation and commissioning	Often constitutes 10–20% of the equipment cost.
Personnel and organizational	
Staff training	Additional costs for training operators, adjusters, programmers
Availability/absence of personnel	It may be necessary to hire specialists or collaborate with integrators.
Change management	Costs for changing business processes, overcoming resistance, and developing corporate culture
Financial and market	
Exchange rate differences and imported components	Currency risks can negatively impact the project budget.
Taxes, duties	When importing, IRC can have a negative impact, while tax preferences can have a positive impact.
Availability of subsidies, grants, benefits	Government support can cover up to 50% of the project costs.
Cost of capital (discount rate)	Consideration of implementation risks when calculating NPV, IRR, DPP

Source: Developed by the authors.

Table 2

Classification of General Financial Measures of State Support for Companies Implementing RTC

Name of the measure	Operator	Regulatory documents	The essence of the measure	Duration of the measure
Industrial mortgage (IM)	Ministry of Industry and Trade of Russia	Resolution of the Government of the Russian Federation from 06.09.2022 No. 1570	Conducting the modernization of the facility with preferential financing not exceeding 500 million rubles	Until 7 years
Preferences	Industrial Development Fund	Resolution of the Government of the Russian Federation from 17.07.2015 No. 720	Receiving from the government during the modernization process and after its completion a number of advantages in participating in public procurement and benefits for promoting Russian products in domestic and foreign markets	Indefinitely
Co-financing	Industrial Development Fund	Resolution of the Government of the Russian Federation from 22.02.2023 No. 295	Receiving a loan of up to 100 billion rubles at a preferential interest rate	Investment phase of the project + 2 years
Special Investment Contract (SPIC 2)	Industrial Development Fund	Federal Law from 31.12.2014 No. 488, Resolution of the Government of the Russian Federation from 21.03.2020 No. 319 etc.	State support for investments in serial production projects in an amount not exceeding 50% of the project's capital investments from the total amount of budget expenditures and revenues not received by the state	Up to 20 years
Special Investment Contract (SPIC 1)	Industrial Development Fund	Federal Law from 14.03.2022 No. 57 and etc.	State support for investments in modernization and production development	Throughout the entire duration of the SPIC
Leasing	Industrial Development Fund	Resolution of the Government of the Russian Federation No. 719, Order of the Director of the Industrial Development Fund dated 17.02.2025 No. 17	Acquisition of IRC under co-financing conditions with an initial payment of no less than 10% at a preferential interest rate of 5%	For the duration of the lease agreement

Source: Compiled by the authors based on data from the Robotics Consortium. URL: https://robot-control.ru/support_measures (accessed on 03.04.2025).

investment cost of the IRC implementation project, highlighted in *Table 1*.

Analysis of Financial Support Measures and Their Impact on Cash Flow and Financial Indicators of IRC Implementation Projects

A comprehensive set of state support measures and incentives for the development of industrial robotics and production automation as tools of state policy to ensure technological sovereignty in achieving national development goals by 2030 contributes to the goals of scientific and technological development of the Russian Federation[5] — to form an

[5] Decree on the national development goals of the Russian Federation for the period up to 2030 and the outlook up to 2036. Unified plan for achieving the national development goals of the Russian Federation up to 2030 and the outlook up to 2036

Table 3

Classification of Tax Benefits for Companies Using the General Taxation Regime And Implementing RTC

Name of the tax	An article containing benefits	The essence of the benefit
Profit tax	259.3	The introduction of increasing coefficients of 2 and 3 in the calculation of depreciation for objects with high energy efficiency, for advanced technological equipment for SPIK participants, for companies that have leased equipment, and others
	286.1	Receiving regional tax investment deductions that reduce the company's expenses on acquiring fixed assets
	286.2	Receiving federal tax investment deductions (by organizations paying profit tax to the federal budget at a rate of 8%), which reduce the company's expenses on the acquisition of fixed assets by 50% of these expenses from the initial cost
Insurance premiums	427	Introduction of reduced insurance contribution rates for: – societies implementing utility models and industrial designs, the rights to which belong to their participants and founders (autonomous, budgetary scientific institutions and universities); – organizations and individual entrepreneurs engaged in technology implementation activities in the corresponding zone; – companies included in the register of radio-electronic industry organizations and participants of industrial clusters

Source: Developed by the authors based on the Tax Code of the Russian Federation.

effective system of interaction between science, technology, and production, ensuring increased receptiveness of the economy and society to new technologies, and creating conditions for the development of high-tech entrepreneurship.

The mechanism of state support measures, approved by the resolutions of the Government of the Russian Federation, allows companies to access project financing on preferential terms and thereby reduce financial costs for securing project funding sources at the stages of the IRC lifecycle. The impact of financial measures of state support for companies implementing IRC on project efficiency is manifested in the reduction of financial expenses related to the renewal of machinery, equipment, and technological lines, the shortening of the investment phase of projects, the reduction of resource intensity, the increase in the transparency of management processes, and the controllability of results.

For companies implementing IRC, government support measures can be divided into direct and indirect. Indirect measures are aimed at forming infrastructure, creating industrial techno parks, robotics development centers in all federal districts of Russia, stimulating research and development of new IRC models, and preferential promotion of products in the Russian market, as well as restricting access (banning) of foreign-origin goods to procurement.

Direct measures are related to the financial support of companies implementing IRC. They include preferential lending, leasing of robots, subsidies for the technical re-equipment of organizations producing robots

(approved by the Government of the Russian Federation). URL: https://base.garant.ru/411256963/ (accessed on 03.04.2025).

Table 4

The Impact of Financial Measures of State Support for Companies Implementing RTC on Cash Flow and Financial Performance

Name of the measure	Impact on expenses, income, financial result	Impact on individual elements of cash flow	Impact on the financial feasibility of the project	The stage of the project life cycle
Industrial mortgage	Reducing financial expenses for securing project funding sources leads to an increase in pre-tax profit	When calculating the discounted cash flow to equity: a) the net profit before tax and interest on debt (EBIT) increases; b) the amount of capital investments is reduced by the amount of interest savings on the loan; c) the amount of interest at the subsidized rate leads to a reduction in the amount of change in long-term liabilities; d) the discount rate of cash flows decreases when applying the CAPM model due to the reduction of the beta coefficient in the rate calculation When calculating the discounted cash flow on total capital: effects a) and b) are similar to those discussed above; c) The discount rate of cash flows decreases when applying the WACC model due to the reduction in the cost of debt financing	Reduction of the investment phase period of the project, improvement of the balance of cash flow for the project in terms of the timing of inflows and outflows and volumes, increased transparency of management processes and controllability of the result, which reflects in the reduction of project insolvency risks	Operation, modernization
Preferences	The increase in income and profit is associated with the growth in production volumes, changes in the structure and assortment of products, which are of higher quality, due to an increase in their prices	When calculating the discounted cash flow, the net profit in the EBIT calculation increases due to the increase in product output	Similarly to industrial mortgages	Operation, indefinitely
Co-financing	The reduction of financial expenses for securing sources of project financing leads to an increase in pre-tax profit	The mechanism of influence on individual elements of cash flow is similar to industrial mortgage	Similarly to industrial mortgages during the period: investment phase of the project + 2 years	

Table 4 (continued)

Name of the measure	Impact on expenses, income, financial result	Impact on individual elements of cash flow	Impact on the financial feasibility of the project	The stage of the project life cycle
Leasing	Reduction of the tax burden in terms of profit tax, property tax, the possibility of offsetting VAT amounts, the application of accelerated depreciation, and the reduction of financial expenses for securing project financing sources, provided that preferential loan financing is attracted to cover up to 90%* of the advance payment for a leasing deal for technological re-equipment and modernization of fixed production assets	The amounts of cash flows should be calculated specifically for the project, taking into account the terms of the contract with the authorized leasing company	Synchronization of the lease payment schedule with the cash flow from the project within the periods corresponding to the lease term in the lease agreement, increasing the transparency of management processes and the controllability of the result	Operation, modernization

Source: Developed by the authors.

Note: * The maximum loan amount from the Fund can be up to 45% of the total cost of industrial equipment. URL: https://frprf.ru/zaymy/lizing/ (accessed on 03.04.2025).

or their component base, as well as subsidies to compensate for discounts that robot manufacturers and companies implementing them provide to customers.

The characteristics of the current financial support measures are presented in *Table 2*.

The digitized database of all subsidies and grants for business support, which are financed from federal, regional, and municipal budgets on a competitive basis, is presented on the Portal for Providing Financial State Support Measures.[6]

The choice of the measure of state financial support for companies implementing IRC will depend on:

- the specifics of the project being implemented;
- the type of subsidy, the field of activity in which the company applying for the support measure operates,
- categories of the applicant, size of the business submitting the application;
- maximum subsidy amount, etc.

Tax benefits in terms of their economic content are tools for the state to stimulate certain types of activities. They are not mandatory to use; the organization independently decides how appropriate their application is in the course of its activities (Article 51, paragraph 2, part 1 of the Tax Code of the Russian Federation). The classification of tax benefits is presented in *Table 3*.

The effect of a company implementing IRC tax benefits will manifest in a reduction of the tax burden and an increase in cash flow due to the application of accelerated

[6] URL: https://promote.budget.gov.ru/public/minfin/activity (accessed on 03.04.2025).

Table 5

Specific Risks of the Implementation of the RTC Implementation Project for Accounting in the Discount Rate

Risk category	Description	Possible consequences	Rate premium (%)
Technological and infrastructural risks	Failures in the operation of RTK, incompatibility with the current infrastructure	Rework, delays, additional costs for modernization and equipment	+1.5–3.5%
Personnel and social risks	Lack of specialists in RTC operation, social tension	Delay in implementation, increased costs for training, social adaptation	+2.0–4.0%
Regulatory risks	New requirements for safety and certification, restrictions on the import of RTK	Additional costs, project delay	+1.0–3.0%
Environmental risks	Increased environmental requirements for the operation and disposal of equipment	Increase in costs for environmental measures	+1.0–1.5%

Source: Developed by the authors.

depreciation, in the reduction of expenses not only in investment but also in operational activities, which will ultimately lead to an increase in the operational efficiency of companies throughout the entire period of IRC operation. Unlike general financial state support measures, which are predominantly temporary in nature (83.3% of the measures), two out of four tax benefits remain in effect until they are legislatively repealed and may exceed the useful life of the IRC. A summary of the impact of state financial support measures for companies implementing IRC on cash flows and financial performance is presented in *Table 4*.

Thus, the considered measures of financial and tax state support allow reducing the investment cost of the project for the industrial company-investor, increasing the NPV, and thereby enhancing the economic feasibility of implementing the IRC project.

Risk Factors of Implementing the IRC Project that Affect the Discount Rate

When implementing robotic systems (IRC) in industry, it is important to consider various types of risks that affect the return on investment. These risks are incorporated into the discount rate on equity when evaluating the economic efficiency of the project, which is proposed to be determined using a modified CAPM model (formula 1).

$$CAPM = R_f + \beta \times \left(R_m - R_f\right) + S_{sp}, \qquad (1)$$

where R_f — the yield rate on zero-coupon OFZ-30 bonds; β — beta coefficient; R_m — expected market return; S_{sp} — specific risk of implementing IRC.

Types of specific risks are presented in *Table 5*.

The table does not specify financial and market risks, as they are incorporated into the discount rate at the level of β, as well as into the average market return R_m for industrial companies of a specific industry affiliation. The premium to the discount rate is determined by expert judgement in the range of 0–5%. At the same time, different types of IRC are more characteristic of certain risks (*Table 6*).

There are various ways to minimize risks, in particular:

Table 6

The Impact of Risks on the Discount Rate for Various Types of RTC

IRC type	Main risks	Specific risk (Rsp)
Manufacturing (welding, assembly, processing)	Technological and infrastructural, personnel	+2–3%
Logistics (AGV, AMR)	Technological and infrastructural	+1.5–2.5%
Agricultural	Environmental, technological	+3–4%
Medical (Da Vinci, exoskeletons)	Regulatory, personnel, and social, technological	+4–5%
Safety robots	Environmental, personnel, and social	+2–3%

Source: Developed by the authors.

Technological and infrastructural risks → pilot testing before large-scale implementation.

Personnel and social risks → employee training, attracting qualified engineers; gradual transition, explanatory work with staff.

Regulatory risks → analysis of legislation, consultations with lawyers, development of domestic robotics.

Environmental risks → standardization of the operation and disposal of IRCs, consideration in the company's sustainable development strategy.

But in any case, their consideration will increase the objectivity of the discount rate calculation, and consequently, the reliability of the economic efficiency indicators of the IRC implementation project, which will allow the investing company to make an informed decision about the feasibility of its implementation.

CONCLUSION

In conclusion, the following conclusions can be drawn:

1. Russia significantly lags behind world powers in terms of robotization density, therefore one of the directions of the activities of the Government of the Russian Federation is the development of measures for state financial support and tax incentives for industrial companies engaged in the development and implementation of robotic systems.

2. The investment project for the implementation of IRC has specific features related to the life cycle of IRC, its technical characteristics, the risks of implementation and operation, and other factors, which are collectively proposed to be classified into the following groups: a) strategic and organizational; b) technological; c) infrastructural and operational; d) personnel and organizational; e) financial and market. In making the final decision on the feasibility of investing in the IRC implementation project, the industrial company-investor primarily considers financial factors: the availability of government financial support, tax incentives, and the cost of equity (which is taken into account in the discount rate), all of which will determine the investment cost of the project and its economic efficiency indicators: NPV, IRR, DPP.

3. The article characterizes the impact of government support measures on cash flows, financial performance indicators of an

industrial company that has implemented IRC, and the financial feasibility of the project itself. The specific risks of implementing and operating IRC have also been considered, which are proposed to be taken into account when calculating the discount rate using the modified CAPM model. An expert assessment of their magnitude has been provided, including depending on the field of application of IRC.

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O.V. Borisova — analysis of state financial support measures and tax benefits.
S.R. Dreving — the concept and life cycle of RTC, characteristics of the impact of government financial support measures and tax incentives on the cash flows and financial results of the company
O.V. Loseva — development of the concept of the article, introduction, construction of a model for calculating the discount rate taking into account the risk factors of the implementation of the RTC project, formulation of conclusions.
M.A. Fedotova — writing an abstract, analyzing literature, methods and materials, and preparing a list of sources.

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Conceptual Issues of Managing Non-Tax Revenues of the Budgets of Public Legal Entities

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ABSTRACT

In the current conditions of ongoing transformation processes in the economy associated with the reorientation of resources to new priorities, increasing the tax burden of individuals and organizations in various sectors of the economy, developing the institution of state programs and project principles for managing budget expenditures of public-law entities, the importance of managing budget revenues is significantly increasing. High-quality management of the structural elements of the budgets of the budgetary system of the Russian Federation is acquiring a key role in achieving the goals of state financial policy. Insufficient study of the problem of managing non-tax revenues, in contrast to potential sources of tax revenues, the need to search for additional reserves for the growth of revenue sources of budgets at various levels determine the significance of this study. The creation of an integrated system for managing parafiscal revenues of the budgets of public-law entities is particularly relevant, which requires a deep systems approach, taking into account the factors influencing this process, risks, and the specifics of managing these types of income. The objective of the study is to propose a conceptual approach to managing non-tax revenues of public entities' budgets in the context of implementing modern budget policy, taking into account the impact of macroeconomic challenges, identification and systematization of management risks, and developed indicators for assessing the quality of management of these revenues. The methodological basis of the study was a set of general scientific and specific methods of cognition. The approach to managing non-tax revenues of public entities' budgets developed by the authors is based on a comprehensive assessment of their specific features and the proposed classification of non-tax revenues taking into account modern trends in public finance management. Defining the structural elements of non-tax payments made it possible to propose tools and procedures for managing revenues from their receipt, systematize the risks associated with managing non-tax revenues of public entities' budgets, and develop a methodology for assessing the quality of their management and carrying out a reasonable rating of entities managing non-tax revenues in order to use reserves for revenue growth and high-quality management within the budget process.

Keywords: non-tax revenues; non-tax revenue management system; risks of managing non-tax revenues; methodology for assessing the quality of non-tax revenue management of budgets; tools for managing non-tax revenues

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INTRODUCTION

A review and study of domestic and foreign financial and economic literature indicate the advisability of conducting additional research to identify the content and specific features of the mechanism for managing non-tax revenues of the budgets of public law entities, which is confirmed by the following:

1. Non-tax revenues have their own characteristics that distinguish them from tax payments. This requires a detailed analysis of their emergence and management to assess their impact on the overall efficiency of budget revenues;

2. Non-tax revenues occupy a smaller share in budgets compared to tax revenues, but they play an important role in budget policy, especially under conditions of constraints and instability;

3. The diversity and characteristics of non-tax revenues in the budgets of different countries complicate their comparison. This hinders the identification of best practices and their adaptation to the conditions of a specific region or state.

A comprehensive study of non-tax revenues of the budgets of public law entities is a relevant task, the solution of which will not only increase the revenue part of the budget but also improve the quality of public finance management.

In the context of achieving national development goals set forth in the Decree of the President of the Russian Federation from 28.02.2024 No. 145 "On the Strategy for Scientific and Technological Development of the Russian Federation", and the Decree of the President of the Russian Federation from 07.05.2024 No. 309 "On the National Development Goals of the Russian Federation for the Period up to 2030 and for the Future up to 2036", the issue of improving the management of non-tax revenues becomes particularly relevant. This concerns both the measures discussed in political circles and scientifically justified proposals regarding changes to the state budgetary and tax policy.

Thus, identifying the characteristics of non-tax revenues of public law entities' budgets, developing management methodologies for them, and implementing effective measures to optimize this process become crucial in the context of large-scale structural transformation of the economy. This confirms the relevance of the study [1].

LITERATURE REVIEW

The transformation of the income management mechanism of the budgets of the budgetary system is one of the key tasks of public finance. Effective administration and forecasting of income will help mitigate the effects of economic fluctuations and enhance financial stability. Russian and foreign scholars have made significant contributions to the study of non-tax revenue administration. However, the lack of a unified approach to their definition and classification indicates the need for further research.

The issues of substantive characteristics of individual elements in the system of forecasting, administration, and control of revenues of the budgets of public law entities are presented in various scientific works of domestic authors [2–13]. A fragmentary review of the literature indicates gaps in scientific research. The development of conceptual approaches to managing non-tax revenues may include:

- analysis of existing management models and their effectiveness;
- study of international experience in the administration of non-tax revenues;
- the development of recommendations for improving forecasting and administration mechanisms in the budget revenue management system.

There is a wide range of both foreign and domestic approaches to forecasting the revenues of public legal entities, which can be appropriately divided into two categories: forecasting the revenue base and forecasting revenue collection. According to the authors, forecasting the base is understood as

Table

Approaches to Forecasting the Base (Receipts) and Forecasting Collection Rates

Model	Description	Advantages	Disadvantages
DSGE (Dynamic Stochastic General Equilibrium Model)	Low-dimensional models for short-term forecasts of aggregated variables	The possibility of reflecting large-scale shocks from a numerical perspective	A labour-intensive model and unstable to shifts, not all variables are predictable
CGE (Computable General Equilibrium)	Models for long-term forecasts	High correlation between industries reflects institutional changes. The model allows for long-term analysis and easily incorporates scenarios	Incorrect forecasting in unstable conditions
BVAR, VAR (time series)	Models based on retrospective analysis	The model allows for short-term forecasting with a horizon of relative stability	Lack of effectiveness in the face of "black swans"

Source: Compiled by the authors.

anticipating the results of social reproduction through the analysis of macroeconomic and "market-sectoral" factors that influence the subject of forecasting — non-tax revenues — taking into account the impact of legislative changes.

In relation to forecasting non-tax revenues of the budgets of public law entities, it seems appropriate to distinguish the following types of forecasting the base for non-tax payments, as presented in the *Table*.

Forecasting collectability is understood as the anticipation of the results of public reproduction through the analysis of institutional factors affecting non-tax revenues, taking into account changes in legislation that regulate the elemental characteristics of non-tax payments.

In the context of forecasting non-tax payments for the budgets of public law entities, this approach is reflected in the efficiency of their administration — the efficiency of forming the state's revenue sources, which primarily depends on preventing the occurrence of accounts receivable for revenues.

Currently, the literature presents a variety of viewpoints regarding the essence and nature of non-tax revenues of public law entities, reflecting economic and legal categories [7, 14–17]. In the domestic scientific community, there is no unified understanding of the regulation of non-tax payments: some scholars note the necessity of developing separate regulatory legal acts within which the functioning of non-tax revenues will take place; others consider it necessary to include the regulation of non-tax payments within the framework of tax legislation.

The review of scientific papers [6, 18–23] allows for the formulation of an author's approach to revealing the content of non-tax revenues, which "should be understood as monetary funds that arise as a result of certain compensated actions and operations by authorized state (municipal) authorities and management through the implementation of corresponding procedures with property and financial assets, as a result of which monetary funds are transferred to the budgets of state (municipal) authorities based on the principles of irregularity, non-obligation, and compensation" [1].

Thus, the fragmentary literature review provides a basis for concluding the necessity of developing conceptual approaches to improving the mechanism for managing non-tax revenues of the budgets of public law entities.

METHODOLOGY

The methodology of this study is based on theoretical principles and approaches known in domestic and foreign literature related to the tools and mechanisms of managing the revenues of the budgets of the budgetary system. The authors define the management of non-tax revenues for the purposes of this study as "the process of multidirectional influence by authorized state (municipal) bodies on financial relations to ensure the stability of mobilizing the revenues of the budgets of public-law entities from the collection of non-tax payments, taking into account the implemented directions of state policy" [1]. And the management of such revenues involves the use of various elements of non-tax revenue management, such as the object, subject, management procedures, principles, functions, methods, management tools, and information base.

RESULTS

Within the framework of this study, a non-tax payment is considered as a collection of funds levied from legal entities and individuals outside the scope of tax legislation. The funds are withdrawn from financial assets owned or managed by the state (municipal formations) and directed towards financing the activities of public authorities and management bodies of public formations. Non-tax revenue is the result of mobilization, taking into account the structural elements of the payment and its unique characteristics within the framework of specific legal grounds.

An important tool for understanding the role of non-tax revenues in the economy and public finance is their classification. The main types identified by the authors include:

1. By the nature of the movement of value: non-tax revenues can be either permanent (regular receipts from property income collection) or one-time (for example, fines or fees).

2. By the criterion of "transitiveness": some non-tax revenues may be temporary in nature, passing through the budget as intermediate funds.

3. By the nature of legal relations: non-tax revenues can arise from various legal grounds, including contractual relations, administrative acts, and others.

4. By the purpose of the payment: this can be a fee for services, fines, charges for the use of resources, and other targeted revenues.

5. By the regularity of receipts: non-tax revenues can be received regularly (for example, rental payments) or irregularly (one-time contributions).

6. Regarding the presence of non-tax expenditures: for revenues, expenditures characterized as so-called budgetary losses are typical.

7. By the method of accumulation: direct budget revenues or through specialized funds.

8. By the scale of impact on the economy: non-tax revenues can have varying effects on economic development depending on the objectives.

9. By category of payers: non-tax revenues can be collected from various categories of payers.

The lack of a clear legislative definition of the term "non-tax revenues" creates difficulties in law enforcement and accounting for such receipts. It is important that the approaches to their classification and regulation are unified to increase transparency and reduce administrative barriers. The discussion about including fiscal payments in tax legislation or creating a single regulatory act for managing non-tax payments highlights the need to reform the system to improve its efficiency and fairness.

The above indicates that the author's assumption about a comprehensive approach to managing non-tax revenues of public law entities is justified, and therefore it is advisable to consider the tools for managing non-tax revenues and their functional purpose:

1. A risk map, which involves its compilation and maintenance, allowing for

the early identification of potential threats and vulnerabilities in the process of budget formation and execution, thereby reducing risks in budget revenue management;

2. Regulatory legal acts that provide for the introduction and amendment of regulations governing non-tax payments, which ensures a legal basis for their collection and management and contributes to greater transparency and legitimacy;

3. Technological maps that contribute to the standardization of processes related to the management of non-tax revenues of budgets;

4. A unified information system, the formation and maintenance of which will allow for the centralization of information on non-tax revenues of budgets, improving data access and analysis;

5. Refinement of budget revenue forecasting methodologies, which will allow for the most accurate assessment of future revenues and improve the quality of revenue forecasting for budgets at various levels;

6. Maintaining a registry of individuals with overdue debts will help promptly monitor the situation with accounts receivable and take appropriate measures for its collection;

7. The verification of the legality of operations is an important tool for ensuring compliance with the law and preventing dishonest actions;

8. Assessment of asset preservation, which will allow identifying risks of loss or inefficient use of resources.

The implementation of the proposed tools, according to the authors, is aimed at increasing the efficiency of managing non-tax revenues of the budgets of public law entities, ensuring the openness and transparency of the budget process, and the rational formation and use of finances within the framework of the state's budget policy.

The system for managing non-tax revenues of the budgets of public law entities, taking into account the elemental characteristics of non-tax payments, is presented in *Figure 1*.

The management of non-tax revenues of public law entities' budgets (*Fig. 1*) is carried out within the framework of objectives aimed at enhancing the financial stability of budgets and ensuring more effective public management and stimulation of economic growth, such as:

- maintaining competition in various sectors of the economy within the framework of creating appropriate conditions for economic entities through the modernization of non-tax payments, which will ensure the stimulation of entrepreneurial activity and their investment activities for sustainable economic growth;
- improving the quality of public (municipal) services;
- improving the efficiency of managing state (municipal) property [1];
- within the framework of the implementation of the environmental agenda, the use of natural resource capital (the emergence in the legal field or the modification of non-tax payments related to natural resources contributes to increased responsibility for their use, thereby leading to more rational resource use);
- regulation within the framework of foreign economic policy (adjusting the terms of import and export fees can create more attractive conditions for investors and promote the growth of foreign economic activity, which is important for the overall development of the economy and the increase in revenue volumes in budgets for this subgroup of receipts).

It is also important to consider the need for monitoring and evaluating the results of implementing these measures to adjust the strategy for managing non-tax revenues in budgets.

The features of the mechanism for managing non-tax revenues of public law entities' budgets imply the application of certain methods of influencing financial relations within the framework of managing non-tax revenues, which are advisable to divide into:

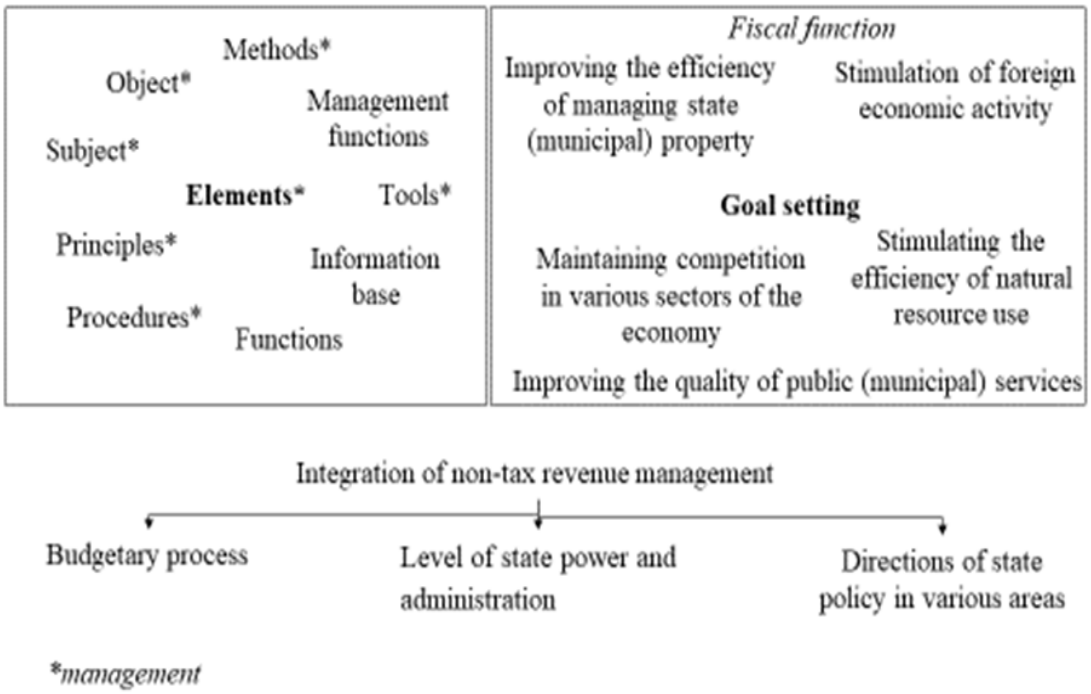

Fig. 1. **Mechanism for Managing Non-Tax Revenues of Budgets of Public-Law Entities**

Source: Compiled by the authors.

- economic measures that involve changing the conditions and mechanisms of payment collection, which can significantly affect the volume of budget revenues: (1) varying the rate of non-tax payments: changing rates can stimulate or restrict certain types of activities depending on the goals of state policy; (2) impacting the base of non-tax payments: includes expanding or narrowing the objects of taxation, allowing for flexible responses to changes in the economic situation; (3) changing the deadlines for non-tax payments: flexibility in deadlines can help improve the financial condition of payers and increase overall revenues; (4) preferential and concessional payment regimes for non-tax payments;
- administrative methods that involve changing the organizational aspects of managing non-tax revenues in terms of: (1) making changes and adjustments to contractual relationships, contract terms, for example, for the use of property owned by the state; (2) optimizing administrative regulations and procedures to reduce administrative costs and increase efficiency.

The combined use of economic and organizational-administrative methods contributes to the additional mobilization of financial resources into the revenue part of the budgets of public-law entities.

DISCUSSION

The management of non-tax revenues in the budgets of public-law entities is associated with the likelihood of various types of risks, and within the framework of minimizing their impact, with identifying possible reserves for their growth related to the administration mechanism. The authors of the article have attributed the main aspects concerning the identification of risks and reserves for replenishing the revenue part of the budgets of public-law entities, for example, from the environmental fee, to the following:

1. Identification of risks.

1.1. Independent calculation of payments (risk of data inaccuracy: payers may underreport production volumes to reduce the amount of the fee, which will lead to budget shortfalls; lack of control: the absence of verification by the chief administrator

creates opportunities for manipulation of reporting).

1.2. Filling out declarations (errors and inaccuracies: payers may make mistakes when filling out declarations, which also affects the accuracy of calculations; transactional costs: not all companies have a sufficient level of understanding of legal requirements, which can lead to discrepancies).

1.3. Recycling Standards (non-compliance with standards: payers may fail to meet established recycling standards, which also reduces collection revenues; monitoring difficulties: the lack of a control system for compliance with standards complicates the identification of violations).

2. Search for reserves to replenish the revenue part of the budget.

2.1. Strengthening control (introduction of audits: it is necessary to develop a system of regular audits of taxpayer reporting to improve data accuracy and reduce risks; creation of information systems: implementation of automated systems for monitoring production volumes and compliance with recycling standards).

2.2. Motivation to comply with regulations (benefits for conscientious payers: introduction of a reward system for companies that diligently fulfil their obligations; tightening sanctions for violations: increasing fines for inaccurate data or failure to meet standards can serve as an incentive for more responsible behavior).

The mechanism for managing non-tax revenues of budgets, such as proceeds from the environmental fee, requires a comprehensive approach to identifying risks and reserves. Strengthening control will contribute to improving the efficiency of revenue collection and enhancing the financial stability of the budgets of public-law entities.

The conceptual approach to managing non-tax revenues of public law entities' budgets requires a deeper analysis and assessment of management quality. The methodology developed by the authors, based on a combination of quantitative and qualitative indicators [1], is an important step towards improving the management of non-tax revenues of public law entities' budgets (*Fig. 2*). The main elements of the methodology include:

- types of non-tax payments, a system of inherent indicators including detailed characteristics (non-tax payment rates and payment periods, etc.), which contributes to more accurate revenue forecasting;
- consideration of management quality indicators (factor analysis of deviations is aimed at identifying the causes of discrepancies between forecasted and actual revenues; the procedure for administering and forecasting revenues must be clearly established to ensure transparency and efficiency);
- monitoring and rating of management entities (regular monitoring of the activities of non-tax revenue management entities allows for prompt responses to changes and issues; rating provides the opportunity to compare management efficiency among different entities, which contributes to a better understanding of practices and approaches).

The advantages of the author's methodology include a comprehensive approach characterized by: (1) a combination of quantitative and qualitative indicators, allowing for a more comprehensive assessment of management efficiency; (2) a cause-and-effect relationship (establishing connections between indicators helps identify the root causes of problems in the management of non-tax revenues); (3) flexibility, whereby the methodology can be adapted to the specifics of various examples of public law entities (different types of subjects of the Russian Federation, municipal entities, etc.).

The developed author's methodology for assessing the quality of non-tax revenue management in the budgets of public law entities is an important tool for improving the efficiency of the budget process as a whole; it

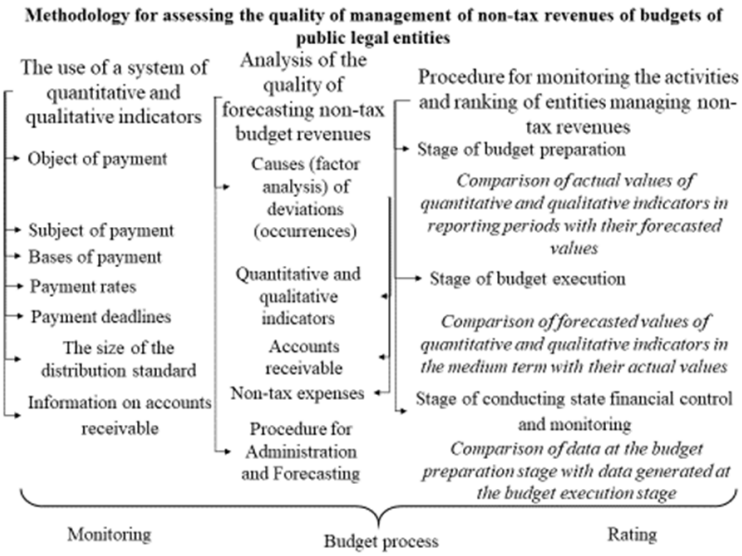

Fig. 2. **Methodology for Assessing the Quality of Management of Non-Tax Revenues of Budgets of Public Legal Entities**

Source: Compiled by the authors.

not only allows for identifying problems but also promotes the implementation of best management practices, which ultimately leads to increased sustainability of the budgets of public law entities.

CONCLUSION

The conceptual approach to managing non-tax revenues of public law entities presented in the article indicates the necessity of identifying essential characteristics and systematizing non-tax revenues considering their specifics. The essential characteristics include the specificity of non-tax payments (taking into account the peculiarities of non-tax revenues allows for highlighting their unique features, which is important for developing effective management strategies) and the approach to classifying non-tax revenues (forming a classification based on identified characteristics contributes to a deeper understanding of the structure of revenues and their sources). The structural elements of management are linked to the systematization of management risks, the results of risk assessments, the identification of potential threats and opportunities for increasing the state's financial resources, and the determination of key sources of budget revenues that can provide additional financial resources in the context of changes in the state's budgetary and tax policies. The methodology for assessing the quality of management proposed by the authors is based on a system of indicators for evaluating the management of non-tax revenues at various stages of the budget process and allows for monitoring and analyzing the effectiveness of implemented measures, as well as ranking the entities managing non-tax revenues of the budgets of public law entities in the context of increasing accountability and transparency of activities. The author's approach to managing non-tax revenues of public law entities' budgets is comprehensive and multi-level, which allows not only to identify problems but also to propose solutions. In the context of modern challenges in budget planning and management, such a methodology can become an important tool for increasing the efficiency of forming and using financial resources in public law entities.

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IPO Underpricing Factors: Technology and Non-Technology Sectors in Terms of Information Asymmetry and Retention of Control Theories*

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ABSTRACT

This study investigates the relationship between the underpricing of company stocks in initial public offerings (IPOs) and the key factors associated with two dominant theories: information asymmetry and retention of control. The main objective of the study is to determine which factors considered by the two theories affect stock underpricing in the technology and non-technology sectors. Multiple regression models are used to identify the significant factors of underpricing for each sector, and the adjusted coefficient of determination is used to compare the explanatory power of the models of each theory. The sample includes 321 IPOs launched between 2000 and 2020 on the leading US exchanges NYSE and NASDAQ. The results show that in the technology sector, the significant predictors of underpricing are research and development (R&D) costs, the age of the company at the time of going public, and the Roll-up strategy. In the non-technology sector, the key underpricing factors are the proportion of publicly traded shares and the age of the company. It is concluded that the theory of information asymmetry demonstrates the greatest explanatory power in the context of the technological sector, which indicates the significant influence of information barriers on the formation of market prices. At the same time, in the non-technology sector, the predictive power of regression models was significantly lower, which indicates the need for further search and analysis of additional factors affecting the undervaluation of shares in this sector. Thus, this study contributes to a deeper understanding of IPO undervaluation mechanisms, emphasizing the importance of taking into account the specifics of different industry segments when analyzing and forecasting market processes.

Keywords: initial public offering **(**IPO); company; underpricing; uncertainty; profitability; issuer; information asymmetry

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INTRODUCTION

2021 was a record-breaking year for initial public offerings (IPOs) since the dot-com boom of 2000, with a total of 2.436 companies entering global markets with a total issue volume of $ 459.9 billion.[1] Among various markets, the United States occupies one of the leading positions in the world in terms of IPO volume and the total value of outstanding shares. In 2021, 1.035 IPOs were conducted on the US stock market, which is 115.62% more than in 2020.[2]

However, there is an underpricing anomaly in IPO markets[3]: the price at which IPO shares were sold to early investors (the offer price) turns out to be lower than the price at which shares are subsequently traded on the market [1, 2]. This indicates an underpricing of the company at the pre-bidding stage compared to the market assessment. Underpricing the initial public offering can have serious consequences for the company and leads to significantly lower amounts of capital raised.

[1] EY.com. EY Global IPO Trends. URL: https://www.ey.com/en_gl/ipo/trends (accessed on 20.04.2023).

[2] Stock Analysis. IPO Statistics. URL: https://stockanalysis.com/ipos/statistics/ (accessed on 20.04.2023).

[3] Underpricing is used as a synonym for the yield of the first day of trading: the greater the underpricing, the higher the yield.

* The article was prepared on the basis of the final qualifying thesis "Factors of underpricing of initial public offerings in the American market" by A.A. Galich under the scientific supervision of A.G. Mirzoyan.

Among the many theories explaining this phenomenon, the theories of information asymmetry and theories of control retention, which have the greatest predictive power, stand out [2, 3]. However, when considering theories of underpricing, differences in underpricing factors between two main sectors are often not taken into account: technological and non-technological. This study contributes to the literature in the following aspects. First, by constructing separate models for technological and non-technological samples of companies, we find a significant difference in the factors of underpricing: the profitability of the first day of trading of companies in the technology sector is more influenced by variables related to the theory of information asymmetry, and for companies in the non-technological sector — by variables related to the theory of maintaining control. Secondly, we find differences in the ability of underpricing theories to explain underpricing in the two sectors. Variables related to information asymmetry theory can better explain the underpricing of technology companies. In relation to non-technological companies, the explanatory power of regression models turned out to be low for both theories.

The work is structured in the following way: the first part contains a review of literature on IPO underpricing theories. The second part describes the research methodology and the data used for the analysis. The third part is devoted to constructing statistical models and interpreting the results.

LITERATURE REVIEW

Despite a significant number of empirical studies investigating the phenomenon of underpricing, there is still no unified theory in the literature that explains the reasons for this underpricing of initial public offerings (IPOs). [4].

There are 4 blocks of the most popular theories of underpricing in the literature: theories of information asymmetry, institutional theories, theories of ownership and control, and behavioral theories. This paper considers two of the most common and applied in the analysis of underpricing: the theory of information asymmetry and the theory of control preservation [2, 3].

Theories of Information Asymmetry

Theories of information asymmetry are based on the assumption that there is a significant information imbalance in the IPO market between the parties to the initial public offering process.

The Signal Theory

The signal theory suggests that the information asymmetry between buyers and sellers is overcome by the signals given by the latter [5]. In relation to the IPO process, this means that certain characteristics of the company and the IPO process can act as signals to the market about the company's growth and development prospects. In order for the signal to be perceived, it must be observable and difficult to repeat for unpromising firms. For potential IPO investors, such signals may include: the Underwriter's rating, R&D costs, the fact of venture financing, and the age of the company.

Underwriter's Rating

Underwriters who have established themselves in the market tend to avoid participating in IPOs of unpromising companies in order to preserve their reputation in the eyes of investors [6, 7]. Thus, it is not necessary for an underwriter to underestimate the price of the initial offer in order to attract investors — his reputation allows him to ensure sufficient demand from investors, which, in turn, makes it possible to set a fair or even inflated share price during an IPO.

R&D Costs

Investments in research and development are one of the main sources of the company's competitive advantages [8]. Investing in R&D can serve as a signal of the company's great innovation potential and long-term growth prospects. However, investors face difficulties in assessing the likelihood of realizing this potential, which increases the degree of

uncertainty, makes it difficult to objectively assess the company's prospects and ultimately leads to a greater underpricing of the IPO [8, 9].

Venture Financing

A venture capital-backed IPO is an initial public offering of a company previously funded by venture investors. On the one hand, venture capital supports young and innovative companies, investing in which involves additional risk. The presence of venture capital investments in a company can cause an increase in the profitability of the first day of IPO trading, due to the deliberate underpricing of the issue price to provide investors with a risk premium [10, 11]. On the other hand, the availability of venture capital financing when going public can signal the reliability of a company, thereby reducing uncertainty for potential investors. Venture capitalists, as a rule, are the main shareholders of the company, holding seats on the board of directors [12]. Existing research shows that firms receiving venture capital achieve higher productivity growth [13], profitability, and operational performance after issuance [14].

Age of the Company

The age of the company at the time of the initial public offering affects the investment risks. Companies with a longer history of activity have a large amount of information, which makes them more attractive in the eyes of investors. For young companies, the degree of uncertainty associated with future development prospects is high, which is often accompanied by an increased level of investment risk and underpricing [15].

All of the above factors play an important role in determining the IPO price and allow companies with high potential to attract investors and obtain favorable terms for the placement of shares.

Hypothesis 1. The age of the company, the Underwriter's rating, and the availability of venture financing reduce the underpricing of IPOs, while R&D costs increase the underpricing of IPOs.

Theories of Maintaining Control

Theories of maintaining control explain the underpricing of ownership fragmentation when issuing IPO shares: an undervalued price allows attracting a larger number of small investors and avoiding the concentration of a significant share of the company's shares by a large investor [16]. However, companies may have a sufficient number of shareholders with large blocks of shares even before going public, in which case attempts to prevent the occurrence of blocking blocks of shares by lowering the price are pointless [17].

At the same time, there are other ways to ensure control over the company, such as issuing dual-class shares [18]. When issuing dual-class shares, one class is offered to the public and the other to company founders and executives. The class offered to the public has limited voting rights — 1 vote per share, or no voting rights, while the shares available to founders and executives provide more than one vote per share and thus provide control over the company. Managers of companies with dual-class shares have no incentive to lower the price in order to prevent the formation of a block of large shareholders in the primary IPO market [19]. The management control hypothesis implies that IPOs with dual-class shares have a lower degree of undervaluation than IPOs with single-class shares [20, 21].

Hypothesis 2. Companies that have issued dual-class shares have, on average, all other things being equal, a lower underpricing of IPOs than companies issuing single-class shares.

The share of shares listed on the stock market can be an indicator of the company's quality: managers with positive information about the company will signal this by selling only a small part of the company during the IPO [22]. One of the possible reasons why an increase in the company's free-float[4] share may lead to a greater underpricing is related to increased transparency and accessibility of information for investors [22, 23]. When most of the company's shares are in

[4] Free-float — the share of stocks issued in free circulation.

free circulation and available for sale, investors can assess its real value based on current market conditions and expectations. This leads to an increase in demand for the company's shares and, as a result, to an increase in the price on the first day of trading on the market [24].

The company's entry into the stock exchange is also possible in the form of a "Roll-up" transaction, which allows a group of small companies to combine their enterprises into one structure in order to place shares on the stock exchange. As part of the deal, the owners of the founding companies (the acquired companies) agree to sell their companies and receive payment from the proceeds from the initial public offering of shares of the newly created company. To acquire each founding company, a new company is created, which conducts an IPO. During such mergers, the organizational structure of all companies changes, which may create additional uncertainty in assessing future opportunities and, consequently, may lead to greater underpricing [21, 25]. Logran and Ritter [26] found that in the long run, combined companies show lower financial results than other IPO firms.

Hypothesis 3. The ratio of shares offered to the public to the total outstanding shares and the use of a "Roll-up" strategy positively affect the underpricing of IPOs.

Comparison of Technological and Non-technological Sectors

Depending on the sector under consideration, the undervaluation factors may vary: technology companies, as a rule, are more underestimated than others, since they involve a high level of risk and uncertainty [27]. Underpricing of technology companies may also be related to an attempt to attract the attention of large institutional investors, who, as a rule, are not interested in participating in IPOs of companies with a small market capitalization [28].

Descriptive statistics (Table. 1) Our sample of American IPOs from 2000–2020 shows that the tech and non-tech sectors differ significantly from each other in many ways: by age at the time of the IPO, the size of the company, and the financial performance of the company one year before the IPO. Tech companies have lower revenue at the time of their IPO and a greater underpricing, which significantly (at a 1% significance level) exceeds the underpricing of non-tech companies by 30 percentage points (*Table 1*).

Since tech firms are smaller, have a short history of activity before going public, and are associated with a high level of risk and uncertainty, we assume that the underpricing of technology companies can be explained to a greater extent by the theory of information asymmetry and related variables. For non-technological companies, the theory of ownership and control should be more applicable, since these companies are associated with less uncertainty and, accordingly, are less susceptible to information asymmetry between participants in the IPO process.

Hypothesis 4. Variables responsible for the theory of information asymmetry (R&D costs, venture financing, company age, underwriter rating) can explain a large proportion of the differences in underpricing in the technology industry, while variables related to the theory of ownership and control can explain non-technological ones ("Roll-up" strategy, dual-class stocks, the ratio of shares offered to the public to the total outstanding shares).

DATA AND METHODOLOGY

To collect the data, we used several sources of information (*Table 2*). A description of the variables used is given in the Appendix (*Table A1*). The sample included companies registered in the United States that listed on the NYSE and NASDAQ exchanges between 2000 and 2020. We excluded issues of depositary receipts, unit placements, and real estate investment funds (REITs) from the sample, as well as placements with an offer price below $ 5 per share, as these may not be attractive to institutional investors. Additionally, companies related to the financial sector were not included due to the specific nature of their financial statements. The final sample consists of 321 companies.

Table 1

Mean Values of Variables by Sectors

Variable	Technology	Non-Technology	Mean difference
Revenue, USD million	376.9	1021.5	–644.6**
Net debt, USD million	144.9	540.0	–395.1**
Underpricing	0.5	0.2	0.3***
Age (years)	13.9	20.4	–6.5***
Current liquidity	2.0	2.8	–0.8*

Source: Compiled by the authors.

Note: Number of observations for the technology sample — 118 companies, for the non-technology sample — 203 companies; *p < 0,1; **p < 0,05; ***p < 0,01.

Table 2

Data Sources

Data Type	Data Sources
The financial performance of the company prior to the IPO	Thomson Reuters Eikon and Cbonds website*
The IPO offer price, stock price at the opening and closing of trading	IPOScoop.com**
Details of the IPO transaction	Warrington College of Business Website ***

Source: Compiled by the authors.

Note: * Cbonds. URL: https://cbonds.ru/?show_main; ** IPOScoop.com. URL: https://www.iposcoop.com/; *** Warrington College of business. URL: https://site.warrington.ufl.edu/ritter/ipo-data/ (accessed on 20.01.2023).

Control Variables

The IPO offer price can serve as an indicator of an investment bank's assessment of demand for a company's shares, which, in turn, can influence investors' decision to purchase shares [21]. The size of the company, expressed in terms of assets, and the size of the total issue can signal to investors about the stability of the company, which means it can significantly negatively affect the profitability of the first day of IPO trading [29]. We also include financial indicators in the models, such as return on assets, book value per share, and current liquidity, which are often taken into account by investors when making decisions about investing in an IPO; these indicators in the literature act as proxy variables for a company's specific risk and can also significantly positively affect undervaluation [30, 31]. The number of IPOs conducted this year may indicate the general market sentiment of investors and lead to increased demand for IPO shares [32]. In the literature, linear regression analysis is most often used to analyze underpricing factors and test underpricing theories, where the dependent variable is the underpricing (profitability of the first day of trading) of an IPO [10, 33]. In this study, we also use regression analysis methods to test the hypotheses put forward.

Model Construction Results

Table 3 shows the results of the regression evaluation for each sector.

Belonging to the technology sector significantly (at a 1% significance level) increases the underpricing of IPOs by 0.193 percentage points (*Table 3*). Variables related to the theory of information asymmetry turned out to be significant predictors of underpricing: for technology companies, the availability of venture financing reduces underpricing by an average of 0.188 percentage points, all other things being equal. For technology companies, age significantly reduces underpricing, while for non-technology companies, age, on the contrary, significantly increases underpricing. This can be explained by the fact that for technology companies, age reduces uncertainty due to the availability of more information available. R&D costs significantly (at the 1% significance level) increase the underpricing of only technology companies. The ratio to the Underwriter's reputation turned out to be insignificant for both sectors. Thus, the first hypothesis is partially confirmed.

The share of free-float significantly (by 10% of the significance level) increases the underpricing of non-technological companies. Thus, Hypothesis 3 is partially confirmed. The issue of dual-class shares significantly (at a 10% significance level) has a positive effect on underestimating only non-technological companies. The direction of influence is opposite to expected, so Hypothesis 2 is not confirmed. To verify the stability of the results obtained, models with a different number of observations were evaluated (observations with the largest Cook distance value were excluded from the sample — influential observations), as well as models with consistent inclusion of variables of interest. Checking for the stability of the coefficient's significance over the "Dual-class shares" variable in models for the non-technological sector showed that the coefficient turns out to be insignificant when 10 influential observations are removed from the sample (p-value = 0.11), and the coefficient also becomes insignificant when evaluating models with sequential addition of variables of interest (*Table A2*). The coefficients before the Roll-up variables (p-value < 0.001), the logarithm of the company's age (p-value = 0.006) and the logarithm of R&D costs (p-value = 0.007) in the model for the technology sector proved to be consistently significant in relation to the removal of influential observations, and the significance remains with the consistent inclusion of variables of interest in the model (*Table 3*). The coefficient before the venture financing variable turns out to be insignificant when 5 influential observations are removed (p-value = 0.621), the coefficient estimate changes sign, which indicates the instability of the results obtained.

To analyze the ability of theories to explain underpricing, we evaluated models (*Tables 4, 5*), each of which includes only variables corresponding to one of the theories. The quality of the models was compared using adjusted R^2

Adding variables assumed by the theory of information asymmetry to the model increases the adjusted coefficient of determination by 5.5 percentage points — the adjusted coefficient of determination for a model that includes only control variables is 33.3%, and for a model that includes variables related to the theory of information asymmetry is 38.8% (*Table 4*). Accounting for uncertainty factors can improve the quality of the underpricing model of technology companies. Among the factors related to the theory of ownership and control, only the coefficient before the binary variable of the roll IPO turned out to be significant: the inclusion of this variable increases the adjusted coefficient of determination by 5.7 percentage points. Thus, we have obtained a comparable improvement in the predictive abilities of underpricing models. At the same time, the inclusion of variables assumed by both theories in the model increases the adjusted coefficient of determination by 12 percentage points.

For the sample of non-technological companies, the coefficient before the variable of the company's age turned out to be significant (*Table 5*). Variables related to the theory of ownership and control (dual-class shares and free-float) are significantly positively associated with underpricing. The

Table 3

The Results of Building Regression Model

Variable	Dependent Variable: Underpricing		
	All sectors	Technology	Non-technology
Information Asymmetry			
The technology industry	0.193*** (0.044)		
The logarithm of R&D costs		0.074*** (0.027)	
Venture financing		−0.188* (0.110)	
The logarithm of the company's age		−0.301*** (0.101)	0.062*** (0.022)
Ownership and Control			
"Roll-up" IPO		0.808** (0.316)	
Dual- class shares			0.082* (0.047)
Free-float			0.160* (0.093)
Observations	321	118	203
R^2	0.229	0.512	0.213
Adjusted R^2	0.217	0.471	0.188
F-statistics	18.974***	12.588***	8.819***

Source: Compiled by the authors.

Note: Standard errors are given in parentheses below the coefficients. All models use the same set of control variables, the list of used control variables is given in *Table A1*; *p < 0,1; **p < 0,05; ***p < 0,01.

adjusted coefficient of determination of the model increased by 2.7 percentage points when adding a variable related to the theory of information asymmetry, from 15.2% to 17.9%, and by only 0.4 percentage points when adding factors related to the theory of ownership and control. The percentage of explained variance in underpricing of companies in the non-technology sector remains low. By comparing the quality of the models of the two sectors, the theories of information asymmetry and ownership and control are better able to explain the underpricing of technology companies, which partially confirms Hypothesis 4.

HYPOTHESES TESTING RESULTS

As a result of the analysis, three hypotheses put forward (Hypothesis 1, Hypothesis 3, Hypothesis 4) out of four were partially confirmed (*Table 6*). In this paper, we mainly considered variables that act as signals of greater or lesser uncertainty for investors, on the basis of

Table 4

Testing Underpricing Theories on a Technology Sample

Variable	Dependent Variable		
	Underpricing		
	Information Asymmetry	Ownership & Control	All Models
Information Asymmetry			
The logarithm of R&D costs	0.074** (0.029)		0.074** (0.031)
Venture financing	−0.217* (0.132)		−0.208* (0.113)
The logarithm of the company's age	−0.295*** (0.096)		−0.310*** (0.093)
Ownership & Control			
"Roll-up" IPO		0.637* (0.344)	0.665*** (0.178)
Observations	118	118	118
R^2	0.425	0.416	0.490
Adjusted R^2	0.388	0.390	0.453
F-statistics	11.614***	15.983***	13.106***

Source: Compiled by the authors.

Note: Standard errors are given in parentheses below the coefficients. All models use the same set of control variables, the list of used control variables is given in *Table A1;;* *p < 0,1; **p < 0,05; ***p < 0,01.

which they make decisions about investing in an IPO. It has been shown that non-technological companies, on average, have a higher age and are associated with less uncertainty and risk at the time of the IPO, therefore, the factors studied in the work are not fully capable of explaining the underpricing of these companies.

CONCLUSIONS

The availability of venture capital financing and the age of the company are significant signals of the company's development prospects, which reduce uncertainty for investors and thereby reduce the underpricing of IPOs of technology companies. The age of a company has a multidirectional impact on companies in two sectors — it reduces the underpricing of technology companies and increases the underpricing of non-technology companies, which can be explained by the specifics of each sector. We did not find a significant impact of the underwriter bank's reputation on the underpricing of companies in both sectors. The underpricing of non-technological companies

Table 5

Testing Underpricing Theories on a Non-Technological Sample

Variable	Dependent Variable: Underpricing		
	Information Asymmetry	Ownership & Control	All Models
Information Asymmetry			
The logarithm of the company's age	0.058*** (0.017)		0.066*** (0.022)
Ownership & Control			
Dual- class shares			0.080* (0.047)
Free-float		0.148* (0.087)	0.159* (0.093)
Observations	203	203	203
R^2	0.195	0.173	0.222
Adjusted R^2	0.179	0.156	0.194
F-statistics	12.028***	10.356***	7.941***

Source: Compiled by the authors.

Note: Standard errors are given in parentheses below the coefficients. All models use the same set of control variables, the list of used control variables is given in *Table A1;* *p < 0,1; **p < 0,05; ***p < 0,01.

is significantly influenced by variables related to the theory of maintaining control: the proportion of shares issued and the type of shares issued increase the underpricing of IPOs. We found that two-class IPOs are, on average, all other things being equal, more undervalued than single-class issues. However, this result proved unstable to the removal of influential observations.

To test the implications of IPO underpricing theories, we evaluated the models for each sector and compared them with each other using an adjusted coefficient of determination. We have found that the factors associated with the theory of information asymmetry are better able to predict the underpricing of companies in the technology industry than the factors considered by the theory of maintaining control. The explanatory power of models built for companies in the non-technological sector turned out to be low even when taking into account all the factors considered by both theories of underpricing. This result indicates the need to consider additional factors that may influence the underpricing of non-technological companies.

This work contributes to theoretical and applied science by identifying factors of underpricing of IPOs for two sectors — technological and non-technological. In addition, differences in the ability of undervaluation

Table 6

Results of Hypotheses Testing

Variable	Hypothesis	Sector	Coefficient
Information Asymmetry Theory			
The logarithm of the company's age	H1 (+)	Non-technology	0.062***
The logarithm of R&D costs	H1 (+)	Technology	0.074***
Underwriter's rating	H1 (–)	–	–
Availability of venture financing	H1 (+)	Technology	–0.188*
Adjusted R^2 for the technology sector model (Table 4)	H4 (+)	Technology	0.388
Adjusted R^2 for the non-technology sector model (Table 5)		Non-technology	0.179
Theory of Ownership and Control			
Dual- class shares	H2 (–)	Non-technology	0.082*
The ratio of shares offered to the public to the total outstanding shares (free-float)	H3 (+)	Non-technology	0.160*
"Roll-up" IPO	H3 (+)	Technology	0.808**
The ratio of shares offered to the public to the total outstanding shares (free-float)	H4 (–)	Technology	0,390
Adjusted R^2 for the non-technology sector model (Table 5)		Non-technology	0.156

Source: Compiled by the authors.

Note: *p < 0,1; **p < 0,05; ***p < 0,01.

theories to explain the variability of the profitability of the first day of trading in the two sectors are shown. The results indicate the need to take into account the specifics of each sector when building models explaining the underpricing of IPOs.

The direction for further research may be to analyze the long-term impact of the discovered factors on stock performance after IPO. Considering the long-term results after the IPO will allow us to more accurately determine which of these factors have a positive or negative impact on the company, which would facilitate the development of more strategic recommendations.

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APPENDIX

Table A1

Variable Description

Notation in Models	Description
IPO Characteristics	
Underwriter's rating	The rating of the lead underwriter, taken from the Logran and Ritter School [10], updated for 2021. The ratings are based on a scale from 0 to 9 and are based on a hierarchical system. In the current work, following Logan and Ritter [10], if there is more than one underwriter, the rank of the lead underwriter or the highest-rated underwriter is used
Offer price	**Offer price per share, USD**
Roll-up strategy (binary)	A binary variable equal to 1 if the company followed a Roll-up strategy during the IPO process, 0 otherwise
Company Financials	
The logarithm of total assets	Logarithm of the company's total assets for the year before the IPO, USD million
Return on assets	The return on assets of a company, calculated as the ratio of the company's net profit for the year before the IPO to the total assets of the company for the year before the IPO

Table A1 (continued)

Notation in Models	Description
The logarithm of current liquidity	The logarithm of the ratio of the company's current assets to the company's current liabilities one year before the IPO
The logarithm of capital expenditures	Logarithm of capital expenditures for the year before the IPO, USD million
Number of IPOs per year	The total number of IPOs conducted in the United States in the year the company went public
Net debt/EBITDA	The ratio of net debt to EBITDA for the year before the IPO
Book value per share	Book value of the company per share
EBITDA margin	EBITDA margin, calculated as the ratio of EBITDA to revenue for the year before the IPO

Source: Compiled by the authors.

Table A2

The Robustness of the Results to Successive Addition of Variables of Interest on a Sample of Non-Technology Firms

Variable	Dependent Variable:			
	Underpricing			
	(1)	(2)	(3)	(4)
Information Asymmetry				
The logarithm of the company's age	0.058*** (0.017)	0.063*** (0.018)	0.062*** (0.018)	0.066*** (0.018)
Ownership and control				
Dual- class shares		0.049 (0.049)	0.082 (0.052)	0.080 (0.051)
Free-float			0.160* (0.092)	0.159* (0.093)
Observations	203	203	203	203
R^2	0.195	0.201	0.213	0.222
Adjusted R^2	0.179	0.180	0.188	0.194
F-statistics	13.166	10.637	9.197	8.914

Source: Compiled by the authors.

Note: Standard errors are given in parentheses below the coefficients. All models use the same set of control variables, the list of used control variables is given in *Table A1*; *p < 0,1; **p < 0,05; ***p < 0,01.

Table A3

Table A3

The Robustness of the Results to the Sequential Addition of Variables of Interest on a Sample of Technology Firms

Variable	Dependent Variable: Underpricing			
	(1)	(2)	(3)	(4)
Information Asymmetry				
The logarithm of R&D costs	0.065*** (0.025)	0.067** (0.030)	0.074** (0.030)	0.074*** (0.027)
Venture financing		−0.023 (0.119)	−0.212 (0.133)	−0.188* (0.110)
The logarithm of the company's age			−0.291*** (0.098)	−0.301*** (0.101)
Ownership and Control				
Roll-up IPO				0,808** (0,316)
Observations	118	118	118	118
R^2	0.382	0.382	0.427	0.512
Adjusted R^2	0.348	0.343	0.385	0.471
F-statistics	11.272	10.148	12.078	8.338

Source: Compiled by the authors.

Note: Standard errors are given in parentheses below the coefficients. All models use the same set of control variables, the list of used control variables is given in *Table A1;* *p < 0,1; **p < 0,05; ***p < 0,01.

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Decoding the Nifty50 Puzzle with ANN: FIIs, DIIs and Market Magic

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ABSTRACT

In the context of a dynamic and highly competitive financial market, understanding the behaviour of various categories of investors becomes a key factor in developing effective investment strategies and forecasting market trends. This study examines the phenomenon of Nifty50 — a group of the 50 most liquid and significant stocks in the Indian stock market, which play an important role in forming the overall index. The **purpose** of the study is to determine the influence of foreign institutional investors (FIIs) and domestic institutional investors (DIIs) on the dynamics of Nifty50.The authors apply classical research **methods**: correlation analysis, a statistical model for analysing and forecasting the volatility of time series (GARCH), and artificial neural networks (ANN).The study is based on daily data on investments from the two specified groups of investors and the values of the Nifty50 index of the National Stock Exchange. The study period from 31.12.2019 to 30.11.2023 is divided into two sub-periods: before COVID-19 and after. In periods of economic shocks, such as the COVID-19 pandemic, the behaviour of these two types of investors becomes particularly contrasting. The results of the study showed that FIIs and DIIs are opposite to each other: when FIIs invest, DIIs are net sellers, and when FIIs sell, DIIs are net investors. In the context of the pandemic, FIIs often increased their investments in Indian assets, while DIIs, on the contrary, reduced their positions. However, in the post-pandemic period, the situation changed: DIIs began to play a more significant role in the dynamics of Nifty50, while the influence of FIIs decreased. Thus, the analysis of the interaction between FIIs and DIIs allows us to conclude the complex and multifaceted nature of the influence of institutional investors on the Indian stock market. Their strategies and behaviour have a significant impact on market indices and volatility, which requires careful monitoring and analysis for effective management of investment risks and making informed decisions in unstable conditions.

Keywords: Indian stock market; institutional investors; FIIs; DIIs; Nifty50; GARCH; ANN

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INTRODUCTION

Foreign Institutional Investors (FIIs) and Domestic Institutional Investors (DIIs) exert a profound impact on the Indian stock market, reflecting the dynamic interplay between global and domestic factors. In recent times, FIIs have significantly influenced market trends. Their substantial investments can lead to rapid market movements, affecting indices and stock prices. FIIs often respond to global economic conditions, currency movements, and geopolitical events, creating volatility in the Indian market.

Conversely, DIIs, comprising mutual funds, insurance companies, and other domestic entities, contribute to market stability. Their investment decisions are typically driven by long-term considerations and align with domestic economic growth. DIIs act as stabilizing forces during market fluctuations, providing consistent demand and mitigating the impact of external shocks.

The synergy between FIIs and DIIs influences market sentiment, liquidity, and overall investor confidence. Striking a balance between foreign and domestic investments is crucial for sustaining a resilient and thriving stock market. Their combined influence impacts Nifty50 movements.

The intention behind this study is to investigate the influence of FIIs and DIIs on the capital market, which is reflected in the movements of Nifty 50, the leading index of the National Stock Exchange of India (NSE). Our findings are expected to contribute to the existing knowledge as they examined the effects of international and domestic capital flows on Nifty50 using a robust methodology.

REVIEW OF LITERATURE

The following reviews illustrate essential information from many notable publications on FII and DII capital flow.

Chakraborty investigated the FIIs' effect on the Indian securities market for the period April 1997 to March 2005. The research study made use of secondary data. The monthly flow of FIIs and the monthly average BSE index return were employed in this research study. For each of the two-time series, correlation, standard deviation, skewness, and kurtosis are displayed in order to determine the trend in the two estimated variables across the sample period. On the question of whether FIIs affect stock market returns, there are several competing theories. This paper gives some insight into the direction of the causality relation of FII inflows and stock market returns in Indian Stocks. [1] Similarly, Siddiqui and Seth studied the interconnectedness between Nifty50, BSE 30 and Shanghai Composite and found that Indian markets were not cointegrated with the Indian stock markets [2].

Goudarzi and Ramanarayanan examined the relationship between FII net inflow and BSE 500 stock index movement. The study relies on secondary sources of information like monthly data. To evaluate the collected data from various sources and find the relationship between the FIIs and BSE 500 stock index, the correlation analysis was applied. They investigated Johansen's co-integration test as well. The econometric results show that the causation between the BSE 500 and the FII is bilateral [3].

The goal of Gupta's study is to determine if FIIs are the cause or consequence of the Indian stock market's growth or fall. With data from 1 April 2006 to 28 February 2011, the research investigation was conducted. The daily flow of FII was gathered from the NSE and SEBI official websites. The study used correlation and regression analysis. It says that FIIs have a noteworthy impact on the capital market's growth and decline [4].

Misra conducted the study to see if there is any asymmetry in FIIs' conduct during bull and downturn market cycles. The research study used daily as well as monthly data on Net FII inflows for the time period starting from April 2007 to December 2011. For the stock market returns, they used the closing prices of S&P CNX Nifty index. The author applied causality tests and a parametric regression framework to examine the influences of FII on the Indian stock market. The results also indicate that FIIs reduce risk premiums in the Indian equity market and do not destabilize it [5].

Sultana and Pradhasaradhi made an analysis that is based on 10-year secondary data obtained from the RBI Bulletins and publications available on the Ministry of Commerce's website. In this research study, Correlation, Multiple Regression, and OLS Models are applied to investigate the relationship among the variables FII, FDI, BSE Sensex and CNX Nifty. The study discovered and showed that FDI, SENSEX and NIFTY have a significant positive correlation, while FII, SENSEX and NIFTY have a moderate positive correlation. Their study concluded that the flow of foreign capital flow in the Indian stock market determines the direction of the Indian stock market [6].

Loomba worked to measure the movement of BSE Sensex, the major index of the Indian stock market due to the inflow and outflow of FIIs. The research study is descriptive in nature. The study used secondary data from BSE's website. The data was analysed using Karl Pearson's correlation. The analysis showed that there was a good positive relationship between the FIIs and BSE Sensex [7].

Joo and Mir looked into the FIIs' net investment flow into the Indian stock market. The study looked at the contributions made by FDI that have an influence on the Indian stock market volatility. Secondary data was obtained over a 15-year period from a variety of sources, including websites of SEBI, NSE and BSE, journals and papers. The relationship between FII and the equities in India is determined using a statistical method called correlation. The unit root test was performed to see if the time series was stationary. The authors used the GARCH model to examine the impact of FIIs on Indian stocks. According to the findings, the net inflow of FIIs into India influenced the volatility of India's key stock market indices, the Nifty and Sensex. According to the findings, there is a considerable association in market-leading indexes of NSE and BSE. The unit root test was conducted to see if the time-series data were valid. The study also found that FIIs' investments have a statistically significant impact on the volatility of the NIFTY and SENSEX, two of India's most popular indices [8].

Aswini and Kumar investigated the significant effect of FIIs on the Indian equity market to analyze the relationship between FII and the Indian equity market. The study is based on secondary data gathered over a 20-year period from multiple sources such as the BSE, NSE and SEBI. The research is descriptive in nature. It used correlation analysis to examine the relationship between FII and the stock market. From the research analysis findings, it was revealed that there is a strong correlation between FII and index return. It was found that FII has less impact in the long-term, whereas it has a high impact in the short-term [9].

The purpose of the study by Agarwal is to see how FII capital flows affect the Indian primary market. The research study used secondary data from six years, from 2006 to 2011, which was collected from the SEBI's official website. The acquired data is analysed using statistical tools such as correlation and the OLS model in multiple regression. The study shows how FII inflows in the form of initial public offerings (IPOs) affect the Indian capital market. The capacity of GDP to predict FII inflows in IPOs is compared. The beta value of GDP is higher than the inflow of FIIs, indicating that FIIs do not have significant impact on the Indian financial market [10].

Swapna determined the investment development pattern of FIIs. Investigation of the relationship and impact of FIIs on the Indian Stock Exchange is considered. The study included 12 years of secondary data, which was collected from various sources like BSE, NSE and SEBI. The inflow and outflow net investment of FIIs and the average of the BSE and NSE indices are considered variables for the research paper. The association between these variables is examined utilizing correlation and regression. The requisite hypothesis was formulated and evaluated using ANOVA, and the findings are given in the research article. The article examines the impact of FII inflows and outflows on the BSE and NSE indexes. The research study shows how FII inflows and outflows affect the SENSEX and NIFTY 50 indexes. This study discovered a favourable correlation between FIIs' flow and both index movements [11].

Chhimwal and Bapat determine the impact of unexpected FPI and DII flows on volatility. The research study observed daily FPI and DII flow of investment between March 2009 and March 2018. Secondary data is considered for this study, collected from different sources. The ADF test is implemented to investigate the stationarity of data. TGARCH, ARMA models and t-statistics are used to measure the relationship of FII and DII with that of NIFTY 50. The results of this study show that unexpected disinvestment of Foreign Portfolio Investment (FPI) increases or influences volatility more than unexpected buying. The author reveals that the impact of the unexpected flow of domestic institutional investors (DIIs) has a strong positive relation for small-cap stocks [12].

Bansal measured the relationship between foreign and domestic institutions as Indian stock market participants. The study used daily data transactions of FII and DII investments, which were collected from a variety of sources. This research study used various statistical tools such as descriptive analysis, PP unit test, correlation, VARs, ADF unit test, etc. The author concluded in his research that there is a strong positive relationship and influence of FIIs and DIIs on Indian stock market volatility [13].

Panda and Leepsa showed in their paper the behaviour of institutional investors post-financial crisis in the Indian capital market, particularly NIFTY 500 companies. Their results suggested that FIIs had an edge over DIIs in terms of market performance [14].

Chauhan and Chaklader had used VAR in their study to find that DIIs in India follow smart money value investments, while FIIs seek a positive feedback trading approach [15].

As per Kiran and Ramesh, FIIs and DIIs, along with promoters, have a negative relationship with the dividend payment decisions of companies. These dominate the shareholding of the companies in the majority. Consequently, influencing the markets [16].

Srivastava, Solomon, and Singh examined the effect of exogenous shocks on macroeconomic variables in BSE SENSEX. They found strong evidence on the changes in stock prices because of the exogenous shocks in interest rates, crude oil prices, inflation, trade openness, and exchange rates [17].

According to Goel and Singh, ANN model had the predictive power towards the closing prices of BSE SENSEX with up to 93% accuracy [18].

Table 1

Sample Time Period of the Study and Justification

Data		Justification of starting date	Period
From	To		
31.12.2019	26.03.2023	WHO declared the pandemic	Pandemic Period
27.03.2022	30.11.2023	International Flights Started	After Pandemic Period

Source: Author's calculation.

The movement of stock prices based on the related information at the microeconomic and macroeconomic levels was influenced by the attitude of the investors [19].

Goel, Agarwal, Chhabra, and Som employed ANN to forecast the closing prices of BSE SENSEX with an accuracy rate of 99%. Hence, aiding DIIs, FIIs, and others in decision-making [20].

Panda, Tripathy, Tiwari, and Yarovaya showed that FIIs created better market value as compared to DIIs amongst companies in NIFTY 500 spanning from 2011 to 2020 [21].

Many authors in their papers described the institutional capital inflow since 1992, after the economic reform. The research studies describe how the FII and DII capital inflow and outflow affect the Indian equity market. However, there hasn't been much focus on FII and DII investment during the COVID-19 pandemic. This study mainly evaluates the impact of FIIs and DIIs in the stock market of India, as their influence on the return of Nifty50 is evident during and after the COVID-19 time.

RESEARCH METHODOLOGY

The research is descriptive and relies on secondary information. Data was obtained from the online platform by looking at secondary sources available on websites. The data on FIIs and DIIs daily flows was gathered from the Money Control website,[1] whereas the data on the Nifty50 Index's daily closing values was obtained from the NSE website.[2]

Statistical methods like descriptive analysis, Karl Pearson's coefficient of correlation, unit root test, Johansen's cointegration test, GARCH Model and Artificial Neural Network (ANN) are employed to evaluate the acquired data.

The research spans a period of almost three years, from December 31, 2019 to November 30, 2023, presented in *Table 1*.

The time period was chosen to determine the impact of FIIs and DIIs capital net inflow on the Indian stock market during and after the pandemic. The study uses the Nifty50 as a proxy for the Indian stock market, which is a key NSE index.

OBJECTIVES

The following objectives guided the development of this research:

1. To examine the role of FIIs and DIIs in the Indian equity market, with a focus on theNifty50.
2. To find out the correlation between FIIs, DIIs and Nifty50 index in COVID-19 and post-COVID-19 periods.
3. To forecast volatility persistence in the variables FIIs, DIIs and Nifty50 index in both periods
4. To examine the effect of FIIs and DIIs capital flow on Nifty50 in both periods.

HYPOTHESES

To fulfil the objectives of the research study, the following null hypotheses are framed:

H_{01} = No different correlation level existed between FIIs, DIIs and Nifty50 index in COVID-19 and post-COVID-19 periods.

H_{02} = No different volatility persistence in FIIs, DIIs and Nifty50, individually, in both periods.

H_{03} = No different individual significant effect of FIIs and DIIs capital flow on Nifty50, in both periods.

[1] Website of Moneycontrol. URL: https://www.moneycontrol.com/ (accessed on 20.12.2023).

[2] Website of National Stock Exchange, India. URL: https://www.nseindia.com/ (accessed on 20.12.2023).

Table 2

Summary of the Variables

Variables	Description of Variable	Frequency	Symbol COVID-19 Period	Symbol Pre-COVID-19 Period
Nifty50	National Stock Exchange Index of India	Daily Closing	Nifty1	Nifty2
DII	Net Domestic Institutional Investors	Daily	DII1	DII2
FII	Net Foreign Institutional Investors	Daily	FII1	FII2

Source: Author's calculation.

ANALYTICAL TOOLS AND TECHNIQUES

Descriptive Analysis

Descriptive analysis is a statistical method that summarises and interprets data to reveal essential characteristics. It aims to provide a comprehensive overview of the data, uncovering patterns, trends, and distributions. This method is crucial for understanding the fundamental aspects of a dataset.

Correlation

It shows the direction of the relationship between the variables. The correlation analysis demonstrates the positive and negative relationships between the variables. It lies between +1 and –1 only.

Unit Root Test

A unit root, an autoregressive approach, is used to determine if a data series is non-stationary. The enhanced Dickey-Fuller test is a renowned unit root test with large sample validity.

GARCH

The Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model is a statistical tool used in finance to analyze and predict volatility in time series data. It incorporates past volatility to forecast future volatility, making it valuable for risk assessment and modeling financial market fluctuations.

Artificial Neural Network (ANN)

An artificial neural network (ANN) is a computational model that draws inspiration from the structure and function of the human brain. The system is composed of interconnected nodes, known as neurons, that are arranged in layers. Each connection between neurons is assigned a weight. ANNs are used in machine learning to recognize patterns, make predictions, and perform tasks based on data.

A summary of the variables is presented in *Table 2*. It contains the frequency of data and the symbols.

RESULTS AND DATA ANALYSIS

It is presented as under:

Descriptive statistics

The descriptive analysis is related to various features of COVID-19 and post-COVID-19 period is shown in *Table 3*. In descriptive analysis, statistical measures such as mean, standard deviation, skewness, kurtosis, minimum, and maximum are applied.

It is observed from the above *Table* that the mean inflow of FIIs is negative in both the cases of COVID-19 and the post-COVID-19 period which is –519.6389 and –509.2758, respectively. It revealed that FIIs created a net withdrawal. From the result, it is observed that DIIs mean (497.8541) is higher than FIIs in COVID-19 situation and (783.4972) more in the case of post-COVID-19 situation.

During the COVID-19 period, FIIs had a maximum capital flow of 28 739.17 and in the post-COVID-19 period it, had a maximum capital inflow of 12 770.81 in a single day and a minimum capital outflow of –8295.170, whereas in post-COVID-19, it has a minimum of –7818.610 in a single day.

Table 3

Descriptive Statistics (COVID-19 Period and Post-COVID-19 Period)

Particulars	DII1	FII1	Nifty1	DII2	FII2	Nifty2
Mean	497.8541	–519.6389	14340.76	783.4972	–509.2758	18030.54
Median	381.0800	–493.6800	14956.20	609.8200	–453.7700	17956.60
Maximum	7621.160	28739.17	18477.05	6558.450	12770.81	20192.35
Minimum	–2610.130	–8295.170	7610.250	–6440.050	–7818.610	15293.50
Std. Dev.	1394.777	2582.661	3024.008	1398.244	2142.403	1160.634
Skewness	1.045547	4.522075	–0.555820	0.146911	0.681572	–0.152394
Kurtosis	5.390471	50.85957	2.028524	7.031160	9.554377	2.325767

Source: Author's calculation.

Table 4

Correlation: COVID-19 Period

Variables	DII1	FII1	Nifty1
DII1	1.000000	–0.602802	–0.195317
FII1	–0.602802	1.000000	0.201945
Nifty1	–0.195317	0.201945	1.000000

Source: Author's calculation.

Table 5

Correlation: Post-COVID-19 Period

Variables	DII2	FII2	Nifty2
DII2	1.000000	–0.589017	0.120958
FII2	–0.589017	1.000000	–0.132632
Nifty2	0.120958	–0.132632	1.000000

Source: Author's calculation.

In the case of DIIs, the descriptive analysis shows a maximum of 7621.160 and a minimum of –2610.130 in the case of COVID-19 period, while in post-pandemic duration, it has a maximum of 6558.450 and a minimum of –6440.050.

The analysis shown above in the tables revealed that FIIs have higher standard deviations of 2582.661 and 2142.403 in the pandemic and post-pandemic periods, whereas DIIs had a standard deviation of 1394.777 and 1398.244 in pandemic and post-pandemic respectively. The higher standard deviation of FIIs shows the high volatility nature of FII as compared to DII in the Indian stock market.

In statistics, skewness is an observed degree of variance in a probability density in a data set that differs from the symmetry normal curve (bell curve). From the descriptive analysis of the COVID-19 period shown in the above table, it was observed that FII and

Table 6

ADF Test: COVID-19 Period

Level			First difference		
Symbol	ADF statistics	P–value	ADF statistics	P–value	
Nifty1	–1.430966	0.5677	–16.21111	0.00	
DII1	–7.839630	0.00	–16.36749	0.00	
FII1	–7.460085	0.00	–19.72738	0.00	

Source: Author's calculation.

Note: Exogenous: Constant, Lag Length: Automatic based on SIC, MAXLAG = 25. *MacKinnon (1996) one-sided p-values. Deterministic Terms: Intercept.

Table 7

ADF Test: Post-COVID-19 Period

Level			First difference		
Symbol	ADF statistics	P–value	ADF statistics	P–value	
Nifty2	–0.270710	0.9265	–27.62939	0.00	
DII2	–6.241586	0.00	–23.14143	0.00	
FII2	–7.647897	0.00	–21.72918	0.00	

Source: Author's calculation.

Note: Exogenous: Constant, Lag Length: Automatic based on SIC, MAXLAG = 25. *MacKinnon (1996) one-sided p-values. Deterministic Terms: Intercept.

DII have positive skewness, which shows asymmetry in the data, whereas Nifty50 has negative skewness. In post-COVID-19 situation, data reveals the same situation.

As the kurtosis of all the variables, Nifty50 for pandemic and post-pandemic is greater than 3, it shows that the data series of FII and DII have heavier tails than a normal distribution.

CORRELATION

Correlation among the variables is presented in the following *Tables 4, 5*:

As shown in *Table 4* and *Table 5*, the correlation between the daily closing value of Nifty50 and the associated market players' FIIs and DIIs was calculated for pre- and post-COVID-19 intervals. Based on the data analysis, it was observed that throughout the COVID-19 period, the FII and Nifty50 indices movement has a significant positive correlation of 0.201945, while the DIIs and Nifty50 indices movement has a significant and negative association of 0.195317. It shows that the return from the index is moving with the inflow of DIIs. DII has a substantial negative association with FIIs, with a value of –0.602802, according to the evaluation.

The FIIs had a substantial negative association of –0.132632 in the post-COVID-19 scenario. According to the table, DIIs have a significant positive association of 0.120958 with the Nifty50 index during the post-pandemic period of this study. The study demonstrates that FII has a substantial negative association (–0.589017) with FII in both the post-pandemic and pre-pandemic periods.

UNIT ROOT TEST (ADF)

The *Tables 6, 7* are presented as under:

We checked for stationarity by looking for the series' unit root. The data is said to be non-stationary if the unit root exists in the data. The Augmented Dickey-Fuller (ADF) determines if the data is static. The ADF test was applied to the time series data of FII, DII and Nifty50. The null hypothesis, H_0, is

Table 8

GARCH Model (COVID-19 Period)

Variable	Coefficient	Std. Error	z–Statistic	Prob.
C	15736.23	13.20885	1191.340	0.0000
Variance Equation				
ω	3285.946	1892.312	1.736471	0.0825
α	0.969726	0.275163	3.524185	0.0004
β	0.059852	1.145324	0.411853	0.6804
GARCH Model for FIIs				
Variable	Coefficient	Std. Error	z–Statistic	Prob.
C	–241.5143	162.7565	–1.483900	0.1378
Variance Equation				
ω	5042726	476391.4	10.58526	0.0000
α	0.381161	0.098589	3.866167	0.0010
β	0.057721	0.079010	0.730555	0.4651
GARCH Model for DIIs				
Variable	Coefficient	Std. Error	z–Statistic	Prob.
C	347.6844	64.20789	5.414979	0.0000
Variance Equation				
ω	467361.5	119235.1	3.919665	0.0001
α	0.3733168	0.075799	4.923109	0.0000
β	0.4152000	0.104807	3.961553	0.0001

Source: Author's calculation.

created at the 10%, 5% and 1% significance levels to test the non-stationary in a temporal sequence. The null hypothesis is the opposite of the alternative hypothesis. ADF test suggests that the data series of FIIs, DIIs and Nifty50 has no unit root.

From the analysis shown in the above-given *Tables 6* and *7*, it was observed that in the case of both pandemic and post-pandemic situations, unit root existed in the case of Nifty50 as the P value is higher than 0.05 which is 0.5677 in COVID-19 and 0.09265 in post-COVID-19 situation, it shows that Nifty50 data series is non-stationary at the level. As a result, the null hypothesis is ruled out. The alternative theory is also recognized, but in the case of FIIs and DIIs, the data series does not unit root at a level, as the P-value of FII and DII data series is 0.0000, which is significant and less than 0.05 in both COVID-19 and post-COVID-19 periods, so here the null hypothesis is accepted, and alternate hypothesis is rejected in caseof FIIs and DIIs, as the data series revealed that FII and DII data series are stationary at the level.

While the Nifty50 data series is non-stationary at the level in both pre- and post-COVID-19, so here, in the case of Nifty50 the null hypothesis is rejected. It was found that when the data series were tested at levels FII and DII time series were integrated, at only 1%, 5%, and 10% significance levels, but the Nifty50 time series was not integrated so all the time series data were tested at the first difference level, where the P-value of Nifty50, become 0.0000 which is significant and less than 0.05 so the Nifty50 data series was found to be stationary at the first difference. Here, the null

Table 9

GARCH Model (Post COVID-19 Period)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	17782.91	16.86718	1054.290	0.0000
Variance Equation				
ω	15423.32	7784.229	1.981354	0.0476
α	0.929087	0.284262	3.268416	0.0011
β	0.062818	0.161948	0.387887	0.6981
GARCH Model for FIIs				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	–3774.6250	92.98680	–4.028798	0.0001
Variance Equation				
ω	1258583	219369.2	5.737280	0.0000
α	0.574263	0.078068	7.355935	0.0000
β	0.315054	0.057320	5.496458	0.0000
GARCH Model for DIIs				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	657.5512	67.67952	9.715661	0.0000
Variance Equation				
ω	1231739	180222.6	6.834545	0.0000
α	0.335131	0.80990	4.142875	0.0000
β	0.031118	0.128396	0.242359	0.8085

Source: Author's calculation.

Table 10

Sum of Alpha (α) and Beta (β)

Period	Sum	Nifty50	FIIs	DIIs
COVID-19 Period	α + β	1.029578	0.438882	0.7885168
Post COVID-19 Period		0.991905	0.889317	0.6463110

Source: Author's calculation.

hypothesis is accepted and the alternate hypothesis is rejected.

GARCH

Tables 8–10 related to GARCH are presented as follows:

The significance of α and β reveals that lagged squared error and lagged conditional variance have a definite impact on the conditional variance. This holds true for any variable being studied, as the volatility from earlier periods affects the current volatility of all markets. Volatility clustering is seen in the markets.

Nevertheless, the duration of fluctuations in volatility is heavily contingent on the combined values of the ARCH term (α) and GARCH term (β) parameters. When the total of the parameters is less than one, it

Table 11

RMSE values (COVID-19 Period)

Network	SSE (Training)	SSE (Testing)	RMSE (Training)	RMSE (Testing)	Sample size (Training)	Sample size (Testing)
1	143.180	72.327	0.703	0.727	290	137
2	152.417	59.225	0.702	0.708	309	118
3	143.664	58.823	0.705	0.653	289	138
4	141.389	78.298	0.706	0.740	284	143
5	143.918	53.094	0.701	0.629	293	134
6	156.177	49.017	0.713	0.639	307	120
7	148.182	77.455	0.710	0.763	294	133
8	149.754	72.392	0.707	0.755	300	127
9	159.946	60.83	0.729	0.695	301	126
10	152.556	55.725	0.702	0.690	310	117
Mean	149.1183	63.7186	0.707665519	0.699954634		
S.D.	5.855273709	9.979980794	0.008001293	0.045178702		

Source: Author's calculation.

Note: SSE = Sum square of errors, RMSE = Root mean square of errors.

indicates a propensity for the volatility response to diminish gradually over time. A total of one suggests an indefinite persistence of volatility in response to shocks over time, whereas a total greater than one indicates a rising persistence of volatility over time.

From *Table 10*, it can be seen that the volatility ($\alpha + \beta$) is more than unity in the case of Nifty50, implying increasing volatility persistence over time, in COVID-19 time, which reduced marginally in the COVID-19 era. The scenario is different in the case of FIIs and DIIs. During COVID-19 period, both FIIs and DIIs showed a tendency for the volatility response to decay over time, but the coefficient combination is lesser for FIIs than DIIs. These coefficients increased in post-COVID-19 time.

Artificial Neural Network (ANN)

Analysis based on ANN is presented in *Tables 11, 12, 13* and *14*. Where Nifty50 is taken as a dependent variable, whereas DIIs and FIIs are covariates. Partitions for Training and Test are 70 per cent and 30 per cent, respectively.

Table 11 shows that the average root mean square error (RMSE) values for the training and testing methods during

Table 12

Sensitivity Analysis COVID-19 Period

Network	FII	DII
NN 1	100.0%	99.2%
NN 2	100.0%	71.6%
NN 3	100.0%	10.8%
NN 4	91.1%	100.0%
NN 5	100.0%	38.1%
NN 6	39.2%	100.0%
NN 7	100.0%	95.4%
NN 8	100.0%	30.6%
NN 9	100.0%	1.3%
NN 10	100.0%	21.5%
Average Importance	0.930300905	0.56838625
Normalized Importance	100%	61%

Source: Author's calculation.

Table 13

RMSE values (Post COVID-19 Period)

Network	SSE (Training)	SSE (Testing)	RMSE (Training)	RMSE (Testing)	Sample size (Training)	Sample size (Testing)
1	113.256	57.887	0.638	0.681	278	125
2	129.29	47.368	0.664	0.656	293	110
3	113.307	74.728	0.63	0.773	278	125
4	132.88	53.334	0.686	0.664	282	121
5	118.114	43.032	0.636	0.623	292	111
6	114.035	39.269	0.644	0.554	275	128
7	115.536	46.822	0.645	0.612	278	125
8	114.608	49.33	0.639	0.636	281	122
9	112.239	59.074	0.648	0.659	267	136
10	119.085	52.474	0.648	0.664	284	119
Mean	118.235	52.332	0.648657895	0.652136843		
S.D.	7.153348571	10.00034967	0.014779433	0.053104661		

Source: Author's calculation.

Note: SSE = Sum square of errors, RMSE = Root mean square of errors.

Table 14

Sensitivity Analysis Post COVID-19 Period, %

Network	FII	DII
NN 1	81.9	100.0
NN 2	87.4	100.0
NN 3	62.7	100.0
NN 4	85.7	100.0
NN 5	39.9	100.0
NN 6	27.2	100.0
NN 7	39.7	100.0
NN 8	37.9	100.0
NN 9	26.8	100.0
NN 10	38.7	100.0
Average Importance	76.4	100.0
Normalized Importance	76.4	100.0

Source: Author's calculation.

the COVID-19 period are 0.7077 and 0.6999, respectively. In order to assess the predictive capabilities of each input neuron, a sensitivity analysis is performed. This analysis allowed us to determine the normalized relevance of these neurons by dividing their relative value by the maximum importance and expressing it as a percentage. The findings indicate that the FII is the primary determinant of Nifty50.

Table 13 portrays that the average RMSE values of the training and testing procedures for the post-COVID-19 period are 0.6487 and 0.6521, respectively. The result shows that the DII is more important predictor of Nifty50.

CONCLUSION

It is concluded that the net flows of DIIs in post-COVID-19 time have tremendously increased over the COVID-19 period, but that of FIIs has increased marginally. DIIs are bullish in both pre- and post-pandemic situations. The volatility in DIIs in COVID-19 and post-COVID-19 times remains almost the same, but is reduced a bit in FIIs. The research analysis illustrates that FIIs and DIIs are opposite to each other; when the FIIs invest, the DII are net sellers, while the FIIs are bearish, and the DII are the net investors.

From the analysis, it was found that in the COVID-19 period, the FIIs had a significantly positive correlation, while DIIs had a negative association with the Nifty50. Whereas, in the post-COVID-19 period, FII have a negative correlation, and DIIs have a positive association with the Nifty50.

The case of Nifty50 implies increasing volatility persistence over time, in COVID-19 time, which was reduced marginally in the COVID-19 era. During COVID-19 period, both FIIs and DIIs showed a tendency for the volatility response to decay over time, but the coefficient combination is lesser for FIIs than DIIs. This coefficient increased in post-COVID-19 time. The ANN result shows that the DIIs are a more important predictor of Nifty50 in post-COVID-19 period, but it was FIIs in COVID-19 period.

Lastly, it is noted that H_{01} is rejected as different significant correlations existed between FIIs, DIIs and Nifty50 in different periods. H_{02} is also rejected as there is different volatility persistence in FIIs, DIIs and Nifty50, individually, in both periods. H_{03} is also rejected because there is a significant difference in the effect of FII and DII capital flow on Nifty50 in different periods.

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Determinants of Commercial Bank Lending: Evidence in United Arab Emirates

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ABSTRACT

Banking is one of the highly sensitive industries as its most of the revenue is generated from loans. The current study aims to investigate the impact of interest rates, capital sufficiency, asset quality, and liquidity on the lending behaviour of commercial leading banks of United Arab Emirates (UAE). For this purpose, the investigator aimed to use a quantitative research method so that only accurate, authentic, and fully updated data can be obtained from the selected population. This research would help regulators for the development of credit risk management standards for various credit related problems like economic sector funding, lending restrictions and risk weighted assets, etc. which can put an impact on the asset quality. Moreover, the researcher collected plenty of data from secondary sources to analyse the impact more effectively with good arguments. Furthermore, all the obtained data were further analysed by using a regression model and statistical analysis methods to evaluate the effectiveness, efficiency, and reliability of all the obtained data from various sources. The results of the conducted research suggested that there is a strong impact of various numbers of determinants of commercial banks of UAE on the lending behaviours like interest rates, capital sufficiency, asset quality, and liquidity. The current research study also indicated that the banks of UAE are needed to stay more vigilant in the use of multiple factors while following the lending trends to increase their revenues and profits.

Keywords: lending; bank size; gross domestic product; credit risk; liquidity ratio; volume of deposit; cash reserve; investment portfolio; interest rate

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INTRODUCTION

Since the invention of money in prehistoric times, there have always been some individuals with excess finances, termed as surplus economic units, and others who lack money to fund their immediate needs. K. Miyajima [1] explained the concept of credit emerged when those with surplus funds began loaning money to cover the needs of those with a cash shortfall, resulting in direct lending where participants interacted directly with each other. This involved surpluses (lenders) and deficit units (borrowers) searching for and negotiating with each other individually, with the lender bearing all the risk, as per Sysoeva [2].

Over time, the history of the system witnessed the gradual rise of indirect lending, gradually replacing direct lending. Indirect lending involves banks combining deposits from various surplus entities (companies, governments, and individuals) and providing loans to those in need of funds. Commercial banks reward customers with interest on their savings while also taking on the default risk. The banks attach a margin appropriate to the debtor's risk level to what is paid to depositors to determine the debtor's costs. The loans are then repaid through banks.

Lending is a crucial service provided by banks, contributing significantly to their income generation. Loans may be short, medium, or long-term, playing a vital role in assisting the economic activities of families, businesses, and governments, determining the growth and expansion of any state's economy. According to E.V. Kuz'mina, A.A. Yanin [3], bank lending operation, impact economic growth by providing capital for investment. Despite the liberalization of financial firms in many economies, experts remain divided on the reasons behind borrowing behaviors. Bank loans are a significant source of long-term finance in advanced economies. Commercial banks are crucial in mobilizing assets and

distributing financial resources, playing an important role in shaping a country's economic development and growth. Commercial banks are driven by liquidity, solvency, and profitability in providing loans to clients.

In most industrialized nations, long-term debt accounts for a substantial portion of total loans. Commercial banks in developing markets may be reluctant to make long-term loans to private corporations. The lack of long-term financing is considered a major impediment to economic growth in emerging and developing countries. Large-sized banks, by pooling deposits and capital from multiple industries and organizations, are better positioned to provide a broader range of financial products. Smaller banking institutions are more likely to underwrite modest loans to small business owners. A large balance sheet allows credit risk management teams to diversify their entire portfolio, reducing the risk of asymmetric shocks.

Research has extensively explored the credit extension practices of different financial organizations. This study aims to investigate the influence of asset quality, interest rates, capital adequacy, and liquidity on the lending behavior of commercial banks in the United Arab Emirates (UAE). The study recognizes that savings or cash received from depositors are the primary source of credit, with the loan portfolio accounting for the majority of a bank's assets and income stream. Banks consider factors such as capacity and willingness to repay when making credit decisions. The debtor's risk profile and customer relations are crucial factors assessed by banks, with risk being the most essential component.

Determinants of bank lending behavior relate to the elements influencing commercial banks' loan extension. Factors such as capital adequacy, interest rates, asset quality, and liquidity are considered. Loan pricing, or interest rates, is one of the most important criteria examined during the loan decision-making process. Liquidity refers to a bank's capacity to meet financial commitments, primarily to customers, when those deposits are needed. The relationship between loan provisions and total loans is referred to as asset quality, assessing a bank's effectiveness in increasing income through loan extension. Capital adequacy measures a bank's capital's ability to withstand fiscal and operational fluctuations. In summary, this study delves into the multifaceted dynamics of bank lending behavior, considering various factors that shape credit extension and its impact on economic development.

Problem Statement

Banking is a highly sensitive industry as most of its revenue is generated through loan operations. The loan procedure exposes the bank to considerable risk, which could result in losses. Understanding the causes of loan behavior is crucial for bank executives to ensure successful bank performance and profitability. The financial intermediaries' function of commercial banks is vital in promoting economic growth and development in every country. Banks accumulate funds through these intermediaries, which are then utilized to fund the economy of a nation. Poor lending practices can lead to significant losses for institutions, potentially leading to their demise. This could have a cascading impact on the economy, resulting in the collapse of the entire financial industry.

The primary goal of the study was to identify the factors influencing lending behavior in UAE banks. The precise objectives guiding this research were as follows:

1. To investigate the impact of capital sufficiency on lending behavior in UAE commercial banks.
2. To ascertain the impact of interest rates on lending behavior in commercial banks in UAE.
3. To investigate the impact of asset quality on lending behavior in commercial banks in UAE.
4. To ascertain the impact of liquidity on lending behavior in commercial banks in UAE.

The purpose of this research was to determine the lending habits of commercial banks in the UAE. It is crucial to understand how the financial systems of emerging countries, particularly the UAE, function. This understanding helps gain insights into how interest rates, capital adequacy, liquidity, and asset quality impact the characteristics and structures of loans, which are then reflected in the loan conditions forming the basis of agreements between the bank and its customers. The research will also assist regulators in developing credit risk management standards to oversee various credit-related hazards, such as lending restrictions, risk-weighted assets, and economic sector funding, which will influence asset quality. The staff and management of commercial banks will also benefit from this research, gaining insights into the elements to consider when making credit judgments and managing their credit facilities.

LITERATURE REVIEW

Various researchers have presented numerous theories concerning credit evaluation and regulation. We will

look at four theories: delegated monitoring of borrowers, credit risk management portfolio theory, loan pricing theory, and information asymmetry theory. Since the 1980s, commercial banks have successfully applied Modern Portfolio Theory (MPT) to market risk and credit risk management. Most financial institutions use Value at Risk (VaR) models to manage their market risk vulnerabilities and interest rates. Regrettably, even though banks identify credit risk as their primary problem, the application of current portfolio theory to credit risk has lagged.

Commercial banks understand the influence of credit saturation on their firm profitability, which may be negative if not handled properly. This has commanded most commercial banks to use quantitative techniques for credit risk measurement, while the main impediment has been a lack of trustworthy data. The banking sector [1, 2], has also taken major efforts toward developing tools for assessing credit risk. Banks have also used credit derivative instruments to quickly and effectively shift risk that they do not want to bear while simultaneously preserving client rapport. As a result of these two developing concerns, advancement in credit risk management on a portfolio level has risen tremendously.

In the beginning, banks used an asset-by-asset approach to credit risk management. This approach entailed periodically assessing the loan book's quality and other credit hazards, employing credit risk ratings, and completely incorporating the findings of this study to calculate the potential losses of a specific loan portfolio. The asset-by-asset method is based on a thorough credit examination as well as the bank's own credit risk rating system. Credit risk assessment systems and frequent loan reviews enable managers to identify portfolio changes in real time. Depending on the conclusion of an institution's difficulty in loan recognition, credit risk rating system, and loan assessment, administration may then adjust its portfolio tactics or simply speed up loan monitoring [3].

The fundamental shortcoming of the asset-by-asset method is a failure to give a holistic perspective of the credit risk portfolio, where risk alludes to the possibility that actual losses exceed predicted losses. The incapacity to detect and assess concentration risk is the primary drawback of the asset-by-asset method. Concentration risk is the heightened risk caused by increasing exposure to a potential borrower, related debtors, or a certain sector [2]. As a result, commercial banks supplement this technique with a quantitative evaluation of their loan portfolios using multiple credit models.

The Information Asymmetry Theory concept is based on the notion that a borrower may know a great deal of information about the risk involved with the project that they have asked the bank to fund that the lender may not have. This might result in an issue with unfavorable selection and behavioral hazard. These significant gaps can reduce the efficacy of shifting monies from those with surplus to those in fiscal distress. The bank may overcome these problems in three ways. One, by building a promise to long-term client relationships. Second, by facilitating communication with other stakeholders, and third, by outsourcing the responsibility of borrowers monitoring [3]. Prior to a bank issuing out a loan, all essential information must be gathered to overcome the information asymmetry challenge.

Banks screen borrowers by obtaining information during the loan evaluation process and after loan disbursement. It entails determining if the applicant has met the bank's lending criteria, assessing the borrower to determine his creditworthiness, and post-loan surveillance to ensure that all agreements are met. When banks manage their clients' operational accounts, they have access to sensitive information on cash movements and spending. This confidential data is helpful in the scenario of small and medium businesses.

Financial efficacy in the banking industry has been identified as a need for economic progress. This reveals why so much attention is placed on ongoing study in this field. This is influenced further by changes in the banking business, which is marked by fierce rivalry. Globalization of markets and financial liberalization have spawned a new age of competitiveness for local banking, with many banks broadening their businesses to keep up with the latest trends.

It is impractical for banks to continually give very low interest rates on deposits while still giving high interest rates on credit facilities to increase their revenue. Banks, according to Gamukin [4], should address the issue of moral hazard and adverse selection when attempting to optimize income because it is difficult to target borrower type with confidence at the time of commencing client connection. Because high interest rates are usually favorable to high-risk borrowers, they may cause an unfavorable selection problem. Once these debtors obtain the loans, it is extremely likely that they will engage in

moral hazard behavior because of pursuing high-risk developments.

Banks are in a stronger role to predict the likely achievement of envisaged project financing because they can draw on encounter from equivalent previous undertakings that they have funded. They are generally in a place to obtain important information that entrepreneurs might not even be successful in obtaining easily. They must also be acquainted with the macroeconomic environment of their geographical scope as well as prevalent economic indicators. This discussed the significance of banks in the business communities. Simultaneously, they must strike a balance between income generation and the dangers associated with their bank lending practices, [3, 4].

The bank's credit terms may then be driven by the need to retain its customers, which may display it with an attempt to profit from other investment opportunities such as service fees, which are non-interest-bearing incomes. As a result, financial institutions should not ignore the relevance of relationship factors because they may offer inside helpful data to them in the future. As a result, it's fascinating to see how banks incorporate relationship factors into their credit assessment.

Most of the recent work has been on overall credit expansion in both emerging and developed nations. According to the existing research, consumer lending is influenced by supply-side variables such as liquidity and demand variables such as income gains and borrowing rates (interest). M. Coletta, R. De Bonis, and S. Piermattei [5] identified that high per capita GDP has a positive correlation with the level of debt in various households across 33 developing countries. Consumer lending in Pakistan were shown to be favorably linked with bank liquidity, income bracket, and financial system reforms [5]. Ivanovic [6] researched the drivers of credit facilities in Montenegro before the global financial and economic crisis of 2007 and deduced that an increase in national income and bank liquidity had a significant effect in determining commercial lending.

According to [5] and [3], the unemployment level and the CPI (consumer price indices) have affected loans in Romania. Yuksel, Zengin, and Kartal [7] investigated the influence of macroeconomic variables on customers' lending in Turkey, namely the rate of interest and rate of unemployment. According to [7], interest rates had a beneficial influence on consumer lending, but rates of unemployment have a detrimental effect. Using quarterly data, Gambacorta, Mistrulli [8] explored the association between macroeconomic factors and consumer lending in Middle Eastern and North African nations. According to the research, an increase in Gross domestic product has a beneficial influence on commercial lending. Abdul-Muhmin [9] ascribed the surge in debt levels in UAE to the increased liquidity position of the commercial banks. According to Fox [10], commercial lending is favorably associated with stock prices. A notable study that looked at macroeconomic factors that can influence bank lending in UAE was executed. According to the study, economic expansion, the price of oil, and bank liquidity all have a significant positive effect on lending. The rate of interest was negative and inconsequential.

Several research works on commercial bank lending behavior have been assessed. Some studies concentrate on the variables impacting bank credit extension to aspects of the economy, while others examined the effects of lending on economic progress. Most of these studies agreed that commercial banks should have some rudimentary lending precepts and systems in place to serve as a roadmap in their credit extension operations. As a result, *Fig.*, it is critical to evaluate and consider some of the elements suggested by other researchers in their attempt to learn the determinants of commercial bank loan founding. This research utilizes the following conceptual framework to address the variables that have been identified to have an impact on the lending behavior in commercial banks.

As a result, it is possible to infer that there is a scarcity of study on the variables that drive commercial banks' loan creation behaviour, with a particular emphasis on risk and relationship aspects. Most of the previous research provides insufficient empirical data since the authors concentrated on the effect of such actions on bank borrowers instead of what the results demonstrated for the bank and the banking sector. Additionally, there is limited understanding of how developing nations make credit decisions, the similarities, and differences between lending theory in first-world economies, and the role of connection variables and risk in credit generation, as well as their influence on the overall banking industry. There is a scarcity of empirical research on loan creation behaviour that focuses on borrowing terms in connection to relationship characteristics and risk characteristics of debtors in developing countries. Furthermore, the few studies that were conducted have focused on organizations

registered with the securities exchange stock market, and as a result, there have been few efforts to support research on commercial banks. As a result, the study was meant to fill this information vacuum.

DATA & METHODOLOGY

The descriptive correlation research design will be used in this study. A correlation study is a quantitative research approach in which there are two or more quantitative variables from the same group, for which an assessment is being performed to identify whether there is a link (or co-variation) between or among the variables in question. The study of Hunjra, Tayachi, Mehmood, Malik and Malik [11] suggested that a multiple regression model is used to determine the relationship between the total amount of loans advanced by commercial banks and all the other variables, which were identified as interest rate, asset quality, capital adequacy, and liquidity ratio. A target population is the specific group of people who might benefit from knowledge about a topic. In the context of this investigation, a population may be described as a well-defined collection of people, services, elements, events, groups of objects, or homes that are under investigation. In population research, everyone has an equal chance of success, resulting in a more representative sample. This research includes four banks of the UAE (Abu Dhabi Commercial Bank, First Abu Dhabi Bank, National Bank of Fujairah & National Bank of Ras Al-Khaimah).

To carry out the research, the study relies on secondary data collected from Bloomberg. Secondary data consist of the use of already published papers or materials, as well as information from libraries, such as audited financial statements, books, periodicals, and other reports. Additionally, the information available on the websites of the banks is used in the investigation. The research is conducted over a seventeen-year period, from 2005 to 2021.

The information gathered is mostly quantitative in nature. The quantitative portion of the study is carried out using descriptive statistics. Descriptive statistical techniques are utilized by the researcher to aid in the description of the data and the determination of the degree of difficulty. The instrument of choice for this investigation is regression analysis. Regression analysis is a statistical procedure used to estimate the connections between different variables [11]. It consists of a variety of

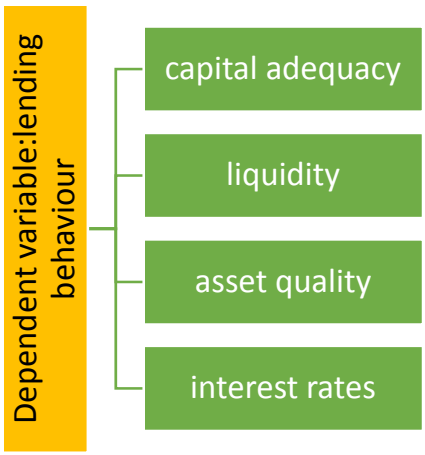

Fig. **Conceptual framework**

Source: Made by authors.

strategies for statistical modeling and analysis of many variables in a situation where the goal of the study is to determine the link between one or more independent factors and a single dependent variable.

During the research, descriptive and inferential statistics will be used in the analysis. The trend analysis method is developed to identify the behavior of the variables over a seventeen-year period. A t-test with a 95 percent confidence interval will be used to calculate the means of the variables and to identify correlations between them. When the degree of correlation between the variables is determined, the research will use an econometric approach, applying the multiple regression analysis of the Ordinary Least Squares (OLS) technique. The secondary data is gathered from the banks' audited financial records, which are then combined. In the research, descriptive and inferential statistics were employed in the analysis, with regression analysis serving as the primary instrument of investigation.

The aggregate of all loans advanced by the banks in each financial year is used to assess bank lending behavior. To determine liquidity, the ratio of total loans issued to total assets is calculated for each bank during the research, and the results will be combined to determine the overall industry position. The capital adequacy of a company is determined by calculating the equity capital to total assets ratio. The term "total assets" refers to the total amount of loans and advances. The interest rates component was calculated by computing the average interest rates issued by the Central Bank, designated as Central Bank Rates in this case. Asset quality is determined by dividing the loan loss provision by

the total amount of loans and advances. Regression analysis is carried out to find the correlations between two or more variables that have cause-and-effect relationships and to make predictions about the subject matter based on the correlations. Answers to questions such as:

1. Are there any relationships between the dependent and independent variables?

2. What is the power of the relationship if one exists?

3. Is it feasible to make future-oriented predictions about the dependent variable?

Are sought in this study, among others.

The analysis of regression using a single independent variable is referred to as univariate regression analysis, while the analysis of regression using many independent variables is referred to as multivariate regression analysis. Aiming to account for the fluctuation of the independent variables in the dependent variable synchronously is the goal of multivariate regression analysis Burton, Alexander [12]. The following is how the multiple regression analysis models are formulated in this way:

$$Y = \beta_0 + \beta_1 X_1 + \ldots \beta_{n(1)} X_n + \mu. \quad (1)$$

When attempting to determine the drivers of commercial bank lending behavior in the banking industry in the UAE, with a particular emphasis on the lending behavior of banks in the UAE, the following regression equation is used:

$$Y = \beta_0 + \beta_1 X_1 + \ldots \beta_4 X_4 + \mu, \quad (2)$$

where Y is the dependent variable, in this case, the lending behavior of commercial banks; β is the regression coefficient; β1, β2, β3 and β4 are the slopes of the regression equation; Liquidity is represented by $X1$ = Liquidity ratio (Total loans to Total Assets); Capital Adequacy is represented by $X2$ = Capital Adequacy ratio (Total Capital to Total Assets); Interest Rates are represented by $X3$ Interest/credit Rates (Central Bank Rates, Treasury bill Rates); Asset Quality is represented by $X4$ = Asset Quality (Loan loss provisions to Total Loans); the Volume of Deposits (total deposits to Total assets); and ε is an error term; μ is the error term.

To determine the significance of the regression constants β0, β1, β2, β3, and β4, the t-statistic with a 95 percent confidence level is employed. The F-test will be used to determine the significance of the whole regression at a 95 percent confidence level. The coefficient of determination R 2 and the modified coefficient of determination R 2 are used to determine the extent to which the four independent variables $X1$, $X2$, $X3$, and $X4$.

The Least Squares Method is a kind of statistical analysis. It is quite simple to understand the least squares approach utilized in OLS regression. Consider a scatterplot of data points that shows a linear trend in a single direction. As a result of an OLS linear regression technique, a line of best fit is created, which can then be used to accurately portray the dispersion of the data points with a single line [13]. Because of this fact, the line fit obtained by using the Ordinary Least Squares (OLS) approach will have the minimum value of the sum of squared deviations of each data point from the line.

The OLS regression technique of analysis involves fitting a regression plane onto a "cloud" of data that is considered to have a linear trend, as opposed to other analysis methods. However, even though the regression plane does not touch every point in the data cloud, it can model the partial relationships between each slope (that is, each regression coefficient) and the outcome variable while simultaneously controlling for the effects of the other variables in the model. As a result, in OLS, regression coefficients are determined by minimizing the sum of squares of the differences between the values fitted onto the regression plane and the values observed in the data. For various reasons, OLS regression has many data assumptions that the researcher must verify before starting the study.

In multivariate regression analysis, the following assumptions must be met normal distribution, linearity, freedom from extreme values, and the absence of additional independent variables (assumed by the model).

It is stated in the linearity assumption that a model cannot be adequately defined if the independent variables in the model do not have a linear relationship with the dependent variable when considered as a whole. Another critical requirement is that the connection between each independent variable (except binary variables) and the dependent variable must be linear. This assumption Gambacorta and Mistrulli [8], is vital since a non-linear model fails to describe the systematic pattern of the connection between the dependent and independent variables when using a non-linear model. OLS suffers from interpretability bias due to nonlinearity,

which is exacerbated by the fact that the independent variable's units (or levels) are non-consequential (i.e., any unit change in the independent variables always results in the exact resulting change in the dependent variable).

This assumption may be tested in various ways, including visual and statistical representations. Examination of a scatter plot of the student residuals plotted against the un-standardized projected values is one graphical approach to determining whether the linearity assumption is valid. This scatter plot may be used to determine whether there is a linear connection between the independent factors and the dependent variable taken as a whole.

Incremental F-tests may be performed to determine if any independent variables in the model cannot be described linearly with the outcome variable to perform a statistical assessment of linearity. These tests may reveal whether the variables in the model have a statistically significant impact on the divergence from linearity for the whole model. If there are no statistically significant departures from the mean, the linearity condition is satisfied, and it may be argued that a linear model fits the data well.

The independence assumption of OLS is satisfied if the error terms in the regression model are not connected with one another (i.e., independent of each other) [13]. This assumption is primarily based on how the data were gathered. As a result, if data were randomly picked from a large population, there is probably no link between the error factors.

It is required that the distribution of mistakes (residuals) be regularly distributed throughout the multiple regression plane, according to the normality assumption in multiple regression. Although huge samples are used, there are three reasons why it is critical to test for this assumption. OLS estimators are less efficient for starters when the error distribution includes heavy tails, which happens when outlying data points cause non-normal error distributions to be generated.

Second, skewed error distributions might have a negative impact on how the least squares fit is interpreted in each situation. Since the conditional mean of the dependent variable is impacted by the skewed distribution when the predictors are considered, this is the case. At the end of the day, multimodal error distributions may lead data to be dichotomized into groups, resulting in non-normality in the error distribution as a result.

As a result of this assumption, the dependent variable's volatility around the regression plane (i.e., the error variance) remains constant throughout the analysis. In regression models, heteroskedasticity, also known as nonconstant error variance, is a concern since it reduces the efficiency of least squares estimators and may result in incorrect computations of coefficient standard errors. To test this assumption, a scatterplot of the studentized residuals plotted against the unstandardized projected values should be used to do so. This graphic may be visually inspected to see whether this assumption has been fulfilled by the model. It is possible to test the assumption of heteroskedasticity statistically if it is assumed to exist and if visual examination does not provide compelling evidence of homoscedasticity.

A Breusch-Pagan test may be used to statistically evaluate this assumption. The significance of a significant result ($p < 0.05$) using this test indicates that the dependent variable's variation around the regression plane is not constant under the null hypothesis that the model has constant error variance (i.e., homoscedasticity and heteroskedastic). A nonsignificant p-value, on the other hand, implies that the model's assumption of homoscedasticity has been fulfilled.

RESULTS & DISCUSSIONS

Descriptive Statistics

The descriptive statistics is computed for all the dependent and independent variables included in study.

Measures of central tendency and measures of dispersion are both integral parts of this study. From Table 1, the mean of all variables is greater than the median (except GDP), indicating that all the variables follow a positively skewed distribution rather than a normal distribution. Only GDP is the variable that follows a negatively skewed distribution. The dataset shows variation, as evidenced by the high standard deviation values. The coefficient of skewness supports this observation. Each variable is based on 68 values, and the data were collected over time, spanning from 2005 to 2021. To assess any potential stationarity in the time series data, a Stationarity test is conducted.

Table 2 consists of the results of the Stationarity test. The obtained p-value is compared with a 5% level of significance to examine which variables are significant or not. Only one variable named "RR" is significant, and all the other variables are insignificant. Following Tayachi,

Table 1

Descriptive Statistics

Statistics / Ariable	BL	ASSETS	GDP	IP	LENRAT	LR	RR	CR
Mean	100780.5	174480.4	1.24E+12	0.104470	5159.951	0.119427	0.121853	0.030544
Median	39570.15	57302.00	1.25E+12	0.101854	3381.750	0.102319	0.107216	0.024477
Maximum	423382.7	1000343.	1.51E+12	0.226891	20831.60	0.314797	0.261057	0.107806
Minimum	3302.600	6279.800	9.45E+11	0.023268	246.6000	0.012409	0.023413	0.006161
Std. Dev.	109924.6	225798.4	1.74E+11	0.056284	4798.967	0.066624	0.063260	0.021034
Skewness	1.388818	1.995654	−0.033598	0.406640	1.427546	0.973272	0.460012	1.613339
Kurtosis	4.276462	6.705286	1.612615	2.111203	4.798696	3.720859	2.349282	5.326968
Jarque-Bera	26.47642	84.03577	5.466500	4.112262	32.26276	12.20789	3.597990	44.84097
Probability	0.000002	0.000000	0.065008	0.127948	0.000000	0.002234	0.165465	0.000000
Sum	6853073.	11864665	8.44E+13	7.103973	350876.7	8.121065	8.285972	2.076965
Sum Sq. Dev.	8.10E+11	3.42E+12	2.04E+24	0.212250	1.54E+09	0.297399	0.268120	0.029642
Observations	68	68	68	68	68	68	68	68

Source: Compiled by the authors.

Table 2

Stationarity Test at Level

Variable / Test	t-Stat	P-Val
BL	0.781049	0.538348
ASSETS	0.923884	0.892140
GDP	0.630070	0.630070
IP	0.244592	0.979818
LENRAT	0.936962	0.388858
LR	0.048794	0.645071
RR	0.000264	0.053181
CR	0.098409	0.122262

Source: Compiled by the authors.

Hunjra, Jones, Mehmood, and Al-Faryan [14], to eliminate the effect of stationarity, the 1st Difference technique is applied to the dataset. After applying the 1st difference, the Stationarity test is repeated. Table 3 consists of the results of the Stationarity test.

Table 3 has computed p-value for every variable is compared with 5% level of significance to estimate about the significance of variables. In this 2nd test, "BL, ASSETS, LR and RR" four variables become significant at 5% alpha level while remaining all variables is still insignificant. The 1st difference technique is not effective as much as expected because 6 variables are still insignificant.

Before applying regression analysis, log transformation is applied to the entire dataset in *Table 4*. The value of R-squared explains that 99% of the dataset shows variation, and the fitted regression model is a well-fitted model. Four of the coefficients of the regression equation have a negative effect, and the rest of them show a positive effect on the dependent variable. The significance of all coefficients is tested by comparing with a 5% level of significance. "LOG(ASSETS), LOG(GDP), LOG(LR), LOG(RR), and LOG(IP)" are the significant variables of this fitted model.

CONCLUSION AND RECOMMENDATIONS

The primary objective of this research was to examine the lending habits of commercial banks in the United Arab Emirates (UAE). The financial system of any country plays an integral role in establishing and developing a strong economy. Given that the UAE has faced economic challenges in recent years, the research aimed to analyze the contribution of various determinants, such as interest rates, liquidity, capital adequacy, asset quality, and loan structures, to the

Table 3

Stationarity Test at 1st Difference

Variable / Test	t-Stat	P-Val
BL	0.132471	0.027599
ASSETS	0.056883	0.007803
GDP	0.387849	0.387849
CR	0.045036	0.064163
LR	0.012612	0.010389
VD	0.000979	0.126194
RR	0.042563	0.001912
IP	0.438370	0.069703
LA	0.002701	0.077749
LENRAT	0.139850	0.978875

Source: Compiled by the authors.

Table 4

ANOVA and Log of Variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	–3.364927	2.058895	–1.634337	0.1075
LOG(ASSETS)	1.036347	0.032539	31.84924	0.0000
LOG(CR)	0.048022	0.011613	4.135079	0.0001
LOG(GDP)	0.087989	0.079277	1.109888	0.2716
LOG(IP)	–0.027256	0.018275	–1.491395	0.1412
LOG(LR)	–0.042670	0.013667	–3.122032	0.0028
LOG(LENDRATE)	–0.019568	0.033436	–0.585255	0.5606
LOG(RR)	–0.052226	0.018469	–2.827854	0.0064
LOG(VD)	0.159345	0.028629	5.565923	0.0000
Root MSE	0.050529	R-squared		0.997960
Mean dependent var	11.09646	Adjusted R-squared		0.997684
S.D. dependent var	1.127128	S.E. of regression		0.054246
Akaike info criterion	–2.867848	Sum squared reside		0.173614
Schwarz criterion	–2.574089	Log likelihood		106.5068
Hannan-Quinn criterion	–2.751451	F-statistic		3608.384
Durbin-Watson stat	1.615712	Prob(F-statistic)		0.000000

Source: Compiled by the authors.

lending behavior of commercial banks in the region. To achieve this objective, the research employed the quantitative research method, utilizing surveys from a selected population of four leading commercial banks in four UAE countries. Additionally, the study collected ample data from various secondary sources to support its arguments. All the obtained data underwent analysis, presentation, and utilization for decision-making. The SPSS analysis method was adopted for processing the data. The research findings indicated a significant contribution of the discussed determinants to the lending behavior of commercial banks in the UAE. In conclusion, poor lending practices could lead to significant losses, negatively impacting profits, revenues, and the overall economy of the banking industry. The study emphasized the need for vigilant

and strategic management in formulating lending practices to maintain bank revenues and meet the needs of customers.

The research proposes recommendations to enhance financial determinants for sustained profitability. Firstly, there should be a systematic and efficient provision of currency to commercial banks, such as those in KSA and UAE. This would enable basic banking functions, such as accepting deposits, making loans, serving as a banker for the government, regulating other banks, and controlling money supply. Secondly, lending money to commercial banks requires maintaining cash availability, Miroshnichenko & Mostovaya [15], which is not the function of the Federal Reserve Bank but is the responsibility of commercial banks. The use of cryptocurrency for lending and borrowing, which lacks physical existence and is not issued by a central authority, should be avoided as per [13] and [15].

Thirdly, the central bank, as per Byvshev & Meshkova [16], can implement measures such as increasing reserve requirements for commercial banks, compelling them to keep more money with the central bank, thereby reducing their capacity to give loans. This is a tool of monetary policy. Additionally, studies [17–20] confirmed that the central bank can increase the cash reserve proportion as a monetary tool in the same scenario.

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South Africa's Tourism Sector: Job Creation and Employment Analysis Using the Least Squares Method

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ABSTRACT

Tourism is one of the fastest-growing sector of the world economy, with a significant impact on the socio-economic development of countries. In the context of South Africa, this sector is showing steady growth, generating new employment opportunities and stimulating economic development. The purpose of this study is to analyze the relationship between tourism revenues and employment, as well as to examine the impact of the tourism sector on the creation of new businesses in the country. To achieve this goal, we conducted a detailed analysis of World Bank data from 2001 to 2020, employing the least squares method for analysis. The results of the study indicate that, despite the growth of employment and the creation of new companies in the tourism sector in South Africa, there is no direct correlation between these indicators and the increase in income from tourism. However, new businesses in this area have a positive impact on the level of employment, which is confirmed by empirical evidence. These findings expand our understanding of the complex mechanisms of interaction between tourism and employment in South Africa. The inclusion of new job analysis in the study adds a new dimension to it, deepening our understanding of the economic processes taking place in this industry.

Keywords: tourism; tourism economics; employment; tourism receipts; new jobs; panel analysis; least squares method; South Africa

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INTRODUCTION

Tourism is known to be one of the biggest and fastest-growing global industries. Due to the development of economic dynamics and its ability to absorb the workforce, tourism has an enormous potential. Numerous service industries are connected to tourism, and the success of one industry has an impact on the performance of others in its field [1, 2]. Through increasing investment in new infrastructure, expanding employment possibilities, and raising tax and foreign exchange income, it may help a nation's economy flourish. Tourism has grown to be a significant economic industry in many nations throughout the world because of its significant socioeconomic impacts. One of the key economic activities is tourism, which not only generates a sizable portion of the economy's income but also supports the growth of infrastructure and services as well as numerous employments.

According to some studies, tourism is one of the emerging industries, even though the most important conditions for the development of tourism and accommodation businesses to create employment for millions of people are political stability, decreasing working hours, technological progress, increasing income, and a favourable climate. Nevertheless, the most recent study on quality of life and tourism focuses on the one-sided link between the two, highlighting the enormous effects that tourism arrivals and profits have on quality of life [3]. Additionally, it promotes indirect employment in sectors reliant on businesses, including tourism and lodging, restaurant suppliers, building and maintenance firms that construct and maintain tourist facilities and essential infrastructure, manufacturers of aircraft and airlines, various handicraft producers, marketing firms, and accounting services.

Moreover, tourism influences the generation of new jobs in a variety of industries. In certain nations, tourism's contribution to job creation is essential; for instance, India is the second-largest country for creating tourism-related jobs, according to Chandrakanta Sahoo in Dayananda, with 25 million jobs [4]. It is not known whether employment opportunities in the tourist industry were created because of job

cuts in the forestry sector. On the other hand, there is a possibility that there are connections between the jobs available in the tourist industry and those in the forestry industry; for instance, if there is an increase in the number of visitors to a region, it may promote the development of new hotels and cottages. One of the most significant segments of the world economy today is tourism. Tourism is acknowledged to be a wonderful creator of both direct and indirect commercial possibilities, having managed to sustain numerous economies [5].

There has been a lot of interest in the causal link between tourism earnings and income growth in the tourist economy. In terms of government revenue and administration of tourist-related policies, Pérez-Rodriguez and Santana-Gallego [6] contend that tourism earnings have significant policy consequences for target nations. As can be observed, tourism no longer serves as a supplemental source of income; instead, it has evolved into a model for economic growth with positive consequences on the financial, economic, social, and cultural spheres. Financial development helps to economic growth in several ways, including boosting the effectiveness of investments in tourism, lowering the costs of transactions, and altering people's tendencies about savings. Policy actions intended to encourage sustainable economic development and lower the risk of financial instability can be informed by knowledge of how financialization affects economic growth in emerging nations. Some developing nations may have comparatively sizable financial sectors, despite the fact that they are often defined by lower levels of industrialization and economic growth. Mabeba [7] looked at seven developing nations (Brazil, India, Indonesia, Malaysia, Mexico, Singapore, and South Africa) with sizable financial sectors. Nonetheless, tourism has a significant role in accelerating global economic growth and significantly raises revenue, profits from foreign exchange, and employment [8].

Considering all this, the aim of this study is to examine the relationship between newly opened businesses and employment rates and tourism revenues in South Africa. The literature discusses, on employment in the tourism sector [9] and tourism revenues [10]. In this research, a new model was created by adding the variable of opening new businesses. We believe this study will contribute to the literature.

LITERATURE REVIEW

Employment in Tourism Sector

Economy of every country depends heavily on tourism since it generates jobs. Tourism-related careers have long been desirable and reputable. Women are said to find the glossy image of the tourist industry particularly alluring, maybe making up for the comparatively low salary and little chances. They are more inclined than males to accept inadequate wages and working conditions.

Although being viewed as a low-wage industry in poor nations, tourism generates direct, indirect, and induced employment, claim some studies [11]. Most of the tourist work is unskilled, and its availability is very seasonal. As a result, estimates indicate that 75% of individuals employed in the tourist industry lack the necessary skills or training for their positions, and as a result, they earn much less than other workers [12].

According to the research by Adiya, Vanneste, and Van Rompaey [9], employment in the tourist industry's lodging sector generates lower income than other non-agricultural sectors. The link between economic growth and tourism receipts in Türkiye from 2005 to 2021 was looked at in the research by Huseynli [13]. As a result of the research, it was found that the assumptions were correct and that, the Turkish nation that depends heavily on tourism, has an essential role for tourism income in driving economic development.

International Tourism Receipts

International tourism is one of the largest and fastest expanding service sectors in the world. The ability of a country to reduce the development gap it has with other nations and to find solutions to economic difficulties such as unemployment, balance of payments deficits, and financial and monetary macroeconomic instability is essential to the nation's development and economic progress. In this regard, the tourist industry is seen as an important contributor.

According to the findings of a study conducted by Lorah and Southwick [10], the preservation of the natural environment is linked to higher levels of income and employment in the western region of the United States, which has a beneficial effect on both domestic migration and international tourism. Using panel data from 42 different African countries, Fayissa, Nsiah, and Tadasse [14] conducted a study in which they found

that the incomes obtained from the tourism industry contributed significantly to the economic growth of African countries. They concluded this to be the case after analyzing the results of the study. On a smaller scale, early studies conducted in Swedish mountain municipalities reveal that regions next to national parks (that is, within 15 kilometers) employ a greater proportion of the people in the tourist business than does the national average [15].

The association between the presence of world heritage sites in a nation and foreign visitor arrivals and international tourism income was looked at in the research by Bacsi and Tóth [16]. In the research published by Hesami, Rustamov, Rjoub, and Wong [17], the effect of oil prices on tourist revenues in nations that significantly depended on crude oil exports from 2000 to 2017 was investigated.

New Business Registered

The job market is a location where the workforce that offers the services required by employees or employers meets job supply and demand. Tourists typically have a high demand for the nation they are visiting, including lodging, transportation options, retail establishments, and cultural, recreational, and sporting activities.

There is a correlation between the birth of new firms and the advancement of financial conditions. Kumar and Kumar [18] discovered that activities related to tourism influence a country's economic development. It is common knowledge that the tourist industry is also affected when there is a financial crisis [19]. Yet, the expansion of the tourist industry is primarily responsible for the creation of new employment opportunities. Ribeiro and Wang [20] investigated the feasibility of a tourism-induced growth hypothesis for the period spanning 1997–2018.

There was discovered to be a unidirectional Granger causality between the revenues generated by tourism and the expansion of the economy, as well as between foreign direct investment and both the expansion of the economy and the revenues generated by tourist. A study that was carried out by Eyuboglu and Eyuboglu [21] using data covering the period 1995–2016 in nine countries found that the asymmetric panel causality test indicates that there is causality from the positive shock of tourism to the positive shock of economic growth in two of the nine countries.

RESEARCH METHODOLOGY

Purpose and Data Set

The main purpose of the study is to measure the relationship between newly opened businesses and employment rates in South Africa with tourism revenues. The variables included in the research model were examined through empirical analysis. The data set is made up of the yearly data collection between the years 2001 and 2020. The study considered both the logarithmic values of the profits gained from the tourist industry as well as the number of newly formed firms. The evaluation will be done by a panel, as this was the method of choice. The World Bank provided us with the essential data set for the analysis, which we received from them.

Analysis Method

Since the study includes both time and section size, it is the subject of panel data analysis. Recently, there has been a significant increase in the interest in working with panel data and it has been used quite frequently all over the world. One of the important reasons for the increase in the interest in working with panel data is the desire to control for unobserved individual special effects that may be related to other variables within the scope of the model in determining an economic relationship [22]. In general terms, a panel data model can be expressed [23] by formula (1).

$$Y_{it} = \alpha + \sum_{i=1}^{k} \beta_k X_{kit} + \mu_{it}, \quad (1)$$

$$i = 1, \ldots, N; t = 1, \ldots, T; k = 1, 2, \ldots, q,$$

where i is the units in the cross-section ($i = 1, \ldots, N$) and t is the time ($t = 1, \ldots, T$), k is the rank of each independent variable ($k = 1, 2, \ldots, q$). This general econometric model allows for constant and other regression parameters to be reserved for all units in any period.

The least squares model from panel data analysis was used in the study. This preference stems from the idea that there is no unit and time effect between the variables in the data set.

ANALYSES AND RESULTS

Before the analysis, the general statistics table was checked for the usability of the data set to be

Table 1

Likelihood Ratio (LR) Test Results

Tests	LR statistics	Probability value
Unit and Time Impact	0.00	1.000
Unit Impact	0.00	1.000
Time Effect	0.00	1.000

Source: Compiled by the author.

used in the study. After detecting the aspect ratio problem among the data sets, modeling was carried out. The model required for the analysis considers employment as the dependent variable, and energy consumption and industry as the independent variable. The model estimate of the study is explained by formula (2).

$$Ltourism\,revenue = \beta_0 + \beta_1 employment\ rate + \\ + \beta_2 Lnew\ bu\sin esses\ number + \mu. \quad (2)$$

In panel data models, one of the tests used to determine the validity of the classical model, in other words whether there are unit and/or time effects, is the "Likelihood Ratio Test" (LR). In this test, the H_0 hypothesis is established as "the classical model is true". If the H_0 hypothesis is rejected, it is decided that there are unit, time or both unit and time effects, in other words, the classical model is not suitable. As presented in *Table 1*, there is no effect as a result of the LR test. For this reason, the classical model is suitable in the study.

In order for the coefficients of the variables in the established models to be meaningful and interpretable, it is necessary to test whether they have autocorrelation and varying variance. The test for varying variance was done with White's test *in Table 2*.

As a result of the heteroscedasticity test, it was decided that the variances of the error terms were constant for all sections and their covariances were together to zero. In other words, there is no problem of varying variance in the panel.

As in all time series, autocorrelation is an important problem in panel data analysis. As is known, one of the basic assumptions of regression analyzes is that there is no correlation (correlation) between the same errors for different observations. If the error terms are

Table 2

White Test Results

Test statistic	Probability value
9.584	0.088

Source: Compiled by the author

Table 3

Wooldridge's Test Results

Test statistic	Probability value
21.064	0.016

Source: Compiled by the author.

related to each other, this is called autocorrelation or serial correlation [24]. Before moving on to panel regression analysis, the existence of autocorrelation in the data set was investigated by Wooldridge [25] autocorrelation test.

According to the Wooldridge [25] autocorrelation test statistic in *Table 3*, the null hypothesis that "There is no autocorrelation" in the model was rejected. In other words, an autocorrelation problem was observed between the error terms in the equations.

Similarly, the multicollinearity assumption was tried to be tested in the continuation of the analysis. The variance increases factor (VIF), which gives whether there is a multicollinearity error between the variables, is given in *Table 4*. When the data in the VIF table is examined, it is seen that there is no multicollinearity problem.

In this study, the relationship between the variables was examined using panel data analysis as stated before. Descriptive statistics for dependent, independent and control variables used in the study are given in *Table 5*.

Table 4

Vif Criteria Results

Variables	VIF	1/VIF
Employers	1.01	0.988551
New businesses number	1.01	0.988551
Mean VIF		

Source: Compiled by the author.

The results of the least squares estimation analysis are shown as stated in *Table 5*. According to the analysis results, there is no significant relationship between newly opened businesses and employment rates and tourism revenues in this country.

This research attempted to measure the direction and magnitude of the relationship between tourism revenues, general employment rate and newly opened businesses in South Africa. According to the results of the least squares estimation test, there is an insignificant (prob > 0.217) relationship between the employment rate and tourism revenues. In other words, increasing employment rates does not negatively affect the increase in tourism revenues in this country. The opening of new businesses also has an insignificant (prob > 0.122) effect on tourism revenues. Based on the results of the analysis, it can be concluded that there are not enough businesses supporting the tourism sector in South Africa. However, there are not enough academic sources in the literature to support this evidence.

DISCUSSION AND CONCLUSION

According to the findings of the research that was carried out by Hesami, Rustamov, Rjoub, and Wong [17], oil prices and tourism revenues are cointegrated, there is a long-term equilibrium relationship between the two, and there is a unidirectional Granger causality from oil prices to tourism revenues. These findings were discovered because of the study that was carried out.

Macroeconomic stability is greatly impacted by changes in the price of gold and oil, and these changes also indirectly influence the dynamics of economic growth and the travel and tourism industry. By raising production costs, particularly for energy and transportation, rising oil prices might increase the demand for tourism and exacerbate the current account imbalance, particularly in countries that rely heavily on foreign energy [26]. However, gold price rises are often seen as a sign of global uncertainty and cause economic actors to adopt risk-averse behaviors, which in turn stifles trends in investment and consumption [27]. Because they provide foreign currency inflows, tourism revenues in this setting both balance the balance of payments and favorably impact economic growth via investment and employment channels. Thus, the relationship between the tourism industry and changes in the energy and precious metals markets is strategically significant for the long-term viability of economic growth.

Tourism development and regional development are naturally more complex than they appear in statistical models. This means that some important issues are not highlighted here. Statistical models explain much more than any variation in employment change, raising future research questions. This study, which aims to measure the relationship between newly opened businesses, employment rates and tourism revenues in South Africa, revealed some empirical results. The results obtained as a result of the analysis of the data obtained from the World Bank using the least squares model fill the gap in the literature along with the studies in the literature. As a

Table 5

Least Squares Estimation Test Result

R^2	Number of observations		Prob	
0.2896	20		Prob > 0.0307	
Tourism receipts	Coefficient values	Drisc/Kraay Resistive standard errors	T statistics	P > |t|
Employers	–0.045	0.0353	–1.28	0.217
New businesses number	–0.688	0.423	–1.63	0.122
Fixed Coefficient	13.958	2.189	6.38	0.000

Source: Compiled by the author.

result of the research, it was determined that employment rates in South Africa have an insignificant effect on tourism revenues. Otherwise, increasing employment does not affect the increase in tourism revenues in this country.

According to the empirical results of the least squares estimation test, employment rates in South Africa are found to have an insignificant impact on tourism revenues (prob > 0.217). In other words, increasing employment does not affect the increase in tourism revenues in this country. However, it was found that the opening of new businesses factor included in the research model also had a negative effect on tourism revenues (prob > 0.122). Based on this result, it can be said that the number of businesses supporting the South African tourism sector is low. This result also applies to employment rates. It can be said that the strategy framework of South Africa's tourism sector should be well directed. In this context, the state also contributes to the development of the tourism sector. However, we can state that new businesses opened through the tourism sector in South Africa will also have a positive impact on increasing employment rates.

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ORIGINAL PAPER

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Assessment of the Impact of the Economic Potential of Regions on the Living Standards of the Population

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ABSTRACT

The **purpose** of the paper is to assess the impact of the region's economic potential on the standard of living and to develop tools to improve the efficiency of using the financial potential of a constituent entity of the Russian Federation. The object of the study is the regions of the Russian Federation, and the subject is their economic potential and standard of living. At the first stage, we considered the impact of the resource potential of the regions of the Central and Northwestern Federal Districts based on the use of correlation and regression analysis. Modeling has shown that for the regions of the Central and Northwestern Federal Districts, the most significant impact on the standard of living is provided by investment and innovation potentials. In addition, for the Central Federal District, production and labor potentials also have a significant impact, and for the Northwestern Federal District, the general economic potential, represented by the GRP indicator, is significant. In the second stage, we used the k-means method to cluster 85 regions based on the size of their resource potential and standard of living. The analysis showed that most regions have a standard of living that corresponds to and even exceeds the existing economic potential. This situation seems quite natural, since the standard of living in a region is determined not only by the potential of the territory, but also by the potential of the state as a whole. The assessment of the financial reserve available to the regions is based on the concept of fiscal space, which allows assessing the possibilities of mobilizing additional own and borrowed financial resources to address priority issues of the socio-economic development of the territory. The proposed typology of regions by standard of living and by the size of the fiscal space can be used as a tool for assessing the potential of the fiscal space of the region to address the current socio-economic problems of the territory.

Keywords: budget potential; regional differentiation; cluster; region; standard of living; debt level; financial potential; economic potential; fiscal space

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INTRODUCTION

The high level of differentiation in the socio-economic development of regions is one of the problems of ensuring the economic security of the Russian Federation and a restraining factor for the development of the state. In the Economic Security Strategy, "the uneven spatial development of the Russian Federation, the increasing differentiation of regions and municipalities in terms of the level and pace of socio-economic development" is considered a threat.[1]

Thus, in 2021, the average per capita GDP across the Russian Federation amounted to 830 792.7 rubles. Meanwhile, the GRP in Moscow was 1 935 204.5 rubles, in the Tyumen region — 2 992 775.4 rubles, and in the Republic of Ingushetia — only 148 586.8 rubles. Therefore, the difference in average per capita GRP is more than 20 times. Significant differentiation also occurs between neighboring regions within the same federal district. In the Northwestern Federal District, GRP per capita in St. Petersburg is five times higher than in the neighboring Pskov region. At the same time, reducing interregional disparities in the level and quality of life of the population is an important factor in ensuring sustainable and balanced spatial development of the Russian Federation.[2]

A high level of differentiation is also manifested in the financial sphere [1]. The low level of budget revenues for a significant portion of the subjects of the Russian Federation leads to a high level of their dependence on subsidies from the federal budget, a lack of resources for financing the development of the economy and the social sphere, and also creates problems for the sustainable development of all areas of the population's life activities in the territory [2]. High differentiation is caused by both objective factors and problems in conducting regional policy. The main factor in this is the significantly varying level of resource provision of the regions.

An important direction for solving the problem of reducing the level of differentiation, as well as other priority issues in the regions, is to increase the efficiency of their budgetary and tax policy. At the same time, the evaluation of this policy should be carried out, first and foremost, from the perspective of improving the standard of living of the population as the ultimate consumer of budget-funded services [3]. In the strategic documents of the subjects of the Russian Federation, improving the quality of life of the population is defined as the main goal of socio-economic policy. Therefore, the implementation of all types of policies: investment, industrial, budgetary and tax, etc., should be aimed at achieving this main goal.

At the same time, the diversity of Russian regions in terms of resource availability imposes certain limitations on the possibilities of conducting budgetary and tax policy. In this situation, the issues of assessing the resource potential of regions and developing tools to enhance the efficiency of its use become particularly relevant. The solution to this task is especially important in the financial sector, as it ultimately determines the standard of living of the population in the subjects of the Russian Federation.

The purpose of the paper is to assess the impact of the region's economic potential on the population's standard of living and to develop tools for improving the efficiency of using the financial potential of the Russian Federation's constituent entities. In achieving this purpose, the following tasks are addressed:

- assess the impact of the economic potential of regions in terms of its main types on the standard of living of the population;

[1] The Economic Security Strategy of the Russian Federation for the period up to 2030. URL: http://docs.cntd.ru/document/420398070 (accessed on 09.04.2024).

[2] Government Decree of the Russian Federation from 13.02.2019 No. 207 "On the Approval of the Spatial Development Strategy of the Russian Federation for the Period up to 2025".

• conduct clustering of regions based on resource potential indicators and the standard of living of the population;

• propose tools for managing the financial potential of a subject of the Russian Federation.

In the scientific literature, a wide range of opinions on the structure of regional systems' potential is presented. For example, in the paper [4], the following types of territorial potential are identified:

• spheres of material production;
• non-material sphere;
• service sector;
• social service sectors;
• natural resource;
• demographic;
• labor;
• recreational;
• innovative.

A somewhat different approach to identifying the main types of resource potential is presented in the paper [5]:

• infrastructural;
• natural resource;
• investment;
• personnel;
• economic.

In a number of papers, resource potential is identified with economic potential. For example, in the paper [6], indicators of material and technical, financial and economic, and innovative and institutional potentials are used to assess economic potential. The authors of the paper [7] highlight the following main elements of economic potential:

• natural resource;
• labor;
• production;
• infrastructural;
• innovative.

To assess production potential, indicators of the industrial production index and the volume of shipped goods are used [8]. The paper [9] emphasizes the role of human potential in territorial development. As indicators of labor potential, most authors use the level of employment, wages, and education [10]. To evaluate the effectiveness of the use of economic potential as a whole, indicators of GRP, investments, innovations, as well as budget payments are used.

Effective management of all types of economic potential of a territory implies their monetization, which can be assessed by the size of the financial potential [11]. Its structure includes the following main elements:

• budgetary and tax;
• financial and credit system of the region;
• financial potentials of the population and businesses [12].

The resource-based and process-based approaches to interpreting the financial potential of a region are presented in the paper [13]. Within the framework of the first approach, these are the financial resources obtained by the economic entities operating in the region, and within the framework of the second approach, these are the part of the financial resources actually used to achieve the development goals of the region. Financial potential is the most mobile type of potential, as it can be quite rapidly altered within the framework of the public debt management policy of the Russian Federation entity.

The economic potential has a decisive influence on the standard of living of the region's population, which is assessed using wages, pension amounts, consumer spending, and the share of the population with incomes below the subsistence minimum [14, 15].

Thus, the assessment of potential plays an important role in studying the possibilities and prospects of the socio-economic development of a region. At the same time, the large number of regions and the high level of differentiation in their economic potential highlight the task of clustering, which allows for the division of regions into relatively homogeneous groups. For this purpose, the main indicators of regional development are most often used: GRP, investments, budget expenditures, living standards, as well as

Table 1

Evaluation of the Impact of Indicators of the Main Types of Regional Potential on the Standard of Living (Correlation Coefficients)

Indicators of main types of potential	The ratio of income to the subsistence minimum (Income Y1)		The share of the population with monetary incomes below the subsistence minimum (Poverty Y2)	
	CFD	NFD	CFD	NFD
GDP per capita (GDP, *X*1)	**0.83**	**0.66**	**–0.68**	**–0.62**
Investments per capita (Investments, *X*2)	**0.85**	0.31	**–0.74**	–0.59
Expenditures of the consolidated budget of the Russian Federation subject per capita (Budget, *X*3)	0.74	0.35	–0.59	–0.41
The share of organizations that implemented technological innovations (Innovations, *X*4)	0.62	**0.77**	–0.59	**–0.64**
The volume of shipped goods from manufacturing industries and mineral extraction per capita (Production, *X*5)	0.50	0.21	–0.61	–0.37
The employment rate of the region's population (Labor, *X*6)	0.67	**0.76**	–0.62	**–0.77**

Source: Compiled by the authors based on Rosstat data. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed on 09.04.2024).

demographic indicators. According to the author of the paper [16], for clustering purposes, it is also advisable to use indicators of industrial production and innovative activities. When typologizing regions by the level of financial independence, indicators characterizing the potential of regional and municipal taxes, as well as the tax burden on the economy, are used [17].

The typology of the regions of the Northwestern Federal District from the perspective of ensuring sustainable development is presented in the paper [18]. To address the task, the authors used indicators such as the debt level of the constituent entity of the Russian Federation, GRP, population size, per capita income, as well as expenditures on debt repayment and servicing. The paper also concludes that the negative effect of high debt burden begins at levels of about 5% relative to GRP and about 43% relative to the own revenues of the budget of the constituent entity of the Russian Federation.

In recent years, the Government of the Russian Federation has also been using classification tools to assess the debt sustainability of the subjects of the Russian Federation.[3] However, the methodology used does not allow for the alignment of debt indicators and the standard of living of the population in the regions.

METHODS

The subject of the research in this paper is the subjects of the Russian Federation, and the object is the economic potential of the regions in relation to the standard of living of the population. The information base includes data from the Ministry of Finance and statistical collections of Rosstat "Regions of Russia". To assess the overall economic potential, indicators of GRP and investments

[3] Resolution of the Government of the Russian Federation from 04.03.2020 No. 227 "On the Approval of the Rules for Assessing the Debt Sustainability of Subjects of the Russian Federation".

Table 2

Matrix of Paired Correlation Coefficients for the Regions of the Central Federal District

Indicators	*Y*1	*Y*2	*X*1	*X*2	*X*3	*X*4	*X*5	*X*6
*Y*1	1.00							
*Y*2	–0.85	1.00						
*X*1	0.83	–0.68	1.00					
*X*2	0.85	–0.74	0.90	1.00				
*X*3	0.74	–0.59	0.97	0.87	1.00			
*X*4	0.62	–0.59	0.68	0.58	0.60	1.00		
*X*5	0.50	–0.61	0.63	0.60	0.55	0.59	1.00	
*X*6	0.67	–0.62	0.72	0.63	0.67	0.60	0.60	1.00

Source: Compiled by the authors based on Rosstat data. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed on 09.04.2024).

in fixed capital are used, as well as these indicators per capita. The expenditures of consolidated budgets as a whole and per capita determine:

• the amount of budget potential; the share of organizations that implemented technological innovations; the volume of innovative goods, works, services — innovative potential;

• the volume of shipped goods from manufacturing industries; the extraction of mineral resources in the region as a whole and per capita — production potential;

• indicators of the average annual number of employed and the level of employment of the population — labor potential of the territory.

To assess the standard of living of the population, two indicators are used: the first is the ratio of per capita monetary income of the population to the subsistence minimum in the region; the second is the share of the population with monetary income below the poverty line. For analyzing the impact of potential components on the standard of living and constructing a mathematical model across federal districts, correlation-regression analysis and panel data for the period 2017–2021, presented as relative indicators of potential components, are used. The task of clustering regions by the size of resource potential and the standard of living of the population is solved based on the K-means method using absolute values of potential indicators for 2021. To assess the size of the fiscal space, indicators of debt in relation to tax and non-tax revenues and the size of GRP are used.

MAIN RESULTS

At the first stage, we will consider the task of assessing the impact of the economic potential of the regions of the Central Federal District (CFD) and the Northwestern Federal District (NFD) in terms of its main types on the standard of living of the population (*Table 1*). The assessment was carried out based on the calculation of correlation coefficients using panel data for the period 2017–2021.

The analysis shows that almost all the presented types of regional potential have a strong, or at least moderate, impact on the population's standard of living.

At the same time, there are certain differences between the federal districts. Thus, in the Central Federal District (CFD), the indicators of GRP and investments have

Table 3

Matrix of Paired Correlation Coefficients for NFD Regions

Indicator	*Y*1	*Y*2	*X*1	*X*2	*X*3	*X*4	*X*5	*X*6
*Y*1	1.00							
*Y*2	–0.87	1.00						
*X*1	0.66	–0.62	1.00					
*X*2	0.31	–0.59	0.64	1.00				
*X*3	0.35	–0.41	0.72	0.51	1.00			
*X*4	0.77	–0.64	0.45	0.12	0.09	1.00		
*X*5	0.21	–0.37	0.76	0.79	0.66	0.06	1.00	
*X*6	0.76	–0.77	0.62	0.52	0.46	0.64	0.38	1.00

Source: Compiled by the authors based on Rosstat data. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed on 09.04.2024).

a fairly strong influence on both income and poverty. The level of influence of other types of potential is average. For the Northwestern Federal District (NFD), the most significant indicators are GRP, innovation, and labor potential. At the same time, the influence of production potential on the indicators of the population's standard of living is weak for the NFD and average for the CFD.

The significant difference in the impact of potential components on the standard of living of the population in the regions of the Central Federal District (CFD) and the Northwestern Federal District (NFD) justifies the feasibility of constructing separate models for the federal districts.

To build the model for the Central Federal District (CFD), we will consider the matrix of pairwise correlation coefficients (*Table 2*).

The indicators of GRP and budget expenditures have a high level of correlation with the more significant investment indicator, and we exclude them from further analysis. Thus, the formation of the model for the Central Federal District will be based on the following types of potential: investments (X2), innovations (X4), production (X5), and labor (X6). The analysis of the regression equation, obtained based on the indicators of investments, innovations, and production, showed that, according to the Student's t-test, only two types of potential are significant — investments and labor. Taking this into account, the model of the dependence of the income indicator on investments X2 and labor X6 will have the form:

$$Y1 = 0{,}179 + 0{,}0069 \times X2 + 0{,}037 \times X6\,. \quad (1)$$

According to the Student's t-test, factors X2 and X6 are significant, and based on Fisher's criterion, the regression equation is considered statistically significant. The coefficient of determination for this model is 0.75, which means the model quality is quite high.

Regarding the model of the standard of living based on the indicator of the share of the population with incomes below the subsistence minimum (poverty), in this case, the most significant factors are investments X2 and production potential X5. The model satisfying the Student's t-test and Fisher's criterion will have the following form:

$$Y2 = 14{,}68 - 0{,}028 \times X2 - 0{,}003 \times X5\,. \quad (2)$$

The coefficient of determination for this model is 0.59, i.e., the quality of the model is average.

Let's further consider the model of the impact of the components of economic potential on the standard of living of the population in the regions of the Northwestern Federal District (*Table 3*).

The analysis of the pairwise correlation coefficient matrix shows that the least significant factor is the production potential, which also has a strong correlation with GRP and investments.

At the same time, an adequate model of the dependence of the standard of living, represented by the income indicator for the Northwestern Federal District, includes the factors GRP X1 and innovations X4 and has the following form:

$$Y1 = 1,44 + 0,00077 \times X1 - 0,045 \times X4. \quad (3)$$

The coefficient of determination for this model is 0.72, i.e., the quality of the model is quite high.

A similar model for the poverty indicator will have the following form:

$$Y2 = 20,61 - 0,025 \times X2 - 0,26 \times X4, \quad (4)$$

where $X2$ and X4 are the indicators of investments and innovations, respectively.

For this model, the coefficient of determination is 0.67, i.e., the quality of the model is also quite high.

Thus, the modeling showed that for the regions of the Central Federal District (CFD) and the Northwestern Federal District (NFD), the most significant impact on the standard of living is exerted by investment and innovation potentials. In addition, for the CFD, production and labor potentials also have a significant impact, while for the NFD, the overall economic potential represented by the gross regional product (GRP) is significant. The practical significance of the obtained results is determined by the possibility of their use in setting priorities for socio-economic policy.

To solve the problem of clustering regions of the Russian Federation, we will examine the relationship between the main indicators of potential and the standard of living of the population for 85 subjects of the Russian Federation based on data from 2021. The analysis shows that all components of the region's potential have a significant impact on the standard of living indicator, which is presented as the ratio of per capita income to the regional subsistence minimum. As for the poverty level indicator in the region, the degree of influence here is somewhat lower. At the same time, the most significant impact on the standard of living of the population in the regions is exerted by the production potential.

For an adequate assessment of the potential of regions, we will conduct clustering based on the absolute values of indicators using the *k*-means method, which allows us to divide the clustering objects (85 regions) into a specified number of clusters. The potential indicators of the regions have different units of measurement and vary significantly in magnitude. For this reason, their standardization is carried out using the following expression:

$$X_{ст} = (X_i - X_{ср}) / S, \quad (5)$$

where X_i — the value of the potential indicator of the *i*-th clustering object (region), X_{av} — average value of the indicator, S — standard deviation of the indicator for 85 regions.

At the first stage, we will consider the clustering of regions by resource potential (*Table 4*).

The quality of clustering is assessed by the explained variance ratio, which should be more than 0.9. The resulting division of regions into 6 clusters yielded a value of 0.9471 for this indicator, indicating a high quality of clustering. The first three clusters include 6 regions with particularly high and high potential. A relatively small group

Table 4

Clustering of Regions of the Russian Federation by Resource Potential

Clusters	Potential
Moscow	Especially high
Moscow Region, St. Petersburg, Republic of Tatarstan	High 1
Khanty-Mansi Autonomous District, Yamalo-Nenets Autonomous District	High 2
Krasnodar, Rostov, Republic of Bashkortostan, Nizhny Novgorod, Samara, Sverdlovsk, Chelyabinsk region, Krasnoyarsk, Kemerovo	Average
Belgorod, Voronezh, Kaluga, Lipetsk, Tula, Vologda egion, Leningrad, Murmansk, Volgograd, Republic of Dagestan, Stavropol, Udmurt Republic, Perm, Orenburg, Saratov, Tyumen, Altai, Irkutsk, Novosibirsk, Omsk, Republic of Sakha (Yakutia), Primorsky region, Khabarovsk, Sakhalin	Below average
Bryansk, Vladimir, Ivanovo, Kostroma, Kursk, Oryol, Ryazan, Smolensk, Tambov, Tver, Yaroslavl, Republic of Karelia, Republic of Komi, Nenets Autonomous District, Arkhangelsk, Kaliningrad, Novgorod, Pskov, Republic of Adygea, Republic of Kalmykia, Republic of Crimea, Astrakhan, Sevastopol, Republic of Ingushetia, Republic of Kabardino-Balkaria, Republic of Karachay-Cherkessia, Republic of North Ossetia, Chechen Republic, Republic of Mari El, Republic of Mordovia, Chuvash Republic, Kirov, Penza, Ulyanovsk, Kurgan, Republic of Altai, Republic of Tuva, Republic of Khakassia, Tomsk, Republic of Buryatia, Zabaykalsky region, Kamchatka region, Amur region, Magadan region, Jewish Autonomous region, Chukotka Autonomous District	Low

Source: Compiled by the authors based on Rosstat data. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed on 09.04.2024).

of nine regions constitutes the medium potential group. The cluster with below-average potential includes 24 regions, and the low potential cluster includes 46 regions. Thus, more than half of Russia's regions have a low level of economic potential. It should be noted that this assessment is relative and obtained by comparing with the potential of other regions.

Next, let's consider the clustering of regions by the standard of living of the population, represented by the ratios of per capita income to the regional subsistence minimum and the number of people with monetary incomes below the poverty line.

Using the *k*-means method, the minimum number of clusters at which the explained variance is at least 90% is 6. In our case, this figure is 92.3%, indicating a high quality of the obtained clustering.

The results of the clustering of Russian regions are presented in *Table 5*. Regions with the highest standard of living are represented in the first cluster (3 regions). Regions with a high standard of living are included in the second cluster (14 regions). The third cluster (11 regions) is characterized by an average standard of living. The fourth cluster, whose regions have a below-average standard of living (36 regions), is somewhat lagging behind. The fifth cluster

Table 5

Clustering of Regions of the Russian Federation by Standard of Living of the Population

Clusters	Standard of living
Moscow, St. Petersburg, Yamalo-Nenets Autonomous District	Especially high
Belgorod, Voronezh, Lipetsk, Moscow, Yamalo-Nenets Autonomous District, Republic of Adygea, Krasnodar, Republic of Tatarstan, Nizhny Novgorod, Sverdlovsk, Khanty-Mansi Autonomous District, Magadan, Sakhalin, Chukotka Autonomous District	High
Kaluga, Kursk, Tambov, Tula, Yaroslavl, Leningrad, Murmansk, Rostov, Sevastopol, Republic of Bashkortostan, Samara	Average
Bryansk, Vladimir, Ivanovo, Kostroma, Oryol blast, Ryazan, Smolensk, Tver, Republic of Karelia, Republic of Komi, Arkhangelsk, Vologda, Kaliningrad, Novgorod, Pskov, Volgograd, Republic of Dagestan, Republic of North Ossetia, Stavropol, Udmurt Republic, Kirov, Perm, Orenburg, Penza, Saratov, Ulyanovsk, Tyumen, Chelyabinsk, Kemerovo, Novosibirsk, Omsk, Tomsk, Kamchatka region, Primorsky region, Khabarovsk, Amur	Below average
Republic of Crimea, Astrakhan, Republic of Kabardino-Balkaria, Chechen Republic, Republic of Mari El, Republic of Mordovia, Chuvash Republic, Kurgan region, Republic of Khakassia, Altai, Krasnoyarsk, Irkutsk, Republic of Buryatia, Republic of Sakha (Yakutia), Zabaykalsky region	Low
Republic of Kalmykia, Republic of Ingushetia, Republic of Karachay-Cherkessia, Republic of Altai, Republic of Tuva, Jewish Autonomous District	Poor

Source: Compiled by the authors based on Rosstat data. URL: https://rosstat.gov.ru/folder/210/document/13204 (accessed on 09.04.2024).

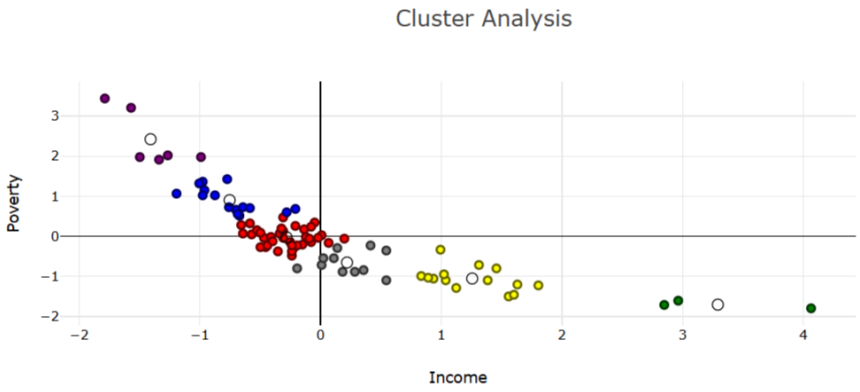

Fig. 1. **Clustering of Regions of the Russian Federation by Living Standards**

Source: Author's calculations.

Table 6

Typology of Regions of the Russian Federation by Standard of Living and Resource Potential

Standard of living	Potential					
	Especially high	High 1	High 2	Average	Below average	Low
Especially high	Moscow	St. Petersburg	Yamalo-Nenets Autonomous District			
High		Moscow Region, Republic of Tatarstan	Khanty-Mansi Autonomous District	Krasnodar Nizhny Novgorod Sverdlovsk	Belgorod, Voronezh, Lipetsk, Sakhalin	Yamalo-Nenets Autonomous District, Republic of Adygea, Magadan, Chukotka
Average				Rostov Bashkortostan Samara	Kaluga Tula Leningrad Murmansk	Kursk, Tambov Yaroslavl, Sevastopol
Below average				Chelyabinsk Kemerovo	Vologda Volgograd Republic of Dagestan Stavropol Udmurt Republic Perm Orenburg Saratov Tyumen Novosibirsk Omsk Primorsky region Khabarovsk region	Bryansk, Vladimir Ivanovo, Kostroma Oryol, Ryazan, Smolensk, Tver Republic of Karelia Republic of Komi Arkhangelsk, Kaliningrad, Novgorod, Pskov North Ossetia Kirov, Penza Ulyanovsk, Tomsk, Kamchatka, Amur
Low				Krasnoyarsk	Altai Irkutsk Republic of Sakha (Yakutia)	Republic of Crimea Astrakhan, Kabardino-Balkar Republic, Chechen Republic, Mari El Republic, Republic of Mordovia, Chuvash Republic, Kurgan, Republic of Khakassia, Republic of Buryatia, Trans-Baikal Territory

Table 6 (continued)

Standard of living	Potential					
	Especially high	High 1	High 2	Average	Below average	Low
Poor						Republic of Kalmykia, Republic of Ingushetia, Republic of Karachay-Cherkessia, Republic of Altai, Republic of Tuva, Jewish Autonomous District

Source: Compiled by the authors.

Table 7

Clustering of Regions of the Russian Federation by Debt Level

Clusters	Debt level
Vladimir, Kursk, Lipetsk, Nenets Autonomous District, Moscow, Vologda, Leningrad, Murmansk, St. Petersburg, Republic of Crimea, Sevastopol, Perm, Khanty-Mansi Autonomous District, Yamalo-Nenets Autonomous District, Tyumen, Chelyabinsk, Altai, Irkutsk, Primorsky region, Sakhalin	Low
Belgorod, Bryansk, Voronezh, Ivanovo, Tver, Tula, Republic of Adygea, Rostov, Republic of Dagestan, Chechen Republic, Republic of Bashkortostan, Chuvash Republic, Orenburg, Samara, Republic of Altai, Krasnoyarsk, Kemerovo, Novosibirsk, Republic of Sakha (Yakutia), Kamchatka	Below average
Kaluga, Moscow region, Ryazan, Republic of Karelia, Republic of Komi, Kaliningrad, Novgorod, Krasnodar, Astrakhan, Republic of Ingushetia, Republic of North Ossetia, Stavropol, Republic of Mari El, Republic of Tatarstan, Kirov, Penza, Sverdlovsk, Republic of Tuva, Republic of Buryatia, Amur region, Magadan, Chukotka Autonomous District	Average
Kostroma, Smolensk, Tambov, Yaroslavl, Arkhangelsk, Volgograd, Kabardino-Balkar Republic, Karachay-Cherkess Republic, Nizhny Novgorod, Saratov, Kurgan, Omsk, Zabaykalsky region, Khabarovsk, Jewish Autonomous District	Above average
Oryol, Pskov, Republic of Kalmykia, Udmurt Republic, Ulyanovsk, Republic of Khakassia, Tomsk	High
Republic of Mordovia	Especially high

Source: Compiled by the authors based on data from the Ministry of Finance. URL: https://www.iminfin.ru/areas-of-analysis/budget/gosudarstvennyj-dolg-sub-ektov-rf?territory=45000000 (accessed on 23.04.2024).

Table 8

Cluster Centers (%)

Cluster	Debt/income	Debt/GRP
1	6.1925	0.598
2	21.527	1.977
3	41.2409	3.8764
4	59.508	5.5647
5	83.9371	7.64
6	165.89	16.71

Source: Author's calculations.

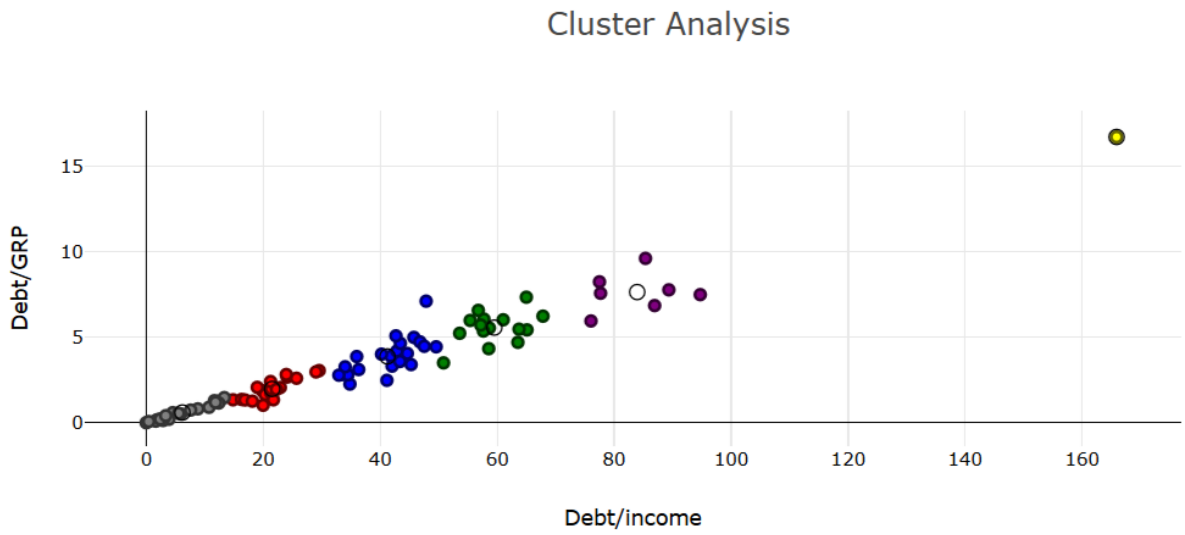

Fig. 2. **Clustering of Regions of the Russian Federation by Debt Level, %**

Source: Author's calculations.

is characterized by a low standard of living (15 regions). Regions in the sixth cluster (6 regions) should be considered poor. Thus, in terms of the standard of living, the regions are distributed among the clusters more evenly than by resource potential.

For two indicators characterizing the standard of living, the results of the cluster analysis can be visually presented in the following figure (*Fig. 1*). A comparative analysis of regions based on the standard of living and resource potential has been carried out based on a two-dimensional typology of regions (*Table 6*).

Moscow has an exceptionally high standard of living as well as resource potential. The Moscow region and the Republic of Tatarstan also have a high standard of living and resource potential. As seen in *Table 6*, most regions have a standard of living that corresponds to and even exceeds their existing economic potential. Thus, regions with both high and medium and low levels of potential have a high standard of living. This situation seems quite natural, as the standard of living in a region is determined not only by the potential of the territory but also by the potential of the state as a whole. The authors of the paper [19] note a lower unevenness of regions in social indicators compared to economic ones, which, in their opinion, is due to the implementation of a unified social policy at the national level.

Table 9

Typologization of Regions in Terms of Living Standards and Fiscal Space

Standard of living	Debt (fiscal space)					
	Low (wide 6.2)	Below average (average 21.5)	Average (narrow 41.2)	Above average (absent 59.5)	High (pre-bankruptcy 83.9)	Very high (bankruptcy 165.9)
Especially high	Moscow, Yamalo-Nenets Autonomous District, St. Petersburg					
High	Lipetsk, Nenets Autonomous District, Khanty-Mansi Autonomous District, Sakhalin	Belgorod, Voronezh, Oblast, Republic of Adygea	Moscow Region, Krasnodar, Republic of Tatarstan, Sverdlovsk, Magadan, Chukotka Autonomous District	Nizhny Novgorod		
Average	Kursk, Leningrad, Murmansk, Sevastopol	Tula, Rostov, Republic of Bashkortostan, Samara	Kaluga	Tambov Yaroslavl		
Below average	Vladimir, Vologda, Perm, Tyumen, Chelyabinsk, Primorsky region	Bryansk, Ivanovo, Tver, Republic of Dagestan, Orenburg, Kemerovo, Novosibirsk, Kamchatka	Ryazan, Republic of Karelia, Republic of Komi, Kaliningrad, Novgorod, Republic of North Ossetia, Stavropol, Kirov, Penza, Amur	Kostroma, Smolensk, Arkhangelsk, Volgograd, Saratov, Omsk, Khabarovsk	Oryol, Pskov, Udmurt Republic, Ulyanovsk, Tomsk	
Low	Republic of Crimea, Altai, Irkutsk, Chechen Republic	Chuvash Republic, Krasnoyarsk, Republic of Sakha	Astrakhan, Republic of Mari El, Republic of Buryatia	Kabardino-Balkar Republic, Kurgan, Trans-Baikal Territory	Republic of Khakassia	Republic of Mordovia
Poor		Republic of Altai	Republic of Ingushetia, Republic of Tuva	Republic of Karachay-Cherkessia, Jewish Autonomous District	Republic of Kalmyki	

Source: Compiled by the authors.

At the same time, the standard of living in a number of regions does not reach the level of existing potential. These include the Chelyabinsk, Kemerovo, and Irkutsk, the Krasnoyarsk, the Altai, and the Sakha Republic (Yakutia). This situation may indicate the insufficiently effective use of the region's economic potential to ensure a decent standard of living for the population.

To assess the potential use of the financial capacity of the territory for the purpose of improving the population's standard of living, we will consider the clustering of regions by debt level (*Table 7*). The debt indicators used are the ratio of debt to tax and non-tax revenues and to GRP (*Fig. 2*). Due to the sufficient homogeneity of the indicators used, the clustering was performed not on standardized but on actual indicators. The subjects of the Russian Federation are divided into six clusters. The explained variance coefficient for this case is 0.9713, which indicates a very high quality of clustering.

Cluster centers are presented in *Table 8*. The regions included in cluster 1 have a low level of debt, averaging 6.2% of their own revenues and about 0.6% of GRP. Twenty regions in the second cluster have below-average debt, approximately 22% of their own revenues and 2% of GRP. The regions in the third cluster are in a borderline debt situation, with debt approaching a dangerous level. The subjects of the Federation in the fourth and fifth clusters have significant debt problems. The Republic of Mordovia has an exceptionally high level of debt.

The assessment of the financial reserves available to regions will be carried out based on the concept of fiscal space, which allows for the evaluation of the possibilities for mobilizing additional own and borrowed financial resources to address priority issues of socio-economic development in the territory. In Peter Heller's paper, fiscal space is defined as a budgetary reserve created to finance justified government expenditures, formed from either own or borrowed funds [20]. At the same time, ensuring the sustainability of public finances is of paramount importance. A priority issue is also the creation of a financial reserve to fulfill social obligations in a situation of unstable economic dynamics. The analysis conducted in work [21] showed that, at the regional level, the term "fiscal space" is most often used to denote the ability to finance a deficit without any restrictions, including without a sharp increase in financing costs or unjustified crowding out of private investments.

To assess the scale of the fiscal space of the regions of the Russian Federation, we will consider a two-dimensional typology based on the standard of living and the level of debt (*Table 9*). Three types of regions are distinguished by the size of their fiscal space: those with wide, medium, and narrow financial space. Their debt levels are approximately 6%, 21%, and 41% of their own revenues, respectively. The next three types of regions correspond to the absence of fiscal space, a high probability of bankruptcy, and an actual state of bankruptcy.

The proposed two-dimensional typology of regions based on the standard of living of the population and the size of fiscal space allows for the identification of the financial reserve of a Russian Federation subject and can be considered as a tool for managing the regional public debt with the aim of improving the standard of living in the regions.

In *Table 9*, the regions highlighted in green have this opportunity. Meanwhile, the regions highlighted in red have already exhausted the possibilities of using market-based borrowing to address social issues. The presented typology is based on data from 2021 and should be considered as a tool for assessing the fiscal space potential of a region in addressing current socio-economic problems.

CONCLUSION

Theoretical research, as well as empirical analysis of economic potential, demonstrate its decisive influence on the standard of living

in the regions and on the issue of interregional differentiation. The models obtained through correlation-regression analysis of the impact of the main types of potential on the standard of living can be used to justify the priorities of socio-economic policy in the Central Federal District and the Northwestern Federal District. Clustering regions by the size of economic potential and the standard of living shows that more than half of the subjects of the Russian Federation have a low level of potential. At the same time, most regions have a standard of living that corresponds to and even exceeds the existing economic potential, which is due to the implementation of a unified social policy at the national level. The most mobile type of regional potential is financial potential, the effective use of which allows for both an increase in the standard of living and an enhancement of economic potential through the financing of investment projects for regional development. The presented typologies of regions by standard of living and debt, as well as the two-dimensional typology, allow for the alignment of financial indicators with standard of living indicators and, in the authors' opinion, can be used as tools of debt policy by the subjects of the Russian Federation to enhance the efficiency of using the region's financial potential in the interest of improving the population's standard of living.

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Risks of Fraud in CTP in Siberia: Causes, Consequences, Regulation

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ABSTRACT*

The problem of unfair actions in Compulsory Third Party (CTP) has persisted in Siberia for several years and, first of all, is related to fraud. The **purpose** of the study is to assess the causes and impact of the risks of unfair actions in the field of CTP on the insurance market using the example of the regions of Siberia. The research **methodology** includes dynamic, spatial and correlation analysis, as well as index and coefficient methods used to assess the total risk. The article analyzes the quantitative indicators of the risk of unfair actions in the field of CTP in the regions of Siberia, identifies the causes of the unfavorable situation, the consequences of a socio-economic nature, and provides proposals aimed at reducing the risk. To improve the efficiency and quality of services in the CTP market, it is necessary to assess the factors constraining its development, regularly conduct communication activities between government authorities and the insurance business, differentiate quantitative indicators when assessing damage, taking into account regional specifics, develop an insurance culture and accessibility of CTP services in remote areas. The study will be useful for regulatory authorities and organizations of the insurance market, executive authorities at the federal and regional levels, and individual subjects of the insurance market in the development of regional insurance policy.

Keywords: auto insurance; insurance premiums; insurance payments; total risk under CTP; frequency of insurance cases; rolling coefficient of you-payments; "red" zone; insurance culture; availability of insurance services

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INTRODUCTION

Compulsory Third Party (CTP) appeared in Russia 20 years ago — the Federal law No. 40 was adopted on 1 July 2003. Since then, there have been numerous changes: CTP insurance is becoming an increasingly transparent, understandable, and convenient form of protection for car owners. The availability of CTP policies, as well as the settlement of claims, is becoming easier due to the development of digitalization processes in the insurance market. Nevertheless, this type of insurance remains the most problematic among all types of insurance in Russia. The issues are related to increased unprofitability, risks of dishonest actions, low quality of settlements, and weak competition. However, CTP is a mass type of insurance that covers a large portion of consumers, so its effective implementation is important in terms of risk protection, ensuring social stability, and developing insurance culture.

Over the past few years, a number of regions in Russia have seen an increased risk of unscrupulous actions in the area of CTP. This has also affected some Siberian regions. The increase in such risks leads to a rise in insurance company losses. As a result, insurers are forced to reduce sales due to the loss of economic interest. And, a supply shortage arises, which inevitably leads to an increase in the final cost of insurance products for consumers. Consequently, approximately one-third of vehicles in the Siberian regions are operated without STP contracts,[1] victims cannot exercise their rights in the event of an accident, social tension rises, and, as a result, consumer trust in the insurance market as a whole decrease. A similar problem is noted in the North Caucasian, Southern, and Far Eastern federal districts.

The purpose of this article is to assess the causes and impact of the risks of fraudulent activities in the CTP sector on the insurance market in Siberia.

The main issues of regulating the insurance market are governed by the law "On the Organization of Insurance Business in the Russian Federation".[2] At the same time, a number of special regulatory legal documents are dedicated to the organizational and economic aspects of CTP: the Law "On Mandatory Insurance of Civil Liability of Vehicle Owners" No. 40,[3] the Regulation of the Bank of Russia "On the Unified Methodology for Determining the Amount of Expenses for Restoration Repair of Damaged Vehicles" No. 755.[4]

The specificity of the insurance business lies in the assessment of risks by insurers, taking into account the probability of an insured event occurring and the statistics of payments. The peculiarity of CTP lies in its non-market nature, which is why this type is initially considered unprofitable for insurers and subsequently became loss-making in a number of regions. Subsequently, systemic problems in the CTP market emerged and worsened:

- insurers' avoidance of entering into and fulfilling contracts;
- refusal of car owners to purchase CTP policies;
- insufficient control by government authorities over compliance with legislation by all market participants.

The listed problems have created opportunities for abuses and dishonest

[1] The number of privately owned passenger cars per 1 000 population by subjects of the Russian Federation (from 2000 to 2022). URL: https://rosstat.gov.ru/storage/mediabank/obesp_legk_avto.xls; Insurance. Statistics. Statistical indicators and information about individual entities in the insurance business. URL: https://cbr.ru/finmarket/supervision/sv_insurance/stat_ssd/2024_4/ (accessed on 22.12.2024).

[2] Law "On the Organisation of Insurance Business in the Russian Federation" No. 4015 from 27.11.1992. URL: https://www.consultant.ru/document/cons_doc_LAW_1307/ (accessed on 22.12.2024).

[3] The Law "On Compulsory Insurance of Civil Liability of Vehicle Owners" No. 40 from 25.04.2002. URL: https://www.consultant.ru/document/cons_doc_LAW_36528/?ysclid=lqj6tau0tt143069011 (accessed on 22.12.2024).

[4] Regulation of the Bank of Russia "On the Unified Methodology for Determining the Amount of Expenses for Restoration Repairs of Damaged Vehicles" No. 755 from 04.03.2021. URL: https://www.garant.ru/products/ipo/prime/doc/400821665/?ysclid=lqj6uey3xh271599393 (accessed on 22.12.2024).

actions in this field by insurers, consumers of insurance services, and various intermediaries. Most often, fraudulent activities are related to the staging of traffic accidents, which leads to increased costs for insurers and a rise in unprofitability.

In modern science and practice, significant attention is paid to the legal, economic, and social issues of CTP. In particular, the features of implementing auto insurance in the regions of Russia [1], the characteristics and specifics of the CTP market [2], as well as the issues of interaction among the participants in legal relations [3] are considered. A number of studies are dedicated to unresolved legal issues related to the implementation of CTP in our country, which reduce the efficiency and accessibility of the service for consumers [4–6].

In the context of insurance claims settlement, it is worth noting issues of technical expertise [7], problematic aspects of pre-trial and judicial loss settlement, as well as methods of protecting the interests of CTP service consumers [8, 9].

Many contemporary papers include the study of unfair practices in CTP. They analyse methods and schemes for committing fraudulent activities, including those within organized crime groups [10, 11], as well as methods for detecting [12, 13] and preventing fraudulent practices [14, 15]. The key role of investigative bodies in investigating fraud in the field of auto insurance is emphasized [16].

It is important to note that insurance fraud is considered a threat to economic security [17]. Therefore, within the framework of regulating the loss ratio in CTP, an important aspect is the economic justification of the cost aspects of CTP and its effectiveness. In particular, the feasibility of adjusting corrective coefficients is considered [18, 19], and an assessment of price adequacy and profitability is provided [20]. A number of authors propose models for assessing risk factors [21]. Also, the research of domestic scientists is dedicated to the issues of social significance and safety of mandatory automobile liability insurance for drivers [22, 23].

METHODOLOGY FOR RISK ASSESSMENT UNFAIR PRACTICES IN CTP

The problem of dishonest actions in CTP is multifactorial, including economic, social, and organizational-legal components. All these aspects provoke the possibility of fraudulent actions — this includes the mass nature of the type of insurance, the imperfection of the current damage assessment algorithms, and often the inconsistency of the actions of insurance participants when insurance events occur.

Insurance fraud is a crime committed through deception regarding the occurrence of an insured event or the inflation of the amount of an insurance payment. Insurance fraud includes providing knowingly false information about circumstances confirming the occurrence of an insured event, staging a traffic accident, an unfortunate incident, or the theft of insured property.[5]

The problem of fraud in insurance activities is one of the significant issues for all participants in the insurance market. Russian insurers lose at least 27 bln rubles annually due to fraud, with about 70% of crimes occurring in the field of auto insurance [17].

Therefore, the analysis of the situation should begin with insurance statistics indicators. Quantitatively, the risk of fraudulent actions in CTP is expressed in the increased value of the "total risk" index, calculated by the Insurance Market Department of the Bank of Russia. Thus, according to the Bank of Russia,[6] the leader of

[5] Resolution of the Plenary Session of the Supreme Court of the Russian Federation dated 20.11.2017 No. 48 (as amended on 15.12.2022) "On Judicial Practice in Cases of Fraud, Embezzlement, and Misappropriation". Bulletin of the Supreme Court of the Russian Federation. No. 2. February, 2018.

[6] Monitoring of regional risks of unfair practices in CTP insurance. Quarterly bulletins of the Bank of Russia. No. 1 as of 01.10.2019 — No. 22 as of 01.01.2025. URL: https://cbr.ru/Collection/Collection/File/46300/monitoring_OSAGO_2025–22.pdf (accessed on 22.12.2024).

the anti-rating among the regions of Siberia is Novosibirsk Oblast, where the situation is complex — from 2021 to the present, the index value has varied from 4 to 6.5 points, which places the region in the "red" zone. Therefore, the issue of CTP in the Novosibirsk region has received increased attention in the paper.

The "aggregate risk" for CTP is calculated based on three indicators across all subjects of the Russian Federation, based on published insurance statistics data from the Bank of Russia (external monitoring indicators):

- average insurance payment: the ratio of total insurance payments to the number of settled insurance events, thousand rubles. As of 1 January 2022, this figure in the Novosibirsk region was almost 90 thousand rubles, which was 1.3 times higher than the average value in Russia (68.5 thousand rubles). As of 1 January 2025, the indicator in the region had already reached 142.6 thousand rubles, which is 1.4 times higher than in Russia (99.9 thousand rubles);
- frequency of insurance claims: the ratio of the number of settled losses to the number of concluded CTP contracts,%. In the Novosibirsk region as of 01.01.2022, this figure was 7.5%, which is 1.3 times higher than the average value in Russia (5.5%). As of 01.01.2025, the indicator was 6%, which is also 1.3 times higher than the average in Russia (4.6%);
- sliding payment ratio: the ratio of insurance payments to insurance premiums,%. For the Novosibirsk region as of 01.01.2022, this figure was 110%, which is 1.6 times higher than the average value for Russia (67%). As of 01.07.2023, the indicator was 86.3%, which is also 1.6 times higher than the average Russian value.

For each of the three aforementioned indicators, depending on the extent of the deviation of the regional value exceeding the average for Russia, penalty points are determined, the sum of which constitutes the final index "total risk" (with values ranging from 0 to 7, where 7 is the maximum risk).

If there is an abnormal increase in indicators (event frequency, average payment, intensity of lawsuits, etc.), it may indicate a distortion in the natural process of loss occurrence, that is, a disruption in market pricing.

These processes will lead to:

- lack of interest from insurers in implementing CTP, reduction of presence in certain regional markets, and restriction of policy sales to particularly unprofitable clients (transport organizations, taxis, drivers with a "bad" insurance history, etc.), imposition of additional services;
- the emergence of "fake brokers", consultants for E-CTP, the sale of counterfeit policies, the entry of false data;
- the increase in citizens' dissatisfaction with insurance services in the Russian Federation entity and the number of complaints against insurers;
- deterioration of the price accessibility of CTP and a decrease in trust in the insurance market.

From 1 July 2024, the methodology for calculating the total risk has been supplemented with a sampling indicator based on the criterion of "recurrence" of losses. The sample includes insurance cases where the same car or driver is involved in accidents multiple times during the analysed period.

To analyse the reasons for the increased risk of fraudulent activities in CTP in the regions, it is also advisable to use internal monitoring indicators that take into account the regional situation in the CTP sector in a specific subject of the Russian Federation, including:

- the level of consumer complaints regarding the CTP service;
- the intensity of court payments in damage settlements;
- the activity of initiating criminal cases in the field of CTP.

These indicators can largely reflect the effectiveness of the work of regional executive authorities, including law enforcement and judicial bodies. Therefore,

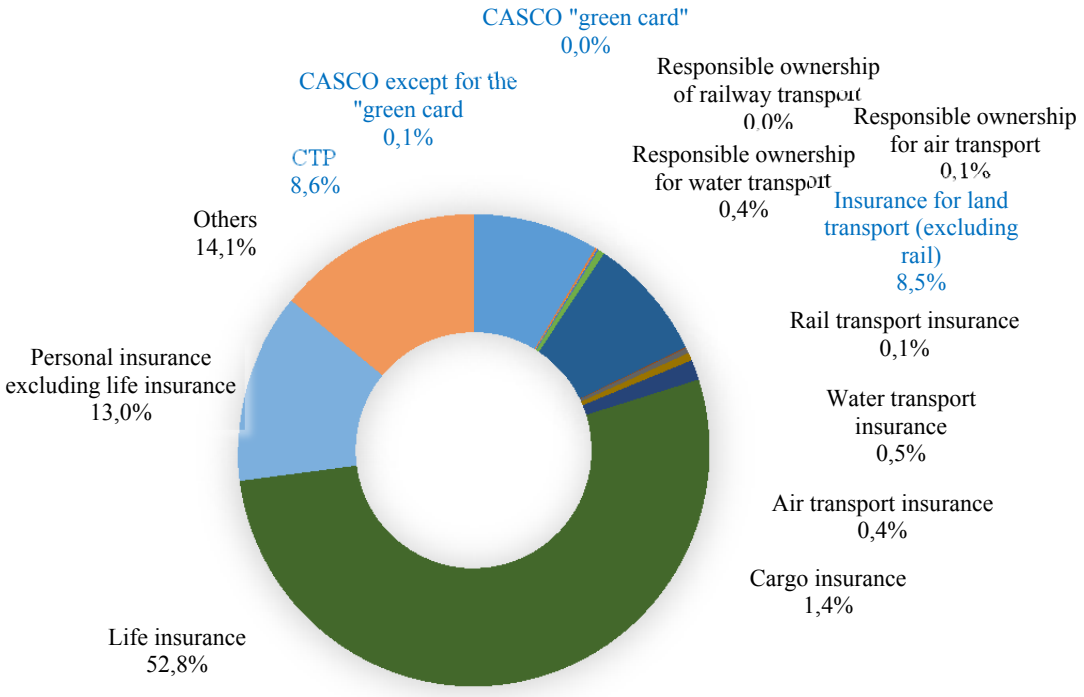

Fig. 1. **Structure of Insurance Premiums in Russia in 2024**

Source: Author's calculations.

it is advisable to assess the risks of fraudulent activities in the area of CTP by comparing these two groups of indicators in territorial and temporal aspects.

ANALYSIS OF THE SITUATION IN THE CTP

CTP belongs to the group of types of auto insurance. Based on the content of the published insurance statistics of Russia, the concept of "transport insurance" is distinguished, which includes the insurance of all types of transport (land, water, air), the liability of vehicle owners, and cargo insurance.

Auto insurance is a part of transportation insurance and includes: insurance for land motor vehicles (comprehensive coverage); liability insurance for vehicle owners (CTP and CASCO).

It should be noted that this type of insurance is economically and socially significant, as it occupies a substantial share of the Russian insurance market and, accordingly, forms the largest insurance fund and provides protection for the property interests of those injured in traffic accidents[7] (*Fig. 1*).

In *Fig. 1*, other types of auto insurance are highlighted as they are closely related to CTP and often accompany it, but their share is insignificant. The category "Other" includes other types of property and liability insurance that are not the subject of this study.

In the regions of Russia, the share of CTP in the structure of insurance premiums varies, and consequently, the level of total risk also varies (*Fig. 2*). Thus, in the North Caucasus Federal District (NCFD), the share of CTP exceeds 20%, in the Siberian Federal District (SFD) it is 16.5%, and in the Central Federal District (CFD) it is 5.1%.

Fig. 3–6 present the CTP indicators in territorial comparison.

The amount of insurance premiums for CTP per contract in the SFO is slightly lower, while the number of payments is higher

[7] Insurance. Statistics. Statistical indicators and information about individual entities in the insurance business. URL: https://cbr.ru/finmarket/supervision/sv_insurance/stat_ssd/2024_4/ (accessed on 22.12.2024).

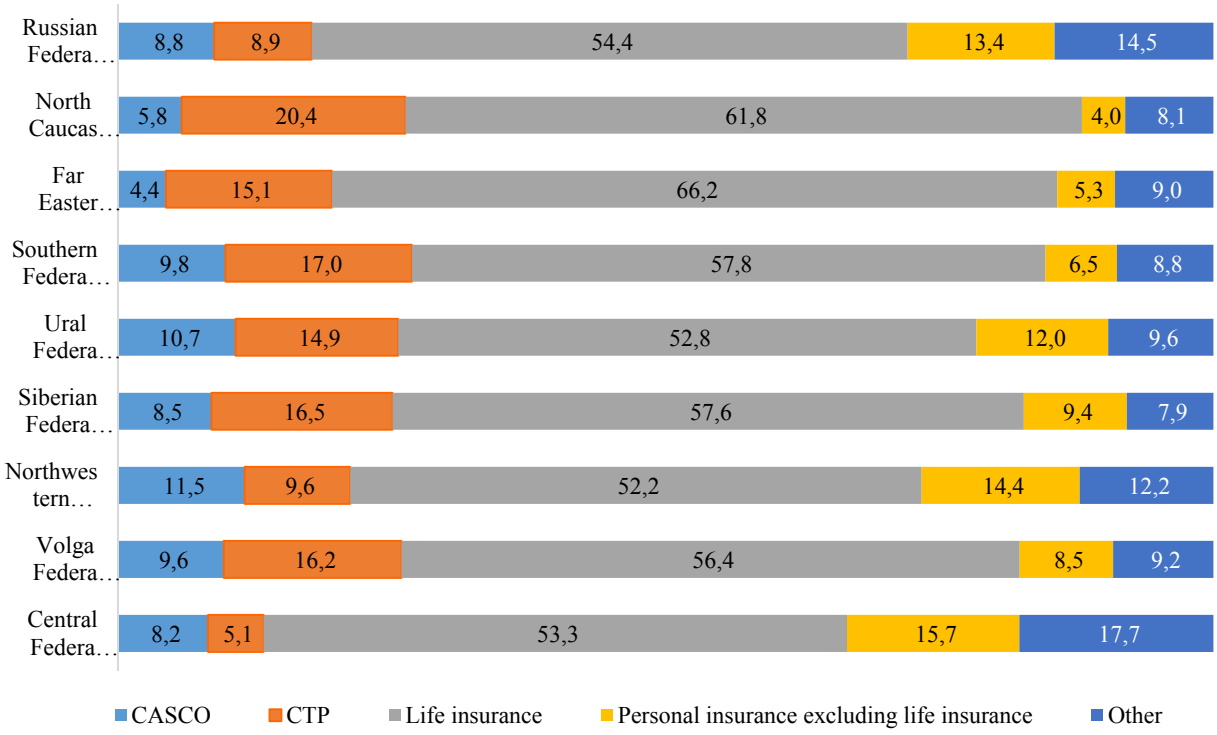

Fig. 2. **Share of Insurance Premiums for STP in the Structure of Insurance Premiums in FD in 2024**

Source: Author's calculations.

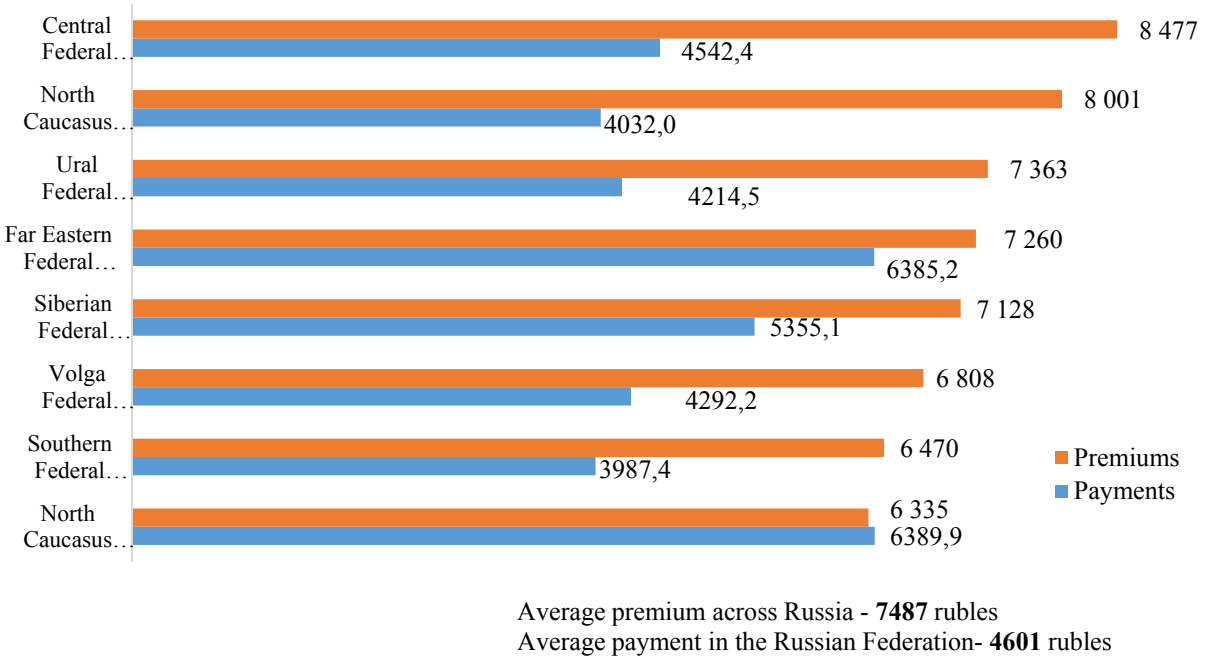

Fig. 3. **Premiums and Payments for STP for one Contract Under FD in 2024, rub.**

Source: Author's calculations.

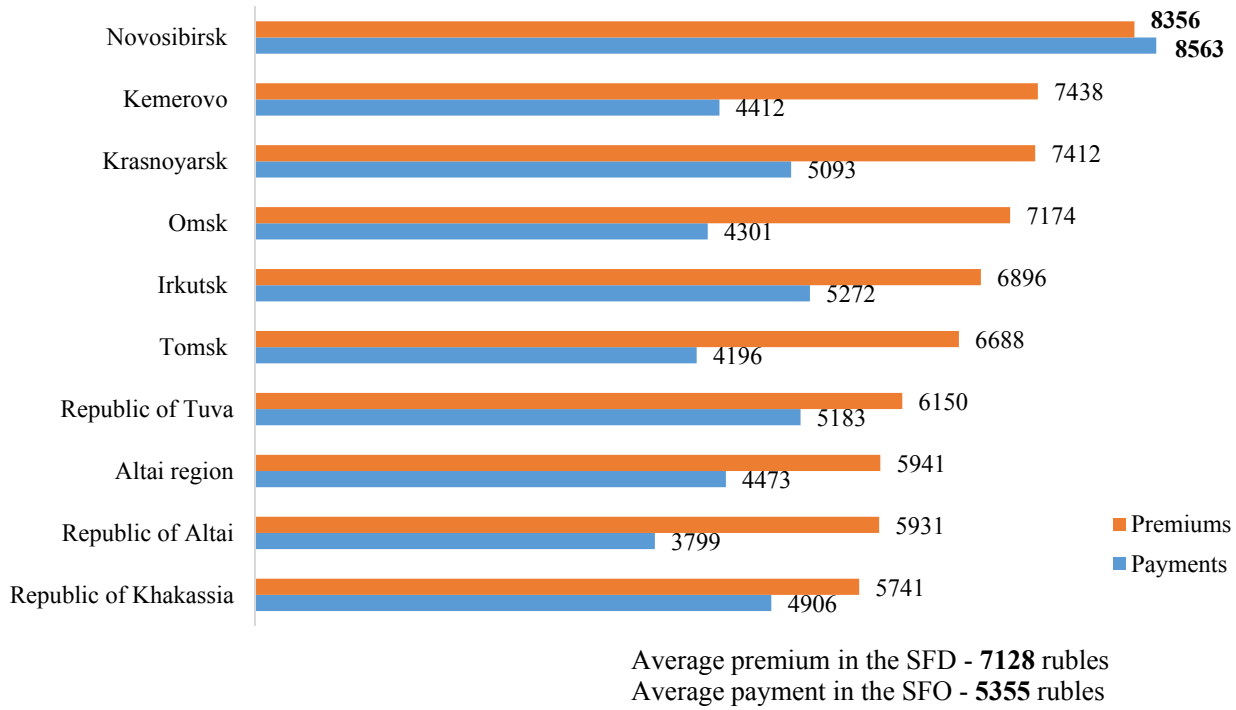

Fig. 4. **Premiums and Payments for STP per Contract for the Subjects of the SFD in 2024, rub.**

Source: Author's calculations.

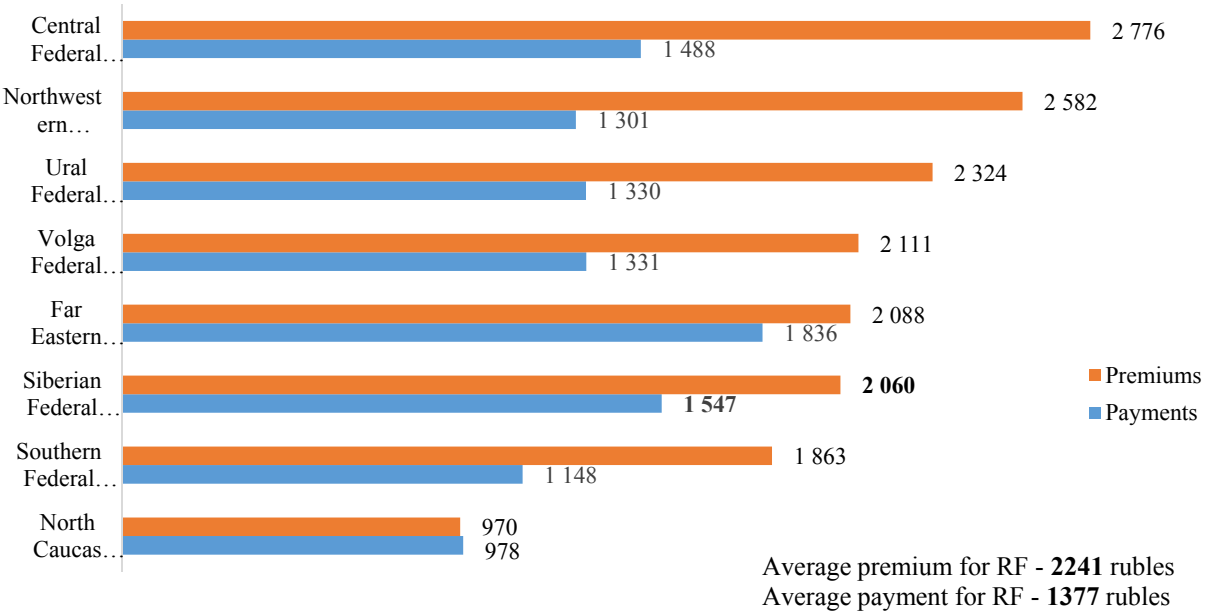

Fig. 5. **Premiums and Payments for STP per Capita by FD in 2024, rub.**

Source: Author's calculations.

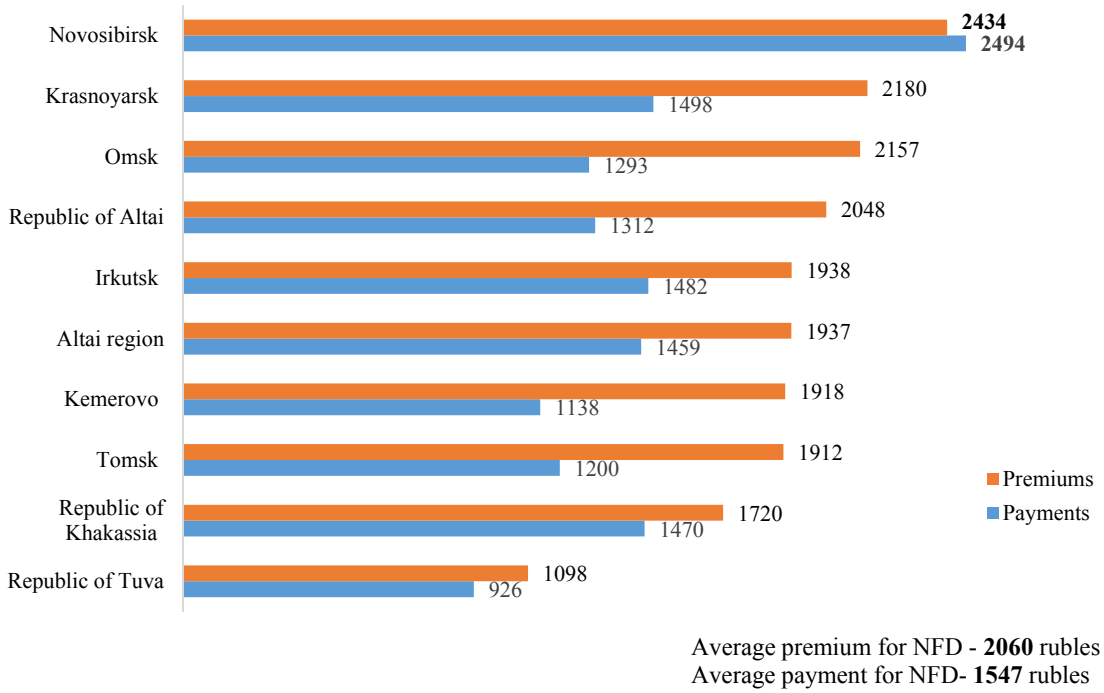

Fig. 6. **Premiums and Payments for STP per Capita for the Subjects of the SFD in 2024, rub.**

Source: Author's calculations.

Table 1

Paired Correlation Coefficients Between Premiums and Payments for STP and Compulsory Motor Liability Insurance and Other Types of Insurance in 2024

STP	Insurance of vehicles		Insurance citizens' property		Life insurance	
	Premiums	Payments	Premiums	Payments	Premiums	Payments
Premiums for CTP	0.8788	x	0.8535	x	0.8594	x
Payments for CTP	x	0.8199	x	0.8363	x	0.8101

Source: Author's calculations.

than the average in Russia. This indicates a higher loss ratio for this type of insurance in the SFO compared to the national average. The consequence is the lack of interest from insurers in providing CTP, a reduction in presence and sales volumes in certain areas — there is a refusal to provide the CTP service or the imposition of additional services, which leads to a violation of the principle of universal insurance.

Novosibirsk leads in the sum of premiums and payouts per policy among the subjects of the Siberian Federal District (SFD) and is the only one where payouts exceed premiums. The sum of premiums in the region is 17% higher than in the SFD and 12% higher than the national average. The sum of insurance payouts in Novosibirsk is 60% higher than the SFD value and 86% higher than the average for Russia. These figures confirm the high loss

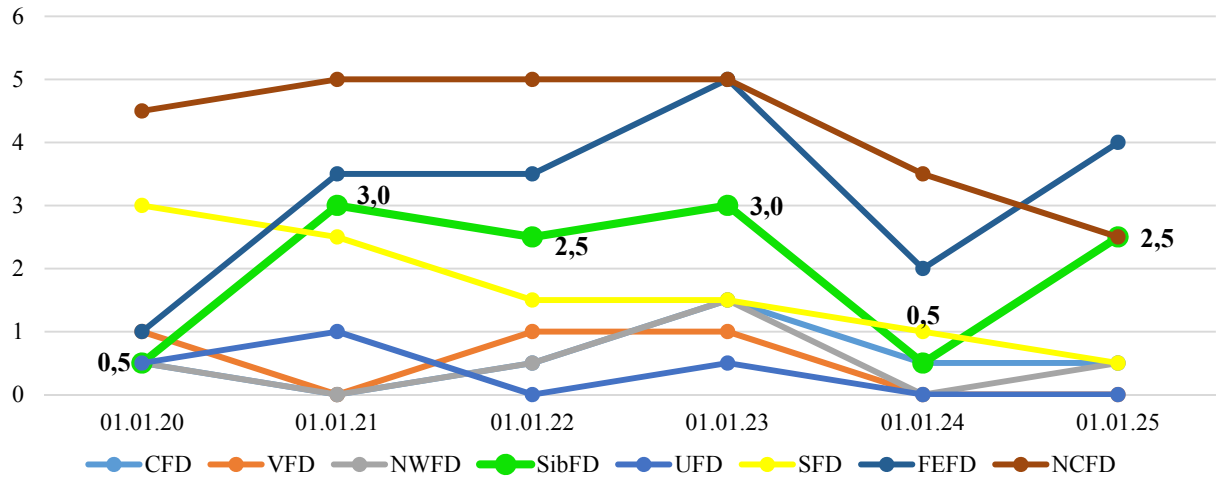

Fig. 7. **Total Risk for STP by FD, Points**

Source: Monitoring of the CTP of the Bank of Russia.

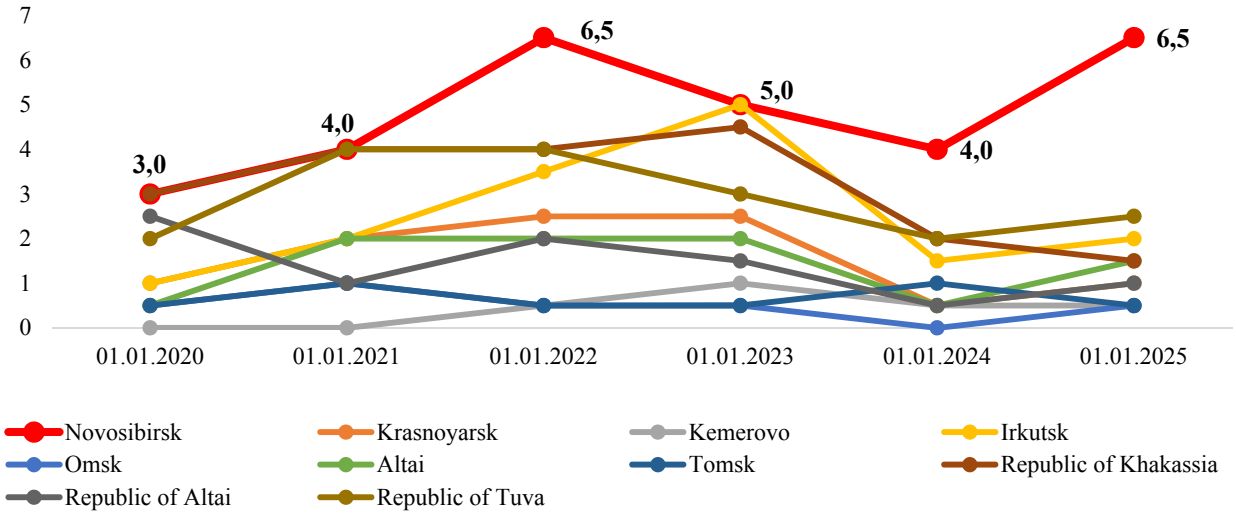

Fig. 8. **Total Risk for STP by Regions of the SFD, Points**

Source: Monitoring of the CTP of the Bank of Russia.

ratio of compulsory motor third-party liability insurance (CTP) in the region.

Overall, across federal districts, bonuses and payments vary significantly, with the Siberian Federal District occupying average positions. In the Novosibirsk, the payout per capita significantly exceeds the indicator for all regions of the Siberian Federal District and is 81% higher than the national average. The ratio of payouts to premiums for CTP in the region exceeds one. As a result, profitability decreases, the cost of CTP increases, the supply of policies decreases, and consequently, the total number of contracts concluded in the region also declines.

Since CTP is a mass insurance type, it forms the basis of voluntary insurance types and, consequently, the socio-economic development of the regions of Russia. The relationship between the volumes of insurance premiums for CTP and types of voluntary insurance is confirmed by calculating the correlation coefficients of CTP with other significant types of insurance in a spatial comparison based on data from all subjects of the Russian Federation (*Table 1*).

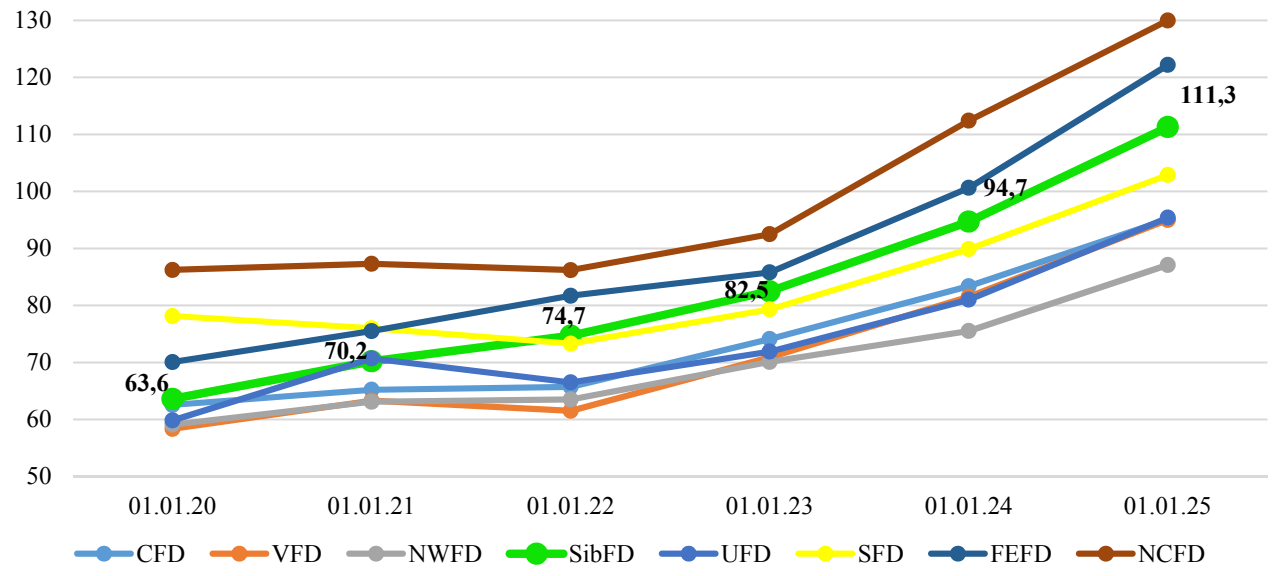

Fig. 9. **The Average Insurance Payment for STP in FD, Thousand Rubles**

Source: Monitoring of the CTP of the Bank of Russia.

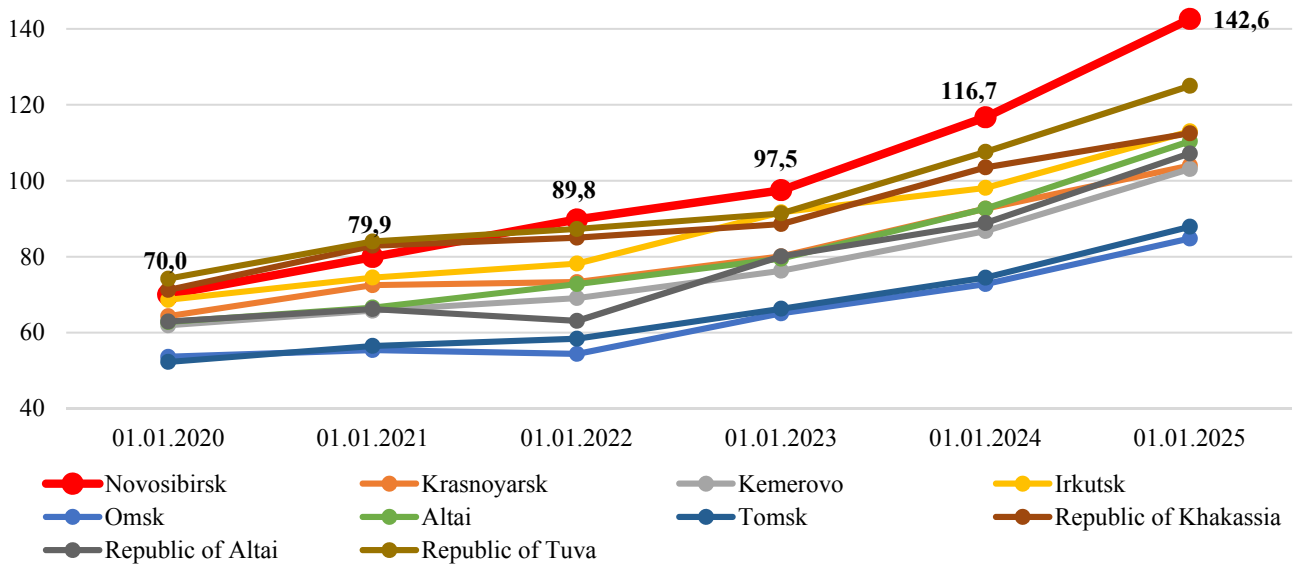

Fig. 10. **The Average Insurance Payment for STP by Regions of the SFD, Thousand Rubles**

Source: Monitoring of the CTP of the Bank of Russia.

Calculations showed a strong correlation (above 0.7) between premiums and payouts for CTP and premiums and payouts for voluntary types of insurance. That is why consumer satisfaction with the CTP service directly affects the development of these segments of the insurance market.

Next, *Fig. 7–14* present the dynamics of the components of total risk for CTP in federal districts and regions of the Siberian Federal District.

Among the federal districts, the highest total risk level is observed in the North Caucasian Federal District (maximum 5 points). It is followed by the Far Eastern Federal District, where the maximum value was recorded on 1 January 2023, after which the situation was stabilized. The Siberian

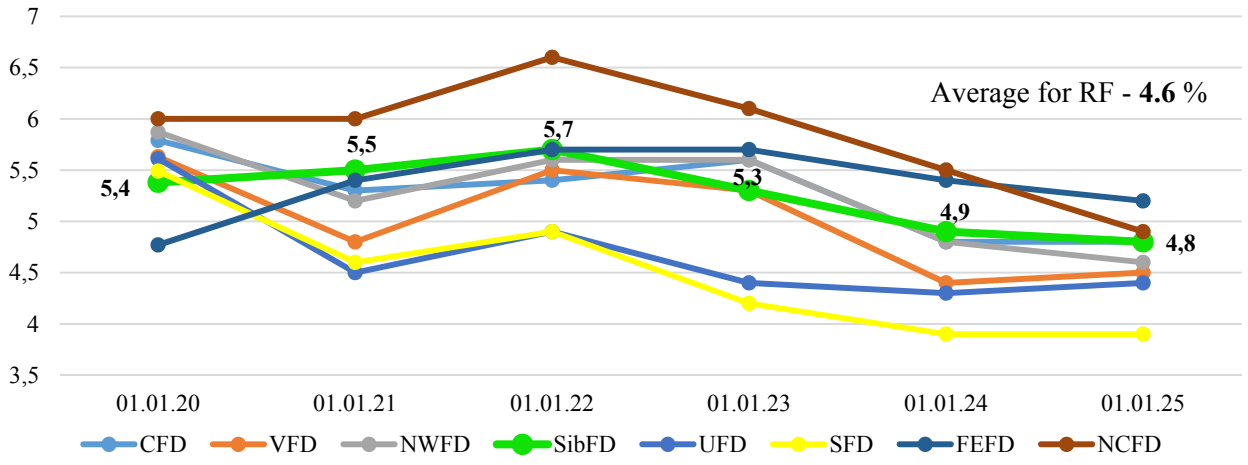

Fig. 11. **The Frequency of Insurance Claims for STP by FD, %**

Source: Monitoring of the CTP of the Bank of Russia.

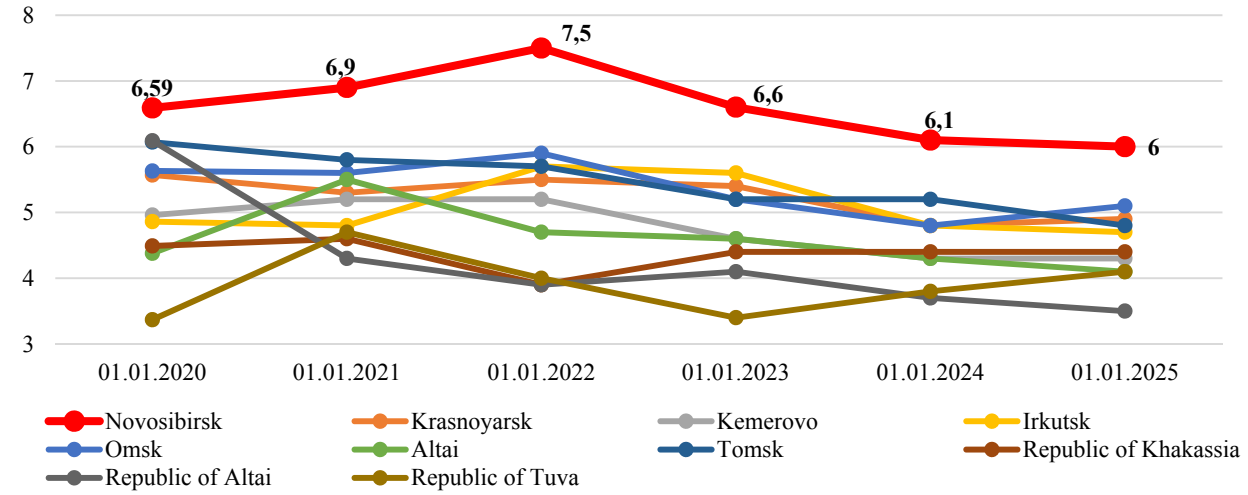

Fig. 12. **The Frequency of Insurance Claims for STP in the SFD, %**

Source: Monitoring of the CTP of the Bank of Russia.

Federal District shows a similar trend — the indicator is above the national average but remains within acceptable limits.

In the Novosibirsk region, the total risk level reached 6.5 points as of 1 January 2025. It leads among the regions of Siberia and ranks second among the subjects of Russia (after Ingushetia). It should be noted that in the other regions of the Siberian Federal District, the indicator has a tendency to decrease since 2023.

The average payout is steadily increasing in all regions of Russia. Among the federal districts, the highest figures are in the North Caucasian Federal District (NCFD) and the Far Eastern Federal District (FEFD), with the Siberian Federal District (SFD) in third place.

Novosibirsk Oblast ranks first in the SFO and fifth in the RF — the insurance payout as of 1 January 2025, amounted to 142.6 thousand rubles, which exceeds the SFO indicator by 28% and the national average by 43%. Additionally, among the regions of the SFO, a high average payout value is maintained in the Republic of Tuva.

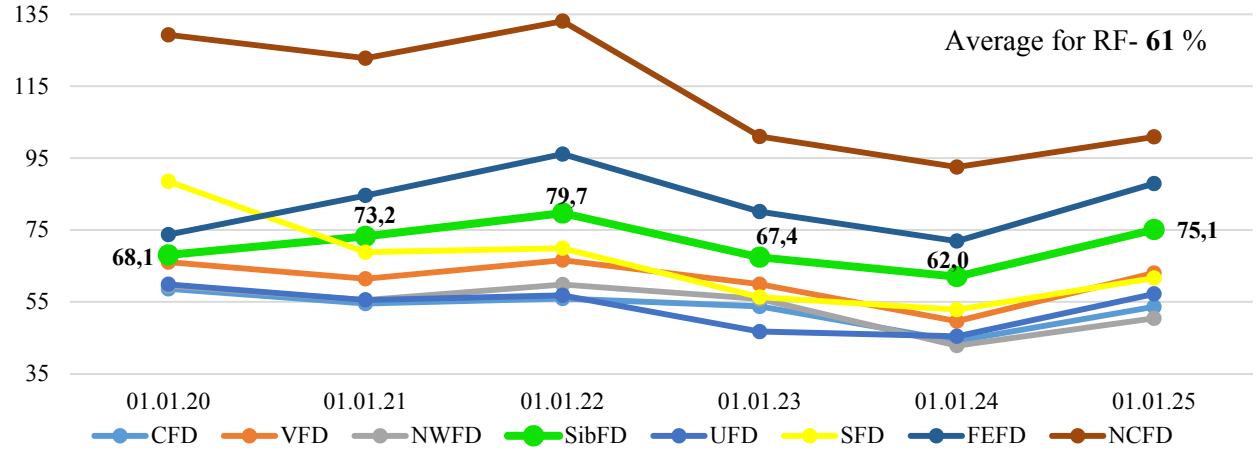

Fig. 13. **Sliding Coefficient of Payments for STP by FD, %**

Source: Monitoring of the CTP of the Bank of Russia.

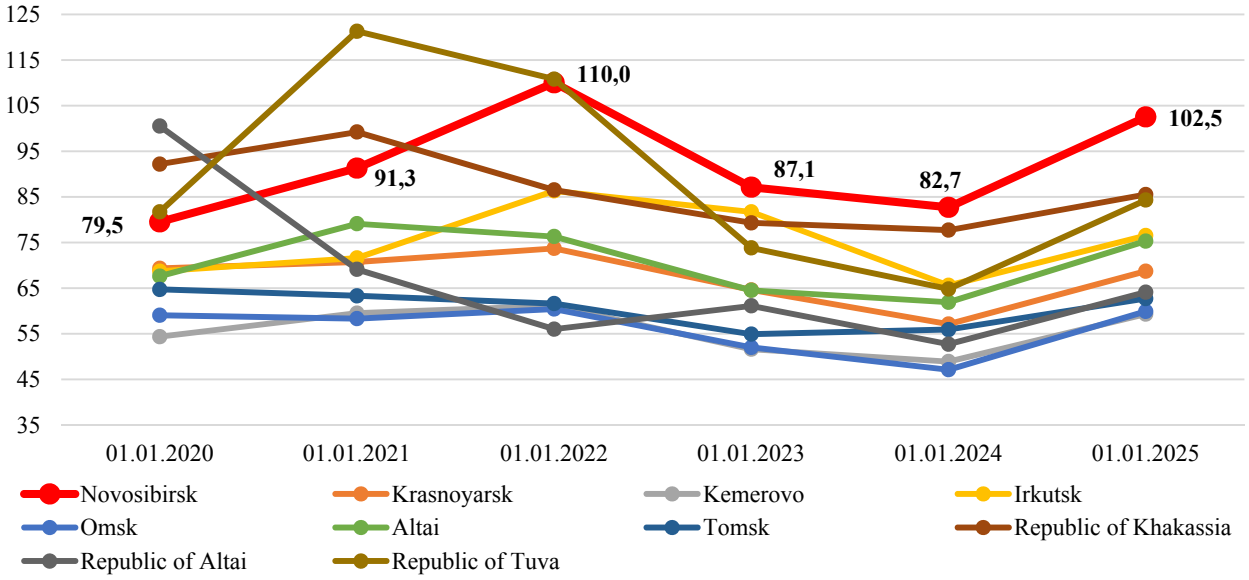

Fig. 14. **Rolling Coefficient of Payments for STP in Accordance with SFD, %**

Source: Monitoring of the CTP of the Bank of Russia.

Among the federal districts, the highest frequency of insurance claims for compulsory third-party (CTP) was observed in the North Caucasian Federal District (NCFD), but since 2022 it has been steadily decreasing, and this trend is seen in all regions. The Siberian Federal District (SFD) occupies an average position in this indicator.

In the Novosibirsk, the frequency of insurance cases is significantly higher than in other Siberian regions as of 1 January 2025, the figure was 6%, which is 11% higher than the average in Russia. Throughout the entire monitoring period, the figure exceeded the equivalent for the Siberian Federal District and Russia by 18–30%. The frequency of court payouts in the region has also remained high over the past five years, which may indicate the activity of unscrupulous legal intermediaries.

In terms of the rolling payout ratio among federal districts, the North Caucasian Federal

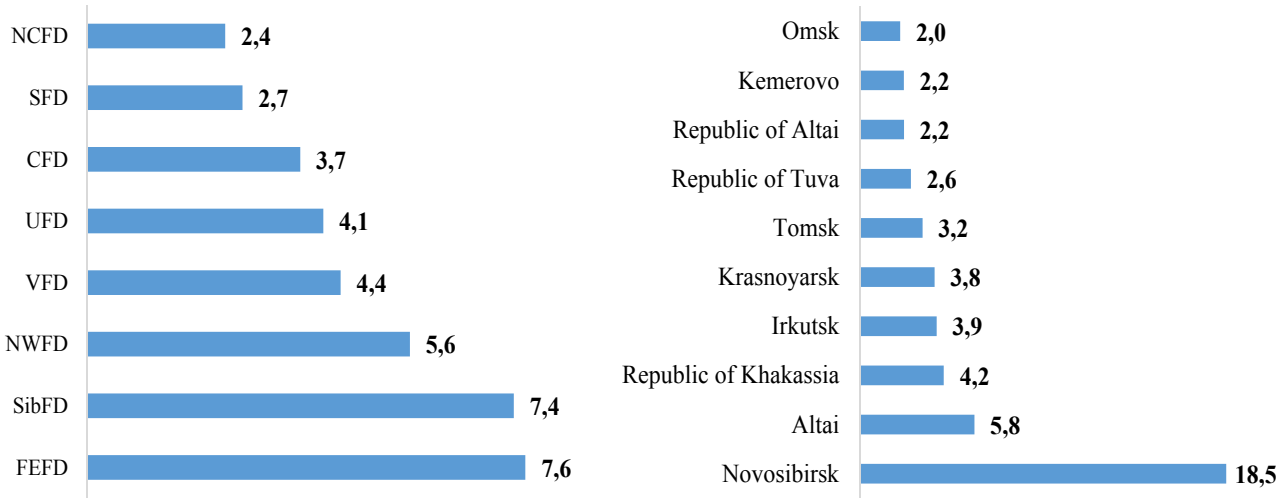

Fig. 15. **Indicators of Repeated Losses for STP in Russia, %**

Source: Monitoring of the CTP of the Bank of Russia.

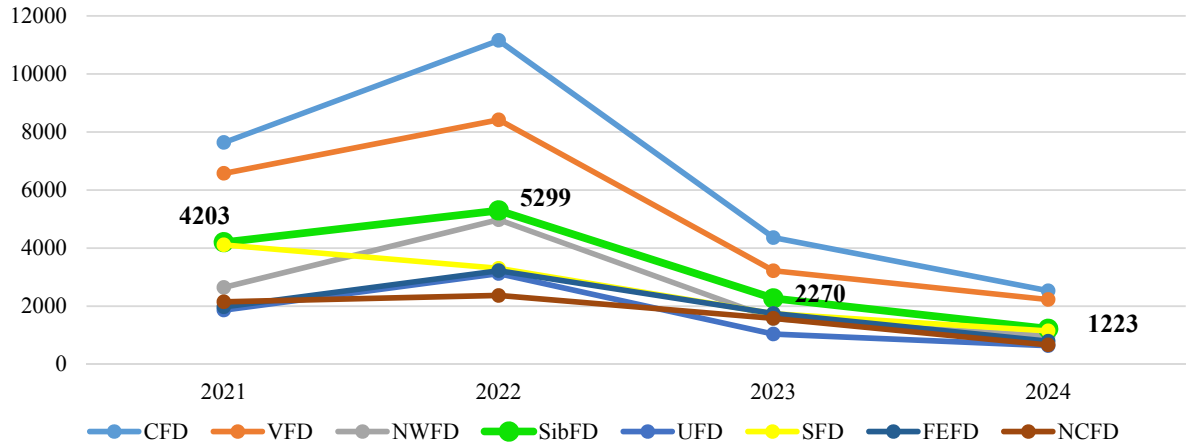

Fig. 16. **The Number of STP Complaints by the FD, Units**

Source: Author's calculations.

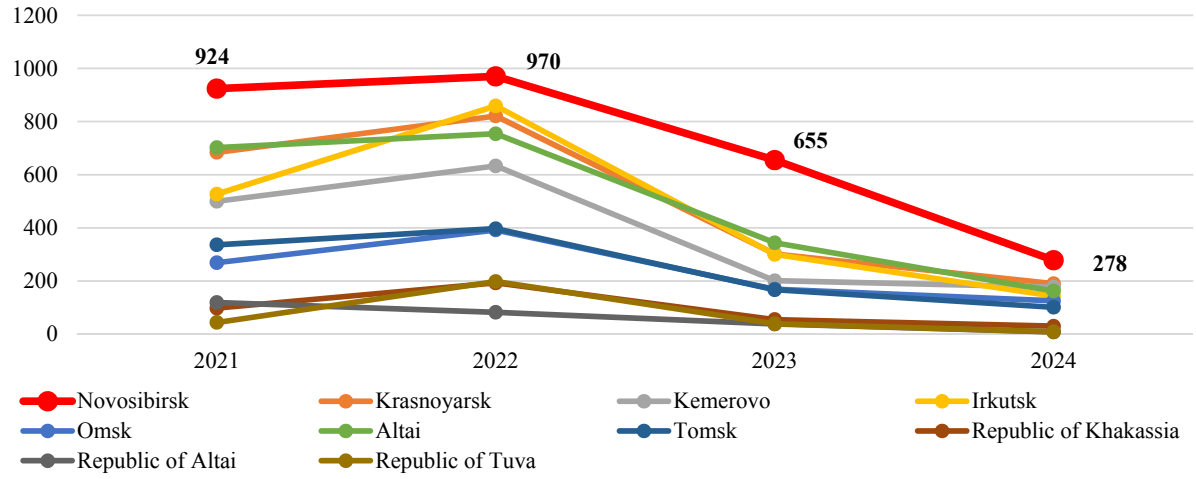

Fig. 17. **Number for STP Complaints by SFD Subjects, Units**

Source: Author's calculations.

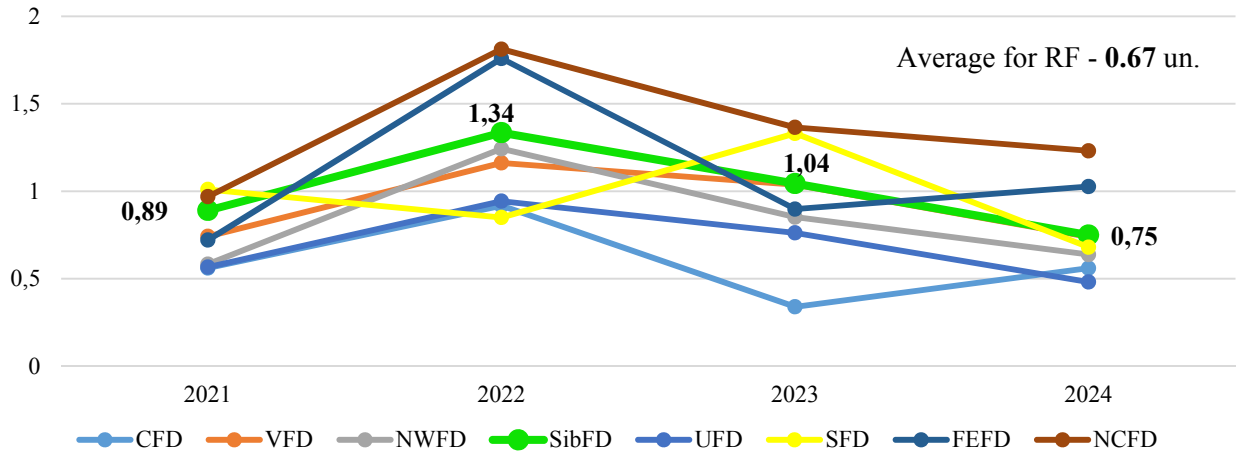

Fig. 18. **The Number of Consumer Complaints per 1000 STP Contracts by FD, Units**

Source: Author's calculations.

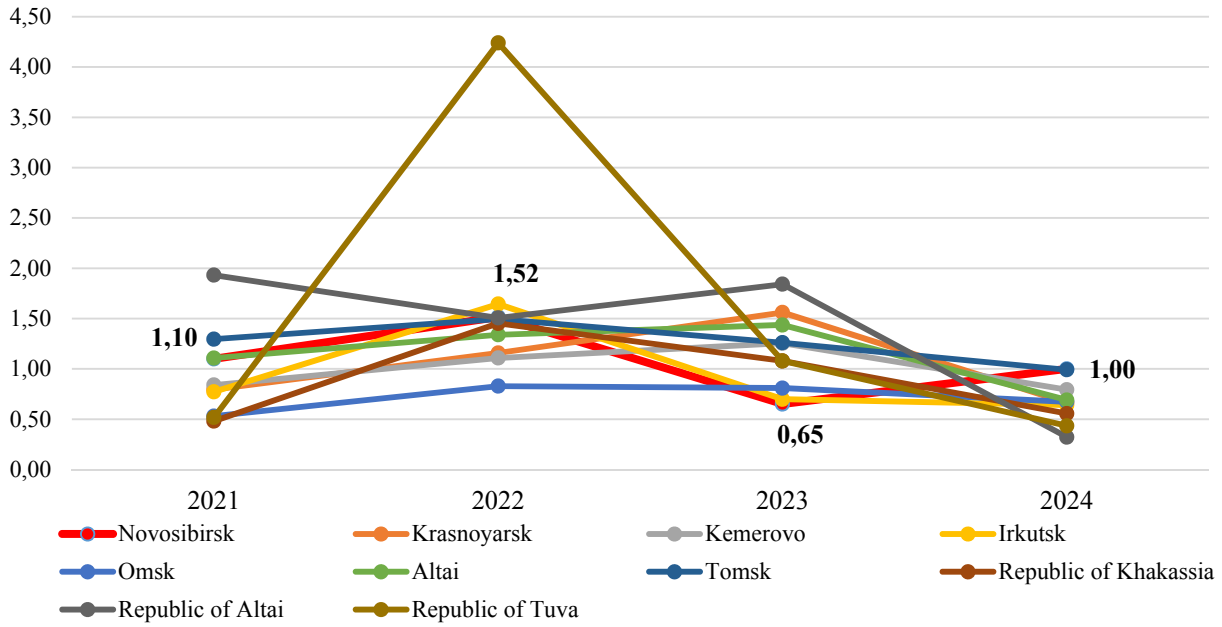

Fig. 19. **The Number of Consumer Complaints per 1000 STP Contracts for the Subjects of the SFD, Units**

Source: Author's calculations.

Table 2

Paired Correlation Coefficients Between the Number for STP Complaints and Indicators of the Risk of Unfair Actions

Indicator	Value
Total risk and complaints regarding CTP	–0.1404
Average insurance payout and complaints regarding CTP	–0.3029
Frequency of insurance cases and complaints regarding CTP insurance	0.2289
Sliding payment ratio and complaints for CTP	–0.1519

Source: Author's calculations.

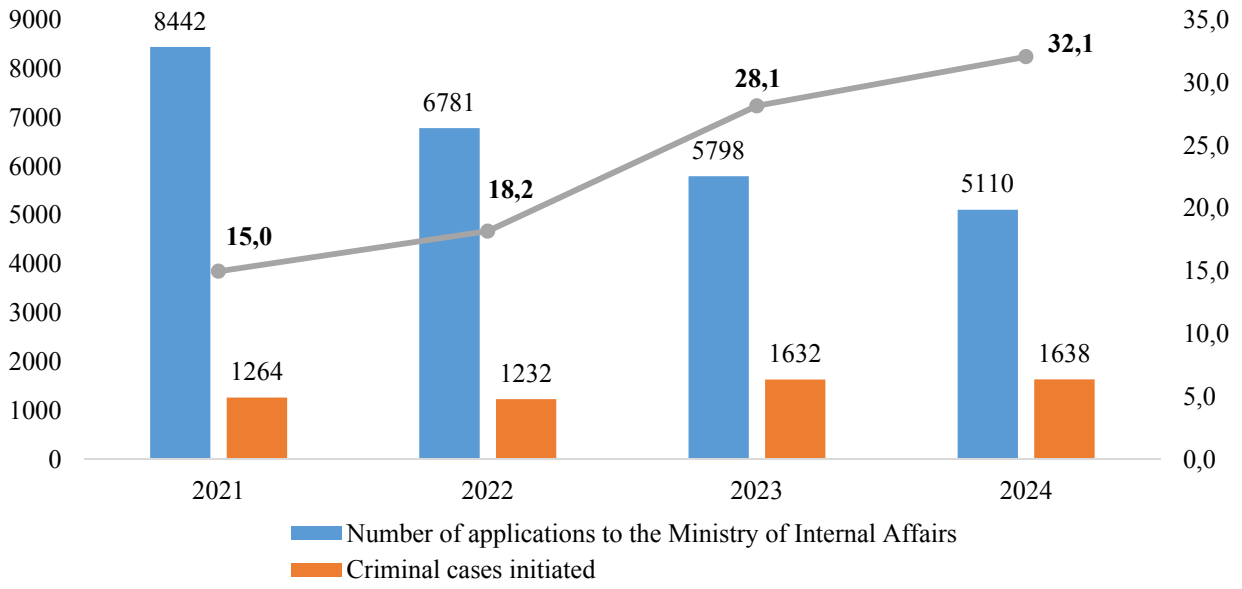

Fig. 20. **Indicators of Criminal Cases for STP in Russia, %**

Source: Author's calculations.

District (NCFD) leads by a wide margin, with a ratio of over 100% or close to it during the monitoring period. The Far Eastern Federal District (FEFD) follows, with the Siberian Federal District (SFD) in third place. The indicator is relatively stable, and in 2024, its growth is noted everywhere.

In the Siberian regions, the rolling payout ratio is volatile. The problematic areas are Novosibirsk Oblast, the Republics of Tuva and Khakassia, where in certain periods the ratio reaches 100% or more.

Fig. 15 shows the sample indicators based on the criterion of "recurrence" of losses as of 01.01.2025.

In the Far Eastern and Siberian Federal Districts, the indicators are the highest, confirming the presence of fraudulent activities in the macroregions. Novosibirsk is the leader in this indicator not only in Siberia but also in Russia — the indicator is 18.5%, which is 4.2 times higher than the average value for the Russian Federation.

Next, the dynamics of the level of complaints regarding the CTP service, which is used as an additional indicator when analyzing unfair practices in CTP, are presented (*Fig. 16–19*).

The highest number of consumer complaints about the CTP service has been recorded in federal districts with high population density and a large number of cars —the Central Federal District, the Volga Federal District, and the Siberian Federal District.

In Siberia, the highest number of complaints also falls on the Novosibirsk region as a zone with an increased risk of unscrupulous actions in CTP. At the same time, the number of complaints is steadily decreasing in all regions. The dynamics of this phenomenon may depend on various factors: changes in the insurance market situation, seasonality, and the insurance culture of citizens. The main reasons cited in consumer complaints were not related to price accessibility, but to actual restrictions when purchasing, disagreement among car owners with the application of the "Bonus-Malus" (BM) coefficient, including due to the activity of electronic BM correction services by third parties and disagreement with the amount of the insurance premium.

The number of complaints per 1 000 CTP contracts has also decreased over the past two years, except in the Southern Federal District

(SFD). This indicator remains quite high in the North Caucasian Federal District (NCFD) and the Far Eastern Federal District (FEFD), which indicates the poor quality of the CMTPL service. It should be noted that in the Siberian Federal District (SFD), the relative number of complaints has halved over the past two years, which is related to the resolution of the service accessibility issue.

By subjects of the Siberian Federal District, the number of consumer complaints per 1 000 contracts is low, including in the Novosibirsk region. The exception is the Republic of Tuva, where in 2022 the figure was 4.2 units (for comparison, the average value for the Russian Federation for the same period was 1.17 units).

Additional risk indicators in CTP, such as the number of consumer complaints, are non-market in nature and therefore do not depend on the dynamics of the main components of total risk. Instead, they are determined to a greater extent by the effectiveness of managerial activities in the regions. This is confirmed by the correlation coefficients between the risk indicators of unfair practices in CTP and the number of complaints regarding this insurance product (*Table 2*).

The coefficients indicate that the correlation between the given indicators is practically absent.

Fig. 20 presents the indicators of criminal cases related to CTP.

The positive dynamics in the number of initiated criminal cases and their ratio to the number of submitted applications indicate an improvement in the efficiency of law enforcement agencies.

WAYS TO REDUCE RISK UNFAIR PRACTICES IN CTP

In the field of combating insurance fraud in auto insurance, the following most effective tools are highlighted:

- improvement of information exchange between participants in the insurance market and regional executive authorities, which is planned to be ensured within the framework of the creation of a unified information system "AIS-Insurance";
- development of interstate agreements to combat fraud between Russia and the CIS countries;
- improvement of video surveillance systems for road traffic participants [15];
- the compilation of "blacklists" of unreliable insurers and agents;
- the creation of public organisations to combat insurance fraud at regional, national, and international levels [17].

Specifically, to address the issue of unscrupulous actions in CTP insurance in regions with increased risk, it is advisable to use a systematic approach that takes into account all factors and measures of influence.

Evaluation and accounting of stimulating and restraining factors in the development of the OSAGO market in regions with similar problems, regular monitoring and assessment of regulatory possibilities by the mega-regulator — timely identification of risk development and response to them, as well as assessment of the changes in the OSAGO situation after the implementation of impact measures.

Thus, as a result of summarizing socio-economic and insurance indicators in several regions of Siberia, the following factors that hinder the development of the insurance market, including in the OSAGO segment, have been identified:

- low level of insurance literacy among citizens and small and medium-sized enterprises (SMEs);
- limited availability of insurance services, which is reflected in the number of physical and remote sales channels, as well as limited financial accessibility in remote and sparsely populated areas;
- agglomeration effects and population density, which provoke an increase in the unprofitability of CTP in cities with high population density;
- the differentiated income levels of citizens, which affect the number of vehicles in use;

• the inertia of insurance market participants, regional executive authorities, and law enforcement agencies in certain regions, taking into account culture and mentality;

• the limited budgetary potential of certain entities of the Russian Federation, which affects the level of activity of interested parties in forming an insurance culture.

Some of the mentioned factors are complex and cannot be managed in the short- and medium-term (for example, budget potential, citizens' income levels). However, they must be taken into account in the implementation of strategic documents in the regions. Other factors can be regulated, including by the mega-regulator and regional authorities (insurance culture level, availability of insurance services).

2. *The implementation of best practices* from regions in preventing fraudulent activities in compulsory motor third-party liability insurance (CMTPL) and the scaling of positive experiences from Russian Federation entities that have managed to reduce the overall risk level or specific indicators.

3. *Formation of unified approaches* to the interaction between law enforcement agencies and insurers, the participation of self-regulatory organizations, the mega-regulator, regional executive authorities, and law enforcement agencies through the creation of interdepartmental working groups and the holding of meetings, including:

• the paper of specialized groups consisting of operational officers, investigators, and detectives to identify and solve crimes in the field of auto insurance;

• the use of methodological materials from insurers by law enforcement, investigative, and judicial authorities (when necessary), with regular updates;

• monitoring compliance with the requirements of legislation on providing information from external surveillance cameras in the field of auto insurance by requesting it from insurers;

• regular assessment of the effectiveness of the financial ombudsman's work in the regions of Russia in terms of pre-trial loss settlement. If the effectiveness of the financial ombudsman's work is found to be low, it is advisable to consider increasing its regional presence in problematic areas[8];

• making changes to the RSA's damage assessment guide to account for regional coefficients of spare parts costs, allowing the use of used parts.

These measures will allow for a reduction in the average insurance payout, bringing it closer to the amount of actual damage, which will help reduce the overall risk of fraudulent activities in the CTP in problematic regions.

CONCLUSION

Within the framework of the study, the problem of fraudulent activities in CTP in the Siberian regions has been substantiated. The causes of the problem are increased loss ratios with negative dynamics, resulting in regions receiving a high-risk assessment for fraudulent activities. The problem is widespread, observed in many regions of Russia due to the specifics of CTP — massiveness and mandatory nature.

As a result of the situation analysis, it was found that the risk level in the Siberian regions is differentiated due to regional differences. The highest risk level is recorded and maintained dynamically in the Novosibirsk. The Irkutsk, the Republics of Tuva and Khakassia also fell into the "red" zone, but subsequently managed to exit it.

The main reasons for the difficult situation in the CTP sector in certain regions are related to the negative economic impact of illegal activities on the CTP system. Such actions are confirmed by increased rates of insurance claims frequency, average insurance payouts, and the "recurrence" of losses. Additionally, the work

[8] In Russia, there are only four branches of the Financial Ombudsman Service in the regions. All complaints are submitted and reviewed remotely.

includes an analysis of consumer complaints regarding the CTP service and the indicators of insurers' interactions with law enforcement and judicial authorities. The increased loss ratio of CTP in certain regions also depends on the level of competition in the insurance market, regional coefficients for the cost of spare parts, the managerial actions of regional and municipal authorities, and climatic and geographical conditions.

It is important to note that CTP is a socially and economically significant type of insurance for the regional economy and the insurance market as a whole, as it shapes public opinion and consumer attitudes towards insurance, determining the pool of trust in the market and authorities. Therefore, it is important to address issues in this area at both the federal and regional levels of governance and self-regulation.

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The Cost of Exemption from Encumbrance of Property Ownership (on the Example of the Cost Indicators of Land Plots)

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ABSTRACT

This article is devoted to the study of cost indicators in relation to "problematic" land plots which have been built with unauthorized construction, contain emergency buildings, or are polluted by waste. Bringing these plots to the appropriate environmental and sanitary-epidemiological standards will lead to significantly higher costs than the cost of this land plot in a condition suitable for commercial or other use. The purpose of this study is to identify the financial principles behind the negative values of property indicators, and how these negative values can become obligations for the owner. To achieve this goal, the author has identified several key tasks: defining the basic principles behind negative value occurrence, describing the economic indicator "cost of exemption from encumbrances on property", and exploring how negative values can become obligations for property owners; a financial toolkit for the use of negative values in valuation activities is proposed. In the course of the research, methods of analysis, generalization, synthesis, comparison, as well as the method of regulatory regulation were used. The author shows and justifies the need to improve the tools of valuation activities, raising the question of the ambiguous understanding and interpretation of such an economic phenomenon as the negative value of property. The study provides recommendations for transforming negative property value into corresponding liabilities of the asset owner. It concludes that negative asset value should be transformed into informal liabilities that are not subject to accounting. It is reasonable to determine the amount of such informal obligations in the amount of the cost of exemption from encumbrance of ownership of property, property rights. The conclusions obtained can be used in the course of evaluation activities, in the implementation of financial analytical procedures during the analysis of the company's activities, in making management decisions, etc.

Keywords: valuation activity; market relations; financial analysis; informal obligations; negative value; imaginary asset; land plot; emergency structure; unauthorized construction; land pollution

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INTRODUCTION

Evaluation activities are an integral part of the economic system of modern society. The results of the assessment (of the value of property, property rights) are used in making managerial decisions, during the control of fiscal authorities, when performing legally significant actions, during court proceedings, etc. [1, 2]. In this study, we will focus on land plots, the value of which (during the evaluation and analytical procedures) is determined as a negative value. At the same time, an effective, reasonable owner will strive to get rid of property that brings only additional costs and losses and will not be able to produce a positive economic effect in the foreseeable future.

The research used methods of analysis, generalization, synthesis, comparison, as well as the method of regulatory regulation. The author shows and justifies the need to improve the tools of valuation activities, raising the issue of an ambiguous understanding and interpretation of such an economic phenomenon as the negative value of property. The study provides recommendations for the transformation of the negative value of the property into the corresponding obligations of the asset owner.

The purpose of the study is to determine the financial principles of the occurrence of negative values of value indicators in relation to property with the further transformation of negative values of financial indicators into obligations arising from the owner of this property.

To achieve this goal, it was necessary to solve the following tasks:

- to determine the basic principles of the occurrence of negative values;
- to describe the economic indicator "the cost of exemption from the encumbrance of ownership of property, property rights";
- to propose financial instruments for using the negative values in evaluation activities.

RESEARCH

Let's consider some possible examples of the existence of such variants of property (in particular, land plots) that have negative values for cost indicators.

The Object of Accumulated Environmental Damage

This concept is disclosed in the current legislation: "objects of accumulated environmental damage — territories and water areas where accumulated environmental damage has been identified, capital construction facilities and waste disposal facilities that are the source of accumulated environmental damage".[1]

At the same time, chemical, nuclear or other hazardous waste may be placed on the land, the elimination (destruction) of which will lead to significant financial costs. Current legislation provides for a special procedure for the disposal of such industrial waste.[2]

The described objects of accumulated environmental damage may also include landfills (landfills, etc.): "waste disposal facilities are specially equipped facilities designed to dispose of waste (landfill, sludge storage, including a slurry barn, a tailings dump, a rock dump, etc.) and include waste storage facilities and disposal facilities waste disposal facilities" (in the same document, the concepts of "waste disposal facilities" and "waste storage facilities" are disclosed).[3] Garbage and waste disposal activities (of various categories) can generate income, at least until the possible volumes of their disposal are developed [3]. At the same time, it is possible to effectively use waste to obtain secondary raw materials [4] or electricity [5].

However, in the current situation, the waste disposal facility does not provide economic

[1] Article 1 of Federal Law No. 7–FZ dated 10.01.2002 "On Environmental Protection".

[2] Federal Law No. 89–FZ of June 24, 1998 "On Production and Consumption Waste".

[3] Article 1 of Federal Law No. 89–FZ dated 06/24/1998 "On Production and Consumption Waste".

benefits (the landfill has reached its capacity, is closed due to court order, recycling of garbage is impossible, etc.).

In the situation under consideration, the business entity owns a land plot, which is, in essence, an object of accumulated environmental damage. It should be noted that for "storage, disposal of industrial and consumer waste (waste disposal)" there is a "fee for negative environmental impact".[4] At the same time, further use of this land plot is impossible in the foreseeable future (the object will not bring economic benefits), but the owner is obliged to bear the costs of disposal and maintenance of the land plot in accordance with sanitary and epidemiological standards. However, failure to comply with these standards will result in costs in the form of penalties. The regulations in force in Russia provide for administrative liability for "non-compliance with environmental and sanitary-epidemiological requirements during collection, storage, use, incineration, processing, neutralization, transportation, burial and other handling of industrial and consumer waste or other dangerous substances";[5] for "destruction of the fertile soil layer, as well as damage to land as a result of violations rules for handling pesticides and agrochemicals or other substances and production and consumption wastes that are dangerous to human health and the environment";[6] for "pollution of glaciers, snowfields or ice cover of water bodies, or pollution of water bodies containing natural medicinal resources, or classified as specially protected water bodies, places of tourism, sports and mass recreation, by production and consumption wastes and (or) harmful substances, as well as burial of harmful substances (materials) in water bodies";[7] for "violation of the rules for the disposal of waste and other materials in internal sea waters, in the territorial sea, on the continental shelf and (or) in the exclusive economic zone of the Russian Federation";[8] for "violating the rules of sanitary safety in forests".[9] The current legislation also provides for criminal liability for environmental offenses, for example, "violation of the rules for handling environmentally hazardous substances and waste".[10] Consequently, the legislation provides for criminal and administrative liability (including financial sanctions) for environmental pollution through the dumping of industrial or household waste (failure to implement waste disposal measures in accordance with the prescribed procedure). It should be noted that such norms of criminal and administrative liability for violation of environmental legislation are common in developed countries [6, 7]. The need to comply with environmental legislation leads to the formation in Russia of a pronounced tendency to increase capital investments and expenditures on environmental protection measures [8], which also confirms the idea of the formation and development of the obligation of an operating business to bear more and more environmental costs.

Land Plots for Which Expensive Land Reclamation Measures Are Envisaged (Provided That the Costs for Them in the Foreseeable Future Exceed the Cost of the Land Plot in an Ecologically and Sanitary-Epidemiologically Normal Condition)

"Land reclamation is the fundamental improvement of lands through hydraulic engineering, cultural engineering, chemical, erosion control, agroforestry, agrotechnical and other land reclamation measures".[11]

[4] Article 16 of Federal Law No. 7-FZ dated 10.01.2002 "On Environmental Protection".

[5] Article 8.2 "Code of Administrative Offences of the Russian Federation" dated 30.12.2001. No. 195-FZ (hereinafter referred to as the Administrative Code of the Russian Federation).

[6] Article 8.6 of the Administrative Code of the Russian Federation.

[7] Article 8.13 of the Administrative Code of the Russian Federation.

[8] Article 8.19 of the Administrative Code of the Russian Federation.

[9] Article 8.31 of the Administrative Code of the Russian Federation.

[10] Article 247 of the Criminal Code of the Russian Federation dated 13.06.1996 No. 63-FZ (hereinafter: the Criminal Code of the Russian Federation).

[11] Article 1 of Federal Law No. 4-FZ dated 10.01.1996 "On Land Reclamation".

Land reclamation measures often lead to an improvement in land quality and, as a result, to an increase in the value of land plots [9, 10]. However, if the analyzed land plots are significantly depleted, a situation may arise when the costs of land reclamation exceed (in monetary terms) the cost of these land plots in their current condition. A similar situation is possible when the land was intensively exploited, but land reclamation measures were not carried out on time and in full. In this case, the estimated value of the land plot, from a mathematical point of view, may have a negative value.

A Land Plot Built up with a Building or Structure in Disrepair That Cannot Be Restored or Reconstructed

It is necessary to understand that "the owner bears the burden of maintaining the property belonging to him, unless otherwise provided by law or contract".[12] The owner of the property is obliged to incur financial expenses for the liquidation of this emergency building [11]. He is also responsible for compensating losses to third parties if there are negative consequences from this emergency facility that are not eliminated by the owner in time. At the same time, the operation of the facility is impossible according to the technical parameters. In this example, it is assumed that the cost of the materials and scrap metal received during the liquidation of the real estate object, as well as the land plot released from real estate, is significantly lower than the cost of the liquidation of the emergency object itself. The land plot on which the building is located in a state of disrepair, unsuitable for operation, may have a negative value.

A Land Plot on Which Construction Is Not Allowed, with Unauthorized Real Estate

Such a plot of land may also have a negative value from an economic point of view. It should be noted that "unauthorized construction is a building, structure or other structure erected or created on a land plot that has not been provided in accordance with the established procedure, or on a land plot whose permitted use does not allow the construction of this object on it, or erected or created without obtaining the necessary approvals, permits or with the consent of the state. violation of urban planning and building regulations, if the permitted use of the land, the requirement to obtain appropriate approvals, permits and (or) the specified urban planning and building regulations are established on the date of commencement of construction or creation of unauthorized buildings and are valid on the date of detection of unauthorized buildings".[13] If, with a high degree of probability, it can be argued that the owner, by a court decision (taking into account all judicial instances), will be obliged to liquidate (demolish) an unauthorized facility (and at his own expense) [12] and the cost of demolition work (minus suitable materials, scrap metal) will exceed the cost of the vacated land, then in this case, there is, from a mathematical point of view, a negative value of the property.

Negative Cost: the Principle of Occurrence

All of the above examples may have positive values of cost indicators in relation to the analyzed property (land plots), however, for this study, situations have been selected when the real estate object (with all rights, obligations and encumbrances) has, from a mathematical point of view, a negative value, i.e. the property not only does not bring economic benefits, but also and it obliges the owner to constantly bear expenses: this particular object leads to a negative cash flow. A negative cash flow indicates that the owner spends more than he earns (or earns nothing at all) from this property.

For a clearer understanding of this issue, here is a theoretical example.

[12] Article 210 "The Civil Code of the Russian Federation (Part One)" dated 30.11.1994 No. 51-FZ (hereinafter: the Civil Code of the Russian Federation).

[13] Article 222 of the Civil Code of the Russian Federation.

The organization owns the land on which the building is located in a state of disrepair. The use of this facility is impossible in principle due to its technical condition. At the same time, there are risks that the structure will collapse on its own and may lead to losses to third parties, damaging nearby buildings during its destruction. In this example, the value of a land plot without an emergency building located on it costs 1.000.000 monetary units and the cost of demolishing the building, cleaning up construction debris and bringing the land for the proposed sale or construction of a new facility will amount to 1.500.000 monetary units. Thus, mathematically, the cost of a land plot with a building in disrepair is a negative value. (1 000 000–1 500 000 = –500 000). From a financial point of view, it is reasonable to consider (minus) 500.000 monetary units in assets as a liability in the amount of 500.000 monetary units. When determining the amount of net assets of a given organization, regardless of where the cost indicator will be reflected in the calculation (in assets with a "–" sign, or as part of liabilities), it will not affect the total amount of net assets being determined.

Now let's turn to the analysis of the existence of cost indicators with a negative value. Let's consider the principle of the occurrence of negative value in relation to individual assets. From an economic point of view, a negative value for an asset arises when the seller is willing to pay extra to the buyer who takes (acquires) his products, paying extra for it, rather than receiving cash. Similar situations are possible in the production of oil (gas) or other natural resources [13, 14] or in the production of electricity [15], when it is impossible (economically impractical) to stop the production process, and the producer is unable (to the full extent) to store the produced product (electricity, oil). Therefore, (for a certain period of time), a situation may arise when the seller (for economically justified reasons) is ready to pay extra for the products produced to the consumer, who takes the result of production in the current mode.

As already described, the probability of obtaining, from a mathematical point of view, a negative value of the property is possible. Despite the existence of such an economic phenomenon as "negative value indicators" in relation to individual assets (property, property rights), many economists deny the possibility of negative market value. Let's analyze the opinions of researchers and practitioners on this issue.

Regarding the validity of the existence of a negative value of property, there are two opposing points of view:

- when determining, from a mathematical point of view, the negative value of property values, the value of the property should be determined in the amount of 0 rubles[14] (or, alternatively, 1 ruble is the conditional theoretical value of a positive value indicator);[15]
- a negative value of the property is possible [16], while it can be reclassified (transformed) into the obligations of the owner of the property [17].

Let's consider the arguments from both points of view. Many researchers and practicing appraisers adhere to the idea that the value of property cannot have a negative value, since any property is worth something, and value is a positive value [18]. A similar idea is also present in paragraph 3 of the Methodological Clarifications,[16] according to which "with zero / negative economic utility, it is recommended to indicate the evaluation

[14] Letter from the Bank of Russia to the inquiry "What is the estimated value of an investment unit of a mutual investment fund (hereinafter referred to as the fund) to be indicated in the certificate of the net asset value of the fund if the net asset value of this fund is negative?" The question is the answer. Bank of Russia: official website. 2017. URL: http://www.cbr.ru (accessed on 28.09.2017).

[15] Methodological clarifications on the issue of zero / negative estimated value No. MP-1/21 dated 18.10.2021 (approved by the Association SROV "Expert Council" and the Union of Forensic Experts "Expert Council").

[16] Methodological clarifications on the issue of zero / negative estimated value No. MP-1/21 dated 18.10.2021 (approved by the Association SROV "Expert Council" and the Union of Forensic Experts "Expert Council").

result in the form of 1 (one) conditional ruble (the minimum whole monetary unit of the Russian Federation)". Similar principles are reflected in the Bank of Russia's position on negative valuation.[17] The essence of the answer boils down to the following: "if the net asset value of the fund at the time of determining the estimated value of the investment unit of the fund is negative, the estimated value of the investment unit of the fund at the relevant reporting date should be recognized as zero," i.e. when mathematical tools determine the negative value of the property (in this answer, in relation to the estimated value of the investment unit of the fund), it is determined that the value of the property is recognized as zero. In addition to the above point of view about the inadmissibility of a negative value of property, there is also an opposite one, according to which the existence of a negative value of property is permissible [16–21]. This statement is supported by European valuation standards, which, in particular, states that "a negative value is a value that represents the legal and, consequently, financial responsibility of the user or owner of real estate. Negative value occurs when real estate objects, in accordance with physical, legal, financial or contractual obligations related to a legal interest, generate real or hypothetical negative cash flows or require significant costs to restore them. Such property becomes a liability or a negative value".[18]

Since in the Russian practice of valuation procedures, most experts are of the opinion that a negative value of the market value of property is unacceptable, it is advisable (if a negative value of the cost indicators is established) to transform the negative value of the asset (from a financial point of view) into the obligations of the owner of this property. This will be especially relevant when carrying out valuation and financial and analytical procedures during the assessment of the value of a business or property complex as a whole.

If the owner has property or property rights to assets that no longer bring and cannot bring economic benefits in the foreseeable future (that is, they have lost all the signs of an asset, including the ability to generate income), then such property creates a negative cash flow. At the same time, in the course of valuation and other financial and analytical procedures, it is advisable to use the concept of "**the cost of exemption from the encumbrance of ownership of property, property rights**". It refers to the costs that an owner must incur in order to get rid of the burden of owning unnecessary, inefficient property (property rights) that does not, cannot, and will not bring economic or other benefits in the foreseeable future. Ownership of property or property rights obliges now or will oblige the owner in the future to bear the costs associated with the ownership of this property or property rights. From a financial point of view, it is advisable to consider such an economic category as "the cost of exemption from the encumbrance of ownership of property, property rights" as one of the options for informal obligations, i.e. the obligation of an organization to make expenses in the foreseeable future to legally get rid of ownership of unnecessary property that encumbers the organization [22].

An informal obligation is an existing or probable financial commitment of an economic entity. It arises from past or predicted events that may lead to an organization losing resources containing economic benefits. An informal obligation does not meet the qualifications inherent in the concept of "obligation" in accordance with the accounting paradigm. Informal obligations in terms of imaginary obligations that are unreasonably accounted for and reflected in accounting and reporting registers are

[17] Letter from the Bank of Russia to the inquiry "What is the estimated value of an investment unit of a mutual investment fund (hereinafter referred to as the fund) to be indicated in the certificate of the net asset value of the fund if the net asset value of this fund is negative?" The question is the answer. Bank of Russia: official website. 2017. URL: http://www.cbr.ru (accessed on 28.09.2017).

[18] European TEGOVA Real Estate Valuation Standards.

excluded from the amount of commitments taken into account when determining the value of an organization.

The concept of an "informal obligation" has rather broad boundaries, including the terms "imaginary obligation", "obligation that has lost some of its qualification characteristics in the process of transformational changes during significant transformations of an economic entity", "hidden obligation" that is not subject to reflection and evaluation in accounting, as well as such economic categories as "economic analog obligations", "probabilistic obligations" and other commitments and liabilities that do not have all the qualifying features of an obligation.

Informal obligations are defined as such from the point of view of the existing accounting rules and they are not subject to reflection in accounting and financial (accounting) statements. However, there is reasonable assurance that such obligations (informal obligations, from the point of view of existing accounting rules) have sufficient features within the relevant economics, discipline or field to be recognized as an obligation and can be used for valuation procedures, management accounting, financial analysis, business planning and other analytical procedures not regulated by accounting rules [19].

From a financial point of view, no effective owner will acquire property in respect of which a negative value has been established (by calculation using mathematical tools). At the same time, the existing owner cannot get rid of an unnecessary and inefficient asset without spending more money on it than he will receive from the new owner for this property: bringing the property into a condition suitable for sale on the open market for a price of positive value will require spending significantly more financial resources (demolition and disposal of emergency construction, unauthorized construction of a building, or cleaning of a land plot from garbage or pollution to a level consistent with environmental and sanitary-epidemiological standards).

CONCLUSIONS

Summing up, it is safe to say that under certain conditions, the owner may own an asset (in this case, a land plot), which, from a mathematical point of view, may have a negative value. The issues of the existence of a negative value of asset values have not been worked out by the scientific community at the moment. This study shows the principle of preserving the scientific view that it is unacceptable to have a negative value of property through the transformation of the corresponding economic category of negative value of property (from a mathematical point of view) into liabilities, which from a financial point of view affects the amount of net assets (own funds) of an economic entity is identical. In this context, it is possible to speak about the reasonableness, from a financial point of view, of the following statement: "negative value of property = obligations (the projected amount of expenses necessary to be released from the encumbrance of property ownership)". The projected amount of expenses that an owner needs to incur in order to get rid of the encumbrance of property ownership is the cost of getting rid of the encumbrance of property ownership determined in this study. It is advisable to consider the negative value of property values, from a financial point of view, as an informal obligation that is not subject to accounting. At the same time, it is reasonable to determine the amount of such informal obligations in the amount of the cost of exemption from the encumbrance of ownership of property and property rights. The practical significance of the results of these studies lies in the possibility to consider and justify the occurrence and presence of negative (from a mathematical point of view) values of property, transforming this negative value into obligations (from a financial point of view) of the owner. The described

principle of financial transformation of negative asset values into liabilities can lead to the development of a unified position in the scientific community on the existence (or impossibility of existence) of negative asset values. The introduction and use of appropriate financial and analytical tools will make it possible to carry out financial, valuation and other analytical procedures more clearly and effectively.

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Sustainability Analysis of the Chemical Industry in the Period of Transformation Using an Institutional Approach

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ABSTRACT

The **relevance** of the study is related to the need to monitor the sustainability of business and improve the institutions of its regulation during the period of transformation of the national economic model focused on technological sovereignty. In this regard, the **purpose** of the study was to develop a methodology for analyzing the sustainability of business models of behavior of companies in the chemical industry using an institutional approach to assess the influence of institutional aspects on the performance of companies belonging to different institutional groups, as well as assessing the transformation in general. The **scientific novelty** of the study lies in the development of analytical tools for assessing the behavior of companies of various institutional groups, which allows us to identify ongoing trends and acts as a navigator for the structural transformation of the industry. According to the results of the study, the most significant institutional factors of the efficiency and sustainability of business behavior models that influence the effectiveness of transformation are participation in government procurement and the mandatory external audit. The author's approach to the formation of institutional groups of companies based on criteria for assessing their business behavior model from the perspective of operational efficiency, investment activity, and financial stability is of **theoretical significance**. The **practical value** lies in the development of an algorithm for identifying points of promising economic growth and indicators for assessing industry transformation to provide support to companies with the greatest multiplier effect. The results obtained can be used in the implementation of priority projects of technological sovereignty and projects of structural adaptation of the economy, as well as the concept of technological development of the Russian Federation for the period until 2030, as a tool for monitoring their implementation and determining the vector of development of priority sectors of the economy, searching for new potential points of economic growth, attracting public and private investments. The proposed tools may be in demand for selecting effective participating organizations in the system of public procurement and government support for business.

Keywords: sustainable development; chemical industry; institutional approach; business model of behavior; the economic growth; transformation assessment indicators; import substitution; investment activity; risks

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INTRODUCTION

The current geopolitical situation requires a large-scale transformation of the national economic model, the key vectors of which have been defined by the Government of the Russian Federation in the priority areas of technological sovereignty projects and structural adaptation projects of the economy,[1] as well as in the Concept of Technological Development for the period up to 2030.[2] This sets the task of improving financial instruments for attracting public and private investments, forming an adequate system for monitoring and controlling the development of priority sectors using transformation indicators, and assessing company behavior to identify potential points of economic growth.

The choice of the chemical industry for studying the processes of transforming the national economic model is due to the high significance of the industry as a high-tech sector and one of the key drivers of economic growth during the period of active import substitution to ensure Russia's technological sovereignty. The advanced development of the industry is associated with the large-scale "chemicalisation" of the national economy. In particular, the restriction of oil and gas exports requires the development of innovations in the production of high value-added products from these raw materials, with the prospect of forming a circular economy that allows for the rational use of resources and achieving the decoupling effect (growth in production while reducing its resource intensity). Along with the problems (dependence on foreign technologies, high level of wear and tear of production equipment, negative external environmental externalities, low added value of produced goods), the chemical industry has important advantages (resource availability, growing demand, need for innovations, potential for import substitution). The sanctions policy regarding the chemical industry does not include direct sanctions limiting producers, but it manifests through personal sanctions on the owners and executives of the largest enterprises, logistical problems; difficulties in international settlements for exported products; refusal of foreign buyers to purchase Russian products or demands for discounts on supply prices; difficulties in obtaining licenses for the supply of imported materials and equipment. At the same time, the imposed sanctions also open up opportunities for industry development related to the freeing up of market niches and import substitution. Thus, an audit by the Ministry of Industry and Trade showed that "out of 79 chemical products banned for sale in Russia, technical sovereignty has been ensured for 38".[3] Experts note an increase in the performance indicators of innovative activities in 2022, which may be related to the stimulation of demand for innovations due to sanctions [1].

The purpose of the study is to develop a methodology for analyzing the sustainability of business models of companies in the chemical industry using an institutional approach to assess the impact of institutional aspects on the performance of companies belonging to different institutional groups, as well as to evaluate the transformation as a whole, including the development of tools for identifying points of promising industry growth to attract investments and provide state support to companies with the greatest multiplicative effect.

METHODS AND METHODOLOGY OF RESEARCH

The research methodology is based on the results of scientific papers by Russian and

[1] On the approval of priority areas for projects of technological sovereignty and projects of structural adaptation of the economy of the Russian Federation: Resolution of the Government of the Russian Federation from 15.04.2023 No. 603.

[2] On the approval of the Concept for Technological Development for the period up to 2030: Order of the Government of the Russian Federation from 20.05.2023 No. 1315.

[3] URL: https://www.vedomosti.ru/business/articles/2022/09/30/943198-minpromtorg-provel-audit-himicheskoi-promishlennosti (accessed on 06.05.2025).

foreign scholars, arguments, hypotheses, and the professional judgement of the authors of this paper, as well as on the fundamental principles of the theory and practice of industry analysis, the institutional approach, information resources available in the digital environment, and methods of financial and mathematical-statistical analysis. The current geopolitical situation not only poses a threat to Russia's economic growth but also serves as a powerful impetus for large-scale structural changes on a qualitatively new basis. This is indicated in the works of scholars A. G. Aganbegyan [2], V. V. Ivanter, B. N. Porfiyrev, D. E. Sorokin, M. A. Eskindarov, V. V. Maslennikov, A. A. Shirov [3], S. D. Bodrunov [4], M. A. Fedotova, and T. V. Tazihina [5]. The most significant risk factors for the transformation of the Russian economy and its sustainable development, according to scientists, are structural and technological restructuring, accelerated growth of investments in production modernisation, increased spending on research and development, which may not yield positive results (O. V. Efimova [6]), and the reduction of dependence on imports and technological backwardness of the Russian economy [7]. The influence of institutional aspects on the sustainability and efficiency of economic entities has been examined by foreign and Russian scholars who developed the theory of economic growth (C. Ménard [8], G. B. Kleiner [9]), the theory of institutional changes, and the theory of dysfunctions (O. S. Sukharev [10]). Among the scholars studying the problems of institutional transformation of the economic model of the Russian economy, it is worth mentioning V. L. Tambovtsev [11], O. S. Sukharev, and S. Yu. Glazyev. Scientists emphasize the expansion of the institutional approach vector by incorporating microanalysis, which allows for the assessment of the impact of institutional factors on the stability of the economy and its economic growth in the short term. In this context, O. S. Sukharev points out the high need to search for new research methods due to the high complexity and heterogeneity of the research objects, and the dependence of the assessment of the "impact of institutional aspects on the quality of rules, which is difficult to quantify" [12]. According to S. Yu. Glazyev, underestimating such influence leads to limitations in the strategic planning of ecosystem development [13]. Scientists G. B. Kleiner, M. A. Rybachuk, and V. A. Karpinskaya rightly point out that under conditions of high geopolitical risks, industry analysis allows for "foreseeing crises and preventing their consequences, which is impossible if limited to macro analysis alone" [14]. According to scientists Yu. V. Simachev, A. A. Fedyunina, and M. G. Kuzyk [15], the institutional approach allows for the study of real processes in different dimensions, which makes it possible to assess ongoing transformations from the perspective of the effectiveness of state policy in achieving multiplicative effects, particularly through the support of industries and companies that ensure such effects. Thus, the hypothesis of our research aligns with the views of many authoritative scholars and posits that the institutional approach allows for the identification of ongoing trends and can serve as a navigator for the structural transformation of the economy, state support for economic entities with the greatest multiplicative effect, which can contribute to the acceleration of the qualitative restructuring of the sectoral structure of the country's economy.

The *Figure* presents a methodology for analyzing the sustainability of business models of enterprises in the chemical industry during the period of economic transformation using an institutional approach. The analysis of macroeconomic and market factors involves assessing the potential of the chemical industry as a condition for successful transformation. Analysis of the industry structure based on various institutional characteristics allows

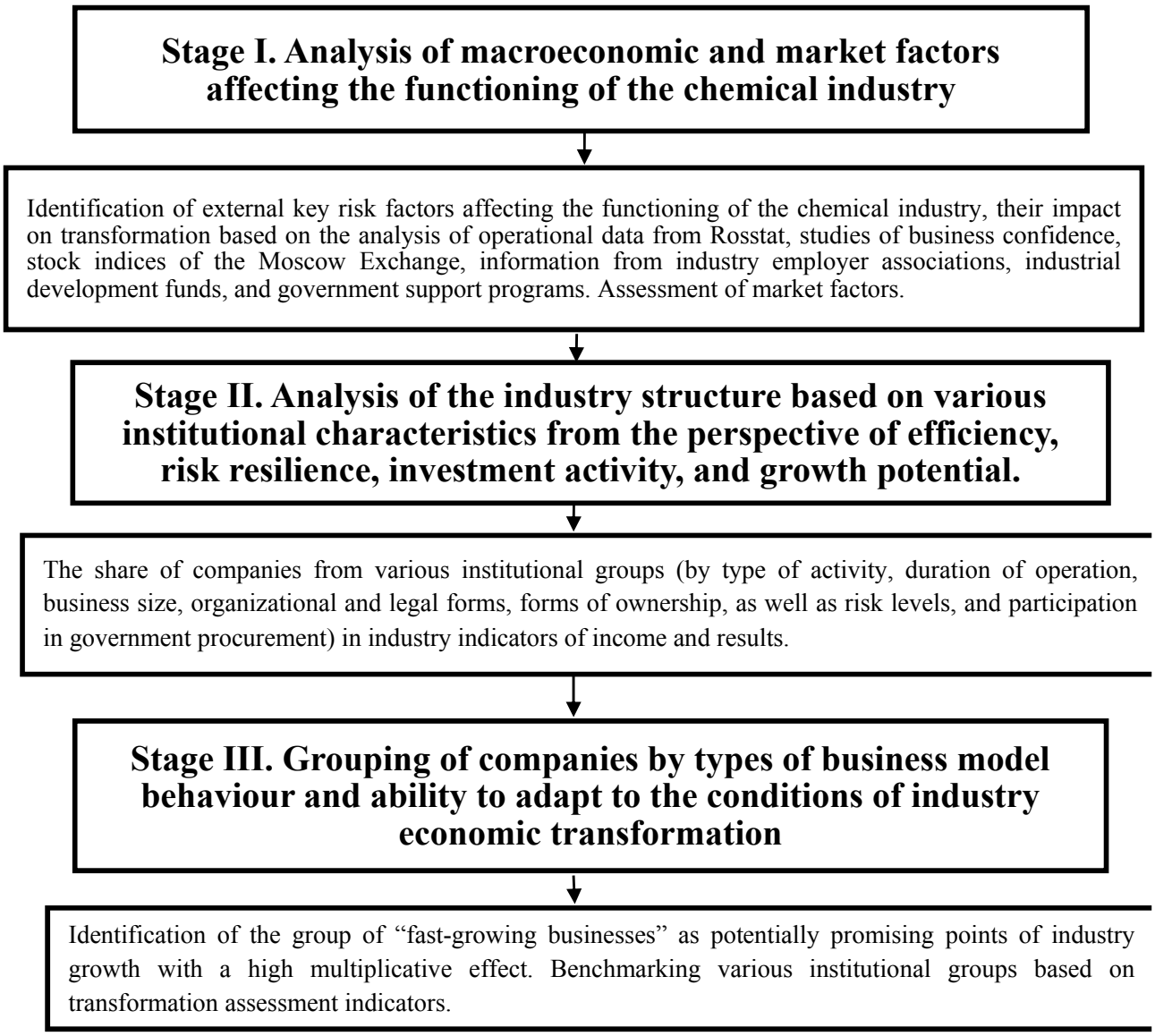

Fig. **Stability Analysis Methodology of Business Models in the Chemical Industry Enterprises During the Economic Transformation Period Using an Institutional Approach**

Source: Compiled by the authors.

for a better understanding of emerging trends from the perspective of the institutional approach. It is based on calculations of the share of aggregated indicators of companies from different institutional groups (by type of activity, duration of operation, size (type), organizational and legal forms, forms of ownership, exposure to risks, participation in public procurement, etc.), as well as the assessment of their share in revenue, assets, and net profit in aggregate indicators across the industry sample.

From the authors' perspective, the business model of company behavior evaluates the overall integrated policy of its sustainable development in accordance with the national strategy for economic transformation, focused on innovation and technological sovereignty. The business model of behavior describes the vector for achieving sustainable development goals through the establishment of indicators of operational efficiency, investment activity, and financial stability as results of the aggregated impact of key risk factors [16].

Table 1

Indicators of Institutional Groups of Companies by Age

Age of companies, years	Share in the number of enterprises, %	Share in equity capital, %	Share in assets, %	Share in revenue, %	Share in net profit, %	Average revenue of the enterprise, million rubles
<4	7.64	0.28	0.91	1.58	0.89	436
4–8	20.79	5.42	7.9	7.13	4.1	723
8–12	18.1	17.83	14.79	11.46	24.51	1 335
12–16	13.46	6.79	6.48	10.05	8.13	1 574
16–20	12.21	5.08	8.42	11.89	7.29	2 053
20–24	10.77	26.90	25.22	21.6	19.54	4 227
24–28	8.14	11.39	10.45	13.77	10.31	3 567
28–32	3.94	6.04	6.13	5.62	4.92	3 001
>32	4.95	20.27	19.69	16.9	20.31	7 200
Total	100	100	100	100	100	2 108

Source: Compiled by the authors.

For the grouping of enterprises by types of business model behavior and their ability to adapt to transformation conditions, the approach of D. Birch [17] was used, which distinguished: gazelle enterprises (high-growth firms, HGFs), which account for a significant portion of production growth in the industry without having a significant share in industry sales; elephant enterprises — large, including state-owned; lion enterprises with an aggressive growth investment strategy aimed at acquiring control over other organizations; mouse enterprises — small enterprises that account for less than half of industry sales.

The author's position is supported by the research of scholars A. Moeuf, R. Pellerin, S. Lamouri, and others [18] on the impact of rapidly growing companies and startups on the qualitative transformation of the economy. Thus, the approach we used, based on the institutional characteristics of companies, allows us to assess the differences in the degree of adaptation to uncertainty risks of companies belonging to different institutional groups during the transformation period, as well as the potential to identify points of promising sectoral growth through companies with the highest multiplicative effect.

RESEARCH RESULTS

The study was conducted using object-level data from the Spark-Interfax information resource on companies in the chemical industry for 2018–2022, aggregated by various institutional criteria, including participation in public procurement, exposure to risks, and others. The sample included 1 597 organizations related to chemical production (OKVED 20 Production of chemical substances and chemical products) with revenue of 120 million rubles or more.

At the first stage, macroeconomic and market factors of the chemical industry were evaluated. The sources included aggregated data from Rosstat on production dynamics, sales, business confidence, reports from the XI Moscow International Chemical Forum,

Table 2

Indicators of Institutional Groups of Companies by Revenue

Revenue, million rubles	Share by number of enterprises, %	Share in equity capital, %	Share in assets, %	Share in revenue, %	Share in net profit, %
<200	25.74	1.03	1.27	1.89	1.05
200–5 200	68.32	16.20	20.39	28.98	14.93
5 200–10 200	2.57	6.89	8.12	8.73	5.66
10 200–15 200	0.81	3.84	3.87	4.76	3.03
15 200–20 200	0.69	13.76	10.96	5.77	5.31
20 200–25 200	0.31	1.43	1.93	3.15	1.64
>25 200	1.57	56.85	53.46	46.74	68.37
Total	100.00	100.00	100.00	100.00	100.00

Source: Compiled by the authors.

indices from the Moscow Exchange, as well as government programs for subsidizing investment projects in priority industrial sectors. According to Rosstat,[4] in June 2022, the business confidence index in the raw materials sector was negative (–1.3); in the manufacturing industry, it was 6.5. However, starting from the IV quarter of 2022, the index has been in the positive zone: in June 2023, it was 4.5 in the manufacturing industry; in the raw materials extraction sector, it was 2.5, primarily due to a 30% reduction in potash fertilizer exports due to the blockage of products in Baltic ports and a decline in ammonia and methanol production due to the closure of the main ammonia pipeline to Europe. In the first half of 2023 compared to 2022, the production of chemical substances and chemical products increased by 2.1%, while for certain types of products, a higher growth was observed: the production of rubber products increased by 15.7%, plastic products by 4.2%, and chemical fibers by 12.7%. The results of the Russian chemical complex's activities in 2022 received a good assessment at the ChemiCos 2023 exhibition: production volume reached 7.7 trillion rubles, which is 13% higher than in 2021, and the export of chemical industry goods in 2022 increased by more than 20%.[5] This was achieved thanks to state support for the chemical industry. The total amount of funding exceeded 34 billion rubles, including loans from the industrial development fund. In 2022, 11 new chemical component production facilities were launched, including for the pharmaceutical, construction, food, and several other industries, and 39 projects were supported through government orders totaling 4 billion rubles from the reserve fund of the Government of the Russian Federation.[6]

The chemical industry has high investment attractiveness, as evidenced by the cumulative

[4] Dynamics of industrial production in June 2023. URL: https://rosstat.gov.ru/folder/313/document/212897 (accessed on 06.05.2025).

[5] In Russia, the export of chemical industry goods has increased by 20%. URL: https://rg.ru/2023/03/21/v-rossii-na-20-vyros-eksport-tovarov-himicheskoj-promyshlennosti.html (accessed on 06.05.2025).

[6] XI Moscow International Chemical Forum. Russian Chemical Society. URL: http://www.ruschemunion.ru/news/lastest_news/id3922.html (accessed on 06.05.2025).

growth of the MOEXMM — Chemistry and Petrochemistry sector index on the Moscow Exchange[7] by 23% in the first half of 2023 (from 30 988.92 on 31.12.2022 to 38 269.94 on 31.06.2023). This, first and foremost, speaks of investors' faith in the strengthening of the financial condition of industry enterprises through state support, as well as the reorientation of major players such as Sibur, EuroChem, UralChem, and PhosAgro towards the domestic consumer and the pivot to the East, as evidenced by the increase in export volumes to China.[8] However, in the structure of the industry's export operations, products of the second processing stage (fertilizers) still dominate, while in imports, products of the third processing stage with high added value (plastics, perfumery, cosmetics, toiletries) prevail.

To understand the conditions of the industry's functioning, we conducted an analysis of entry barriers and economies of scale. The analysis of institutional groups of companies by duration of operation shows that the number of enterprises that managed to enter the industry within 4 years was 7.64%, which means that the administrative barriers of the industry are quite surmountable. However, the penetration rate (the share of industry sales held by new entrants) is low (1.58% of revenue), indicating high economic and behavioral entry barriers that new enterprises will be able to overcome and reach the industry average size (over 2 billion rubles) within 16 years of operation (*Table 1*).

At the same time, it should be noted that the industry is characterized by a significant positive effect of scale, as evidenced by the results of calculations: enterprises with revenues exceeding 25 billion rubles account for 46.74% of the revenue and 68.37% of the net profit (*Table 2*).

Thus, the chemical industry is characterized by relatively high economic and behavioral entry barriers, including the scale effect, which contributes to the formation of concentrated market structures in certain market segments, involving producers with significant market power.

In the second stage, an assessment of the industry structure was conducted based on the grouping of companies according to various institutional characteristics, including performance, stability, investment activity, and growth potential. The industry is divided into 6 sub-industries. A significant share of the industry's revenue (60.4%) is accounted for by the production of basic chemicals, fertilizers, and nitrogen compounds (OKVED 20.1), which is the most investment-attractive (large business with high product margins, accounting for 77.4% of the industry's net profit). The second most significant sub-industry is the production of soap and detergents, cleaning and polishing agents (OKVED 20.4), which accounts for 17.2% of the industry's revenue. The predominant organizational and legal form of business is limited liability companies (57.5% of the industry's revenue), while the most profitable are public joint-stock companies (19% of revenue and 25% of net profit). In the institutional structure of the industry, the private form of ownership dominates: the share of such companies in revenue is 63%, in net profit — 51.93%, which indicates relatively low operational efficiency and the presence of unprofitable enterprises. Companies with joint private and foreign ownership have the highest margin, accounting for 12% of revenue and 28% of net profit.

Grouping of industry companies by business size showed that 80% of revenue comes from large enterprises, which are also the most profitable (90% of industry profit). The business subject to mandatory audit turned out to be more efficient: with 89.3% of

[7] Indices of the Moscow Exchange for Chemistry and Petrochemistry. URL: https://www.moex.com/ru/index/totalreturn/MECHTR (accessed on 06.05.2025).

[8] The government has expanded the program for subsidizing investment projects in priority areas of industry. URL: http://government.ru/docs/47930/ (accessed on 06.05.2025).

Table 3

Indicators of Transformation of the Chemical Industry by Selected Institutional Groups, 2022

Indicators of transformation of selected groups of companies	Institutional groups			
	Fast growing business	Large business	Aggressive growth companies	Other
Average values of indicators by groups				
Operational efficiency				
Revenue growth rate, %	37.76	4.77	19.83	30.7
Share in industry revenue, %	35.79	17.25	12.65	34.32
Share in industry revenue growth, %	58.87	13.89	11.08	16.16
Rate of asset growth, %	29.19	14.07	32.73	23.8
Rate of growth of equity, %	43.59	42.23	37.58	33.77
Rate of growth of net profit, %	87.36	48.78	47.37	53.15
Share of added value, %	24.87	33.8	34.89	26.32
Labour productivity, million rubles per person	19.52	16.85	7. 66	11. 84
Investment activity				
Investment norm	0.13	0.18	0.11	0.12
Ratio of investments to revenue	0.02	0.08	0.04	0.02
Growth rate of non-current assets, %	21.25	0.84	55.65	14.04
Financial stability				
Leverage	0.61	0.08	0.82	0.35
Differential, %	23.69	21.09	15.92	20.99
Return on invested capital, %	27.71	28.56	21.76	25.52

Source: Compiled by the authors.

revenue, it generates 95.43% of the industry's net profit. Grouping companies by risk levels and participation in public procurement allowed us to conclude that 94.5% of industry revenue comes from low-risk enterprises, while public procurement participants (32.4% of the sample) account for 54% of industry revenue.

At the third stage, companies were grouped and classified by types of business model behavior based on their ability to adapt to transformation conditions, using the D. Birch approach adapted to the Russian chemical industry, taking into account the scale of companies that contribute the most to the industry's revenue growth. As a result of the conducted analysis and selection, the following institutional groups were formed:

fast-growing companies with revenue from 1 to 70 billion rubles, an average annual revenue growth rate of over 10% per year from 2019 to 2022, and an increase in long-term financial investments not exceeding 500 million rubles, privately owned, with an age of at least 4 years (LLC "EUROCHEM — UKK"; PJSC "KAZANORGSYNTEZ"; LLC "LAB INDUSTRIES"; PJSC "NIZHNEKAMSKNEFTEKHI" and others — a total of 27 enterprises);

large business — companies with revenue exceeding 70 billion rubles, having an increase in long-term financial investments of no more than 500 million rubles, of any form of ownership and age (PJSC "AKRON"; JSC "AMMONIUM"; LLC "METADINEA"; JSC "SHCHELKOVO AGROCHEM" and others — a total of 7 enterprises);

companies implementing an *aggressive growth* investment strategy, that is, growing through mergers and acquisitions, with an increase in long-term financial investments exceeding 500 million rubles (LLC LITK; LLC STK; LLC TSG — a total of 142 enterprises);

others — companies that are not part of the first three groups and generally represent small and medium-sized businesses (LLC "ATLANT-AZOT"; LLC "AEROSTAR CONTRACT"; LLC "BASF VOSTOK" and others — a total of 1240 enterprises).

The criteria for selecting indicators for assessing transformational processes were based on the goals of transforming priority areas of technological sovereignty projects and structural adaptation projects of the Russian economy, as well as the Methodological Recommendations of the Ministry of Economic Development for preparing sustainability reporting on information disclosure [17]. The indicators we propose include 14 metrics across various areas (calculations are presented in *Table 3*):

- *operational efficiency* as the ability of a business to withstand market risks, accumulate, and effectively utilize resources (assessed by indicators such as revenue growth rates, asset growth, equity growth, net profit, revenue share and revenue growth; share of value added in revenue; labor productivity);
- *investment activity* as the ability of a business to manage production and technological risks and create competitive advantages (investment norm, ratio of investments to revenue, growth rate of non-current assets);
- *financial stability* as the ability to create investment attractiveness (leverage; financial leverage differential; return on invested capital).

The results of the analysis show that the group of *large businesses* stands out significantly with *high values* of business scale, capitalization, and financial stability, but low business activity and declining operational efficiency. The enterprises of the *fast-growing business* group have significantly lower comparable indicators and a smaller share of added value compared to *large and aggressively growing* enterprises with high-tech production. The dynamics of the share of added value are significantly increasing only in the *large business* group (by 15.47% annually), which confirms the conclusion about the presence of development potential.

The growth rate of labor productivity in the industry as a whole is quite high (17.8%), however, the level of labor productivity is highest in the *fast-growing businesses* and has a tendency for further growth. Investment activity is higher among *large businesses*, however, the indicators of investment activity are declining, as the growth in revenue and profit is ensured by price increases, which leads to a decrease in indicators even with stable investments. The dynamics of leverage are also negative, except for *large businesses*, which is due to a sufficient influx of own resources through profit capitalization. At the same time, the efficiency of financial activities (differential, return on invested capital) is quite high. The level of return on capital allows us to conclude that the investment attractiveness of the industry is relatively high, which, unfortunately, did not lead to a significant increase in investments in the industry in 2022, due to high uncertainty, currency fluctuations, and price volatility.

CONCLUSION

The conducted research allowed for the analysis of the impact of institutional aspects on the sustainability of companies belonging to various institutional groups. As a result, a classification of enterprises was identified based on the sustainability of their business model behavior during the transformation period; the most promising enterprises with growth potential and high adaptability to transformation were identified, and a system of transformation evaluation indicators was proposed, which is undoubtedly open, as it is currently limited by the availability of information on enterprises, especially the lack of data on export-import.

The greatest impact on the industry's sustainability was exerted by external risk factors related to country-specific, political, and financial, primarily market and currency risks, as well as operational risks associated with import substitution and the large-scale innovative transformation of industry enterprises, the results of which cannot be achieved in a short period.

At the same time, the introduction of sanctions had a positive impact on the economic growth of the industry, but only in certain segments. Among the institutional factors positively influencing the efficiency and sustainability of businesses, participation in public procurement and the mandatory nature of audits should be highlighted, which proves the significance of these factors in enhancing the effectiveness of the transformation of the economic model towards technological sovereignty. The audited business generates over 95% of the industry's net profit, and the public procurement system creates incentives to enhance its social responsibility. The results and trends of 2023 allow us to conclude a growth in investment attractiveness, but at the same time a decrease in the investment activity of enterprises, which may negatively affect transformation processes in the future. A high growth rate of non-current assets is observed in the group of fast-growing businesses (over 21%) and especially in aggressive growth companies (around 56%). However, for the sustainable development of the industry towards technological sovereignty, due to high innovation risks, enterprises require active government support.

The theoretical significance of the research lies in the author's institutional approach to grouping companies based on criteria of their business model behavior as an ability to adapt to the conditions of economic transformation. The practical value consists in the development of an algorithm for identifying points of prospective economic growth and indicators for assessing industry transformation to provide support to companies with the greatest multiplicative effect. The obtained results can be used in the implementation of priority directions of technological sovereignty projects and structural adaptation projects of the

Russian economy, as well as the Concept of Technological Development for the period up to 2030, as a tool for monitoring implementation and determining the development vector of priority sectors of the economy, as well as for finding new potential points of economic growth and attracting public and private investments.

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Financial Stability and Economic Development: Setting Priorities

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ABSTRACT

The subject of the study is the influence of monetary policy on the dynamics of the country's economic development. **The purpose** of the paper is to establish causal relationships between the key interest rate set by the regulator and the reaction of non-financial companies and banks to it. **The methodological basis** of the study was the theory of economic growth and economic policy, empirical-statistical and qualitative analysis. The study found that, while the regulator successfully solves the problem of ensuring the banking sector's stability, its actions to support the growth of the Russian economy are not always effective. It is **concluded** that it is expedient to set the key rate at such a level that it would be aimed at those who are able to solve the problem of inflation, and would not have an indiscriminate impact on all economic actors, including those that ensure the production capacity increase and the labor productivity growth in order to balance product supply with demand.

Keywords: inflation management; key interest rate; economic growth; sources of enterprises' financing; supply and demand

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INTRODUCTION

By financial stability, the regulator understands the resilience of the financial, primarily banking, system to various shocks.[1] The main goal of the monetary policy (MP) of the Bank of Russia is "to ensure price stability, that is, low and stable inflation. By ensuring price stability, the Bank of Russia creates conditions for the successful restructuring of the economy, which began in 2022, and its balanced growth in the future".[2]

The regulator is successfully maintaining the reliability of the banking system, but there are problems with achieving a low level of inflation. As the regulator points out, "the tightening of MP in 2023, unlike the episodes of 2014 and 2022, did not occur in a crisis situation to prevent risks to financial stability, but in a context of rapid economic recovery to curb inflation".[3]

The Russian economy needs renewal due to the cessation of the previous nature of relations with most industrially developed countries, which radically increases the role of domestic producers of a vast number of product positions in meeting internal demand. For this, most Russian enterprises need modernization and expansion of their equipment fleet to increase the production of finished goods and ensure its quality at the level of the best global standards in order to be competitive. To address this issue, it is critically important to have debt and equity financing for capital investments and to increase working capital. However, in relation to GDP, lending to Russian non-financial organizations, which is the main type of active operations for banks and the primary tool for external fundraising for the majority of enterprises, is significantly lower than such indicators in many developed countries. In the context of the termination of foreign lending (banking and trade), lack of access to the

[1] URL: https://cbr.ru/finstab/ (accessed on 30.05.2024).

[2] Main Directions of the Unified State Monetary Policy for 2024 and the Period of 2025 and 2026. Bank of Russia. November 2023. 193 p. URL: https://cbr.ru/about_br/publ/ondkp/on_2024_2026/ (accessed on 20.05.2024).

[3] Financial Stability Review. II–III quarters of 2023. Bank of Russia. November 2023. 83 p. (2). URL: https://cbr.ru/Collection/Collection/File/46610/2_3_q_2023.pdf (accessed on 25.05.2024).

international capital market, and the presence of a small domestic stock market, it is difficult for businesses to find other ways to finance the expansion and modernization of their production (besides limited own funds and investments from existing shareholders) to meet demand and ensure economic growth.

As a result, a gap arises between supply and demand, as it is difficult for businesses to quickly fill the niches created by the exit of Western companies from the Russian market, and demand, which, except for subsidized mortgages, has changed little in physical terms.

The regulator is raising the key interest rate, arguing that it is necessary to combat "overheating" in certain sectors of the economy, making loans prohibitively expensive for many enterprises across all industries. Consequently, the imbalance between supply and demand is not eliminated, and inflation in conditions of product shortages does not decrease.

The regulator's fight against inflation is hindering the growth of goods supply by domestic companies. This slows down the economy and increases the gap with rapidly developing countries, including China. The Russian government aims to increase production and its efficiency so that the country's GDP grows faster than the global average.[4] In this situation, it is worth reconsidering measures to reduce inflation. They should more accurately address the problem, taking its causes into account. Additional steps may be needed to restructure the economy.

It is also necessary to note that the well-being of the financial sector depends on the condition of its main borrowers — enterprises. If they lack funding, they cannot update their technologies and increase their competitiveness. This reduces their income and makes it difficult to repay loans. As a result, banks may find themselves unable to pay interest to depositors and return deposits. This threatens the financial stability of credit organisations.

In other words, the financial stability of a country's financial system and the development of an economy where supply and demand are balanced are closely linked. Therefore, studying this interrelationship to understand the reasons that hinder the combination of a stable financial condition of banks with their contribution to the development of enterprises and the successful restructuring of the economy is of great importance from both a scientific and practical perspective.

BANK CREDIT AND ECONOMIC GROWTH

The regulator rightly notes that monetary policy creates important, but not the only necessary conditions for the successful structural realignment of the economy, and that MP measures alone cannot influence changes in the economy's potential, "since it is determined by factors such as capital accumulation, the size of the labor force, labor and capital productivity, including as a result of the implementation of new technologies". Actions from the government in the area of budgetary incentives and institutional reforms are also necessary. But it is implied that MP, in its counter-cyclical role, can influence the intensity of the use of these factors, ensuring a smaller cyclical downturn or overheating in the economy.[5] At the same time, it is hardly worth downplaying the impact of bank credit on the country's economy, as the state budget has an order of magnitude fewer resources for direct support of economic restructuring (3.9 trillion rubles in 2024) compared to the credit system (62 trillion rubles — debt of non-financial organizations to banks as of 1 January 2024).

The regulator indicates that "to limit the risks of deviations of inflation from the target, and the economy from the trajectory of balanced growth, a timely and proportionate response from monetary policy is required".[6] In other words, the Bank of

[4] Novak did not support the term "military Keynesianism" in relation to Russia. RBC June 7, 2024. URL: https://www.rbc.ru/politics/07/06/2024/6662b0509a7947a447d4c3d0?from=from_main_2 (accessed on 07.06.2024).

[5] Main directions of the unified state monetary policy for 2024 and the period of 2025 and 2026. Bank of Russia. November 2023. 193 p. URL: https://cbr.ru/about_br/publ/ondkp/on_2024_2026/ (accessed on 07.06.2024).

[6] Main directions of the unified state monetary policy for 2024 and the period of 2025 and 2026. Bank of Russia. November 2023. 193 p. URL: https://cbr.ru/about_br/publ/ondkp/on_2024_2026/ (accessed on 07.06.2024).

Russia is trying to correct, through the key rate, some imperfections that it believes exist in the development of the country's economy. In practice, it turns out that the regulator is restraining the financing of the economy by increasing the cost of money for borrowers and motivating consumers to save rather than spend money on acquiring new goods and services, appealing to the lack of their supply. Moreover, the cost of capital is increasing, which requires much higher returns on investments than the increased yield on bank deposits, which in turn restrains equity financing of projects, as investors believe that the returns previously achievable only through investments in risky projects are now quite attainable with a risk-free bank deposit.

As a result, a conflict arises between the desire of enterprises to increase supply through the expansion of their production capacities and their ability to do so (which the regulator itself acknowledges[7]), including through the attraction of credit, which turns out to be very expensive and inaccessible for many. This preserves the current situation of demand and supply imbalance, and consequently, economic growth.

In this context, the conclusion of K.-S. Lee and R.A. Werner [1, p. 27–28] from their empirical study is enlightening, as it states that in conditions of demand and supply imbalance, interest rates are much less useful as an economic management variable, since the dynamics of economic activity are determined by the quantity of goods and services produced. The fact is that in the case of demand and supply imbalance, the principle of the "short" side is applied, which, when demand exceeds supply, often abuses this market power by raising prices. Examining the relevant data over the past 50 years in the UK, the USA, Gemany and Japan, they also found no empirical evidence of any consistent support for a statistical causal relationship running from interest rates to economic growth. The author's calculations confirm the absence of a stable relationship between these two indicators: the correlation between the dynamics of interest rates and GDP growth over the past 20 years is 0.06 in the USA, minus 0.83 in China, and minus 0.42 in Russia. Accordingly, to ensure sustainable economic growth, it seems advisable to pay attention to the volume of lending, the increase of which contributes to the growth of goods and services production and whose changes are more relevant in explaining GDP dynamics. According to the author's calculations, the correlation between GDP and the volume of bank lending to the non-financial sector and households for the period 2008–2023 was 0.98 in the USA, 0.99 in China, and 0.99 in Russia (*Tables 1–3 of the Appendix*).

However, the relationship between the volume of credit support to the economy and its growth is not always linear. The study by J.-L. Arcand, E. Berkes, and U. Panizza [2, p. 1, 24] finds that bank debt financing has a positive impact on production growth as long as loans to the private sector do not exceed 100% of GDP. At the same time, the relationship between financial depth and economic growth depends on whether the lending is used to finance investments in productive assets or to inflate speculative bubbles.

The decomposition of the indicator of total bank lending to the private sector across 45 developed and developing countries [3, p. 23–24] shows that:

1) lending to enterprises accelerates economic growth, whereas lending to households has no effect.

2) credit to enterprises reduces income inequality, whereas credit to households does not affect this indicator;

3) household credit is negatively associated with sensitivity to excessive consumption, whereas there is no connection between enterprise credit and sensitivity to excessive consumption.

In the Russian Federation, the ratio between bank loans provided to individuals and non-financial organizations and GDP has gradually increased since 2010, reaching 55.6% in 2023. The volume of loans to individuals increased by 8.3 times, to corporate clients by 4.5 times, while the ratio of bank loans to non-financial organizations

[7] What trends are talking about: macroeconomics and markets. Bulletin of the Department of Research and Forecasting. Bank of Russia, April 2024. 27 p.

Table 1

Bank Loans and Country's GDP

Bank loans (as of January 1 of each year) and Russian GDP (for the previous year)	2011	2014	2017	2020	2022	2023	2024	Growth 2023 to 2010
Loans provided by Russian banks to non-financial organizations, trln rubles	13.7	21.8	29.7	33.3	43.5	50.4	62.0	4.5
Loans provided by Russian banks to households, trln rubles	4.1	10.0	10.8	17.7	25.1	27.4	33.8	8.3
TOTAL: loans to the economy, trln rubles	17.8	31.8	40.5	50.9	68.5	77.8	95.7	5.4
Russian Federation's GDP at current prices, trln rubles	46.3	73.0	85.6	109.6	135.8	155.2	172.1	3.7
Ratio of bank loans to the economy to GDP, %	38.5	43.5	47.3	46.4	50.5	50.1	55.6	1.4
Ratio of bank loans to non-financial organizations to GDP, %	29.7	29.9	34.7	30.3	32.0	32.5	36.0	1.2

Source: Compiled by the author using data from the following sources: Information on loans — according to the Central Bank of Russia "Statistical indicators of the banking sector of the Russian Federation"; Information on the GDP of the Russian Federation — according to the Federal State Statistics Service.

to GDP increased by only 1.2 times (*Table 1*). At the same time, the forced refinancing of loans by Russian banks, previously provided to large Russian companies by foreign credit organizations, constitutes a replacement of creditors rather than additional financing for borrowers, although in domestic statistics this appears as additional credit support for the economy. It can be assumed that such loans reduce banks' appetite for lending to smaller borrowers.

Thus, taking into account the conclusions of the aforementioned empirical studies and the provided data on the Russian Federation, it can be assumed that the country's banking system has a huge potential for increasing credit support for the economy, as well as a need to change its current structure, primarily in favor of the demanded debt financing of industrial companies, the development of which accelerates its growth and balances the supply and demand. This assumption is confirmed by the assessment of the rating agency ACRA regarding the excess of the capital adequacy ratio by Russian banks (from 2020 to 2023, it increased from 4 to 5 trillion rubles), which "under otherwise equal conditions allows for an increase in the loan portfolio by almost 60 trillion rubles".[8] This could bring the ratio of bank lending to Russia's GDP closer to the level of many developed economies (*Table 2*).

Considering the financial stability of the non-financial sector of the economy, the regulator focusses primarily on the largest companies, noting that despite the tightening of lending conditions, these companies have reduced their sensitivity to interest rate risk and the quality of loans has not deteriorated.[9] At the same time, the regulator claims that "the near-record level of corporate profits in most sectors gives companies the opportunity to rely more on their own funds than on borrowed financing when investing".[10] In 2023, more than half of all surveyed enterprises in the manufacturing and mining industries planned to expand and modernize their production capacities due to growing domestic demand and operating at the limit of existing production

[8] Double blow. Russian banking sector: forecast for 2024. ACRA. 27 December 2023. 15 p. URL: https://www.acra-ratings.ru/upload/iblock/886/7ehk2k9l9ndsg67tytdyamgiev8302vj/20231227_RFIVP.pdf (accessed on 11.06.2024).

[9] Overview of Financial Stability. Q4 2023 — Q1 2024 Bank of Russia. May 2024. 68 p.

[10] Summary of the key rate discussion. Bank of Russia. 13 May 2024. 12 p.

Table 2

Loans to Private Non-Financial Organizations in % of GDP as of 31 December 2023

Loans	Germany	UK	China	US	Japan	France	Russia
Loans total	122	144	200	150	181	213	99
Loans only from domestic banks	78	79	195	49	123	106	60

Source: Compiled by the author using data from the following source: URL: https://data.bis.org/topics/TOTAL_CREDIT/tables-and-dashboards (accessed on 23.06.2024).

capabilities, as 70% of companies had a share of modern machinery and equipment that did not exceed 50%. Companies report that they financed their investments predominantly through internal sources: in 2023, 81% of companies did this. At the same time, a significant portion of them (61%) relied on their own funds as the dominant source of financing, covering more than 90% of investment expenses.[11]

Orientation towards internal resources for financing one's activities is, on the one hand, a completely normal phenomenon for the corporate sector of the economy. At the same time, the opinion that many enterprises can self-finance their development by 80–90% seems, at best, to be a statistical average of the situation. Large companies possess immense financial power (both due to internally generated resources and greater access to debt financing in terms of volume and cost on one hand, and attracting funds from both banks and the capital market on the other). But their financial situation is incomparable to the meagre financial capabilities of most other non-financial companies, for which credit support and the interest rate are exponentially more important than for large companies. Moreover, many large companies produce little that is directly consumed by the population or participate in the creation of means of production that are in high demand under current conditions. They are focused on product exports and benefit from high export prices and a low ruble exchange rate, which allows them to feel financially at ease.

For medium and small companies primarily operating in the domestic market, as well as for a number of large companies that have received a historic opportunity to fill the niches left by financially and technologically powerful foreign corporations that have exited the domestic market and thus balance supply and demand (in manufacturing industries, for example, in 2023, the share of actually exited companies accounted for 35% of revenue in this sector of the Russian economy [4, p. 3]), such opportunities are generally lacking. Therefore, bank credit for their development is critically important not only for supporting investments but also for replenishing working capital, the need for which sharply increases with sales growth.

Examining the relationship between investment sensitivity and cash flow, E. Almeida and M. Campello [5, p. 23] conclude that for companies with financial constraints, such sensitivity increases, while for companies without constraints, no such effects are observed. In other words, for SMEs, difficulties with credit support for their activities mean postponing investments until their own funds become available.

Moreover, they heavily depend on the import of equipment, raw materials, and components that they use to produce their finished products in order to meet domestic demand. Besides, enterprises need to independently and at their own expense develop new technological solutions, because as noted by the Government of the Russian Federation, "few can share the technological capabilities at the level that Russia needs".[12]

The regulator's reference to the impossibility of successful structural realignment of the

[11] Investment activity in industry in 2023: results of the enterprise survey. Bank of Russia. January 2024. 26 p.

[12] Manturov answered a question about the risks for European companies in Russia. RBC, June 7, 2024. URL: https://www.rbc.ru/business/06/06/2024/666204979a79475e2cb33f05 (accessed on 07.06.2024).

economy solely through monetary policy without influencing such transformation as "capital accumulation, labor resource numbers, labor and capital productivity, including as a result of the introduction of new technologies", which is correct for developed market economies, does not, however, take into account certain features of the development of the Russian national economy.

The level of productivity depends on the availability of modern equipment, which is currently difficult for Russian enterprises to produce due to a lack of funds caused by the high cost of credit, even if they have the appropriate technologies. Additionally, seeking equity financing is hindered by the lack of additional resources among current owners, the modest size of the capital market, and the difficulty of accessing it for smaller companies. As a result, the low productivity of outdated equipment requires an increasing number of employees with the growth in production volumes, as well as the replenishment of working capital, which is funded by earned own funds. In addition, there is another problem related to the fact that the previous focus of retail and industrial demand on imported goods has shifted the demand for specialists from technical professions, the need for which decreased due to the reduction or closure of the corresponding industries, to socio-economic professions. That is, we do not have a total shortage of workers, but structural imbalances in their training and demand, which have existed for the past quarter of a century. By addressing these shortcomings and re-equipping Russian enterprises with new equipment, the situation will improve both in terms of productivity and employment.

Capital does not appear out of thin air; it either emerges as a result of successful entrepreneurial activity (for many people, primarily in SMEs), or through the accumulation of excess wages of middle and senior management in large companies, as well as income from investments in the stock market. These avenues for capital creation exist in the country, but they have not yet gained the same significance as in economies that have developed within market relations for centuries. In all cases, accumulating capital, as well as addressing issues of technological re-equipment and changes in employment, takes time, and therefore it is unlikely that one can expect its rapid emergence in volumes comparable to bank credit.

In the planned economy of the Soviet period, which was based on large-scale production, many of which, possibly in modified form, constitute the foundation of the modern Russian economy, there was no place for SMEs. Meanwhile, in a market economy, small and medium-sized enterprises precisely provide the flexibility to respond to changes in demand and are an important part of the "invisible hand of the market". The contribution of such enterprises to the GDP of the most economically developed countries is at the level of 55–65%, while in the lowest-income countries it is 23%.[13] That is, the widespread activity of SMEs is a clear sign of a more mature economy, which our country strives to achieve as quickly as possible. Meanwhile, in the Russian Federation, according to Rosstat data, the share of SMEs in the country's GDP decreased from 22% in 2017 to 21% in 2022.[14]

In this regard, credit support for SMEs, which in the overwhelming majority are aimed at meeting the needs of the domestic market and have virtually no chance of obtaining equity financing (and the high interest rate further reduces investors' motivation to enter risky projects), as well as limited access to the debt capital market, can provide significant assistance in increasing the country's GDP. As of 1 January 2024, the bank debt of SMEs amounted to 6.9 trillion rubles (excluding SMEs affiliated with large businesses), which is only 11.1% of the total amount of loans to non-financial organizations and 4.9 times less than the debt of individuals.[15] At the same time, the share of SME debt in the section of the OKVED «manufacturing industry» did not exceed 9%. Such volumes of lending are not only modest; they do

[13] International Labour Organization. URL: https://webapps.ilo.org/infostories/en-GB/Stories/Employment/SMEs#engines/gdp (accessed on 11.06.2024).

[14] Rosstat. National accounts. Small and medium-sized enterprises in GDP and GRP. URL: https://rosstat.gov.ru/statistics/accounts (accessed on 11.06.2024).

[15] Annual report 2023. Bank of Russia. March 2024. 331 p.

not even correspond to the share of SMEs in the country's GDP, which indicates a weak motivation for credit organizations to provide debt financing to this segment of the economy. However, the share of overdue debts of SMEs as of 1 January 2024 (5.0%)[16] is on par with problematic corporate loans (5.1% in April 2024 of the total debt of companies) and only slightly higher than this indicator for retail lending (4.2%).[17]

Thus, it appears that the regulator's conclusions about the insignificant impact of high interest rates conceal the differences in perception among various segments of the corporate sector of the country's economy. It is also unlikely that the aforementioned level of self-financing reflects the requirements and capabilities of a significant portion of Russian enterprises. If this level is acceptable for large enterprises, for others it can only indicate the inaccessibility of bank credit, which does not contribute to the progressive growth of the economy. Moreover, the aforementioned circumstances indicate that the demand for bank credit in the Russian Federation is much higher than in developed markets, where capital accumulation has occurred over centuries, production capacities consistently and significantly exceed demand, and their renewal is not hindered by external and internal factors.

INFLATION, INTEREST RATE, AND ECONOMIC "OVERHEATING"

The basic principles of the regulator's monetary policy were established 10 years ago and have not changed since then. K.V. Yudaeva then pointed out [6, p. 13–14] that under conditions of low unemployment and high labour force utilization, as well as an insufficiently favorable business climate, a reduction in rates is unlikely to have a significant stimulating effect on investments in the real economy. Since the slowdown in economic growth in the Russian Federation is structural in nature, it can only be addressed through structural reforms. Therefore, the choice of scenarios based on the use of monetary policy in Russia is limited: it is either low growth and low inflation, or stagflation, that is, low growth and high rising inflation. And the scenario with high growth and limited inflation through monetary policy methods is not feasible. Therefore, "only consistently low inflation can provide opportunities for the further development of the financial system, and thus, for business as a whole".

It seems that the position on the limited ability of the monetary policy to influence economic growth was based on the understanding of the inability of many domestic enterprises to compete at that time with transnational corporations (TNCs), which had advantages in technology, cheap and long-term financial resources, a high reputation, and skilled marketing. The state did not impose any conditions (other than tax payments) on the activities of these TNCs in the Russian Federation, and purchasers of consumer and industrial goods preferred products from foreign companies, that significantly limited the demand for similar goods from a substantial part of Russian companies. In these conditions, the creditworthiness of domestic enterprises raised doubts among banks, and the enterprises themselves had little incentive to attract expensive bank loans, that justifies the regulator's skepticism regarding the ability of the monetary policy to significantly impact economic growth. In this situation, D.V. Tulin concludes [7, p. 6], "the monetary authorities are forced to choose the lesser of two evils".

At the same time, S. Yu. Glazyev, O.S. Sukharev, and O.N. Afanasyeva draw attention [8, p. 23] to the fact that such an approach to monetary policy during the period from 2000 to 2020 created a negative cumulative effect and the tools of monetary policy did not have a significant impact on achieving the goals of the country's macroeconomic policy.

Meanwhile, the practice of developed countries during the specified period, which did not have restrictions like those in the Russian economy, just having moved away from the principles of a planned closed economy with enterprises unprepared for open competition with global

[16] Lending to small and medium-sized enterprises. Bank of Russia. March 2024. 22 p.

[17] On the development of the banking sector of the Russian Federation in April 2024. Bank of Russia. May 2024. 22 p.

leaders in their respective industries, showed, as A. Carstens [9, p. 5], the General Manager of the Bank for International Settlements, testified, that prolonged demand growth at low credit costs does not lead to overheating of economies largely due to the effect of globalization, which, through international cooperation and technological progress, reduces supply costs, allowing for a weakening of the link between GDP growth rates and inflation.

In 2022, the situation changed dramatically. The demand in the Russian Federation, which was previously met by the production of goods by foreign companies in the Russian Federation or by imports, remains, but the Russian enterprises that were previously oppressed by unfair competition cannot immediately restructure to meet this demand under the conditions of import restrictions and the departure of many foreign manufacturers from the country, who took with them the technologies used in their production. In the new circumstances, when Russian enterprises see the emerging opportunities, they are highly motivated to expand and modernize their production capacities, the financing of which through bank loans is one of the best alternatives.

In the new conditions of economic functioning, the previous concerns that "an increase in bank lending (at any interest rates, even the lowest) does not necessarily lead to an increase in the physical volumes of industrial production, the growth of production investments" [7, p. 6], followed by an improvement in financial results due to increased sales, are hardly relevant.

Nevertheless, even under current conditions, the regulator considers it necessary to tighten monetary policy, as the growth rates and levels of aggregate money demand are outpacing the productive capacity of the economy. In this regard, it thinks that the economy has overheated,[18] as evidenced by the regulator's data showing that at the end of 2023, the historical maximum of production capacity utilization was reached — 81%. Meanwhile, the sectoral decomposition of this indicator shows that capacity utilization exceeds 80% only in the mining and agriculture sectors (a significant portion of whose products are exported), the situation in electricity supply and the production of intermediate goods approaches this mark, while the level of capacity utilization in the production of consumer and investment goods does not exceed 75%. At the same time, the last three industries have the greatest need for equipment upgrades to increase labour productivity and expand their product lines, along with enterprises that provide electricity delivery[19]. Domestic companies are still unable to switch to the production of corresponding goods in terms of quality and quantity, which results in the highest dependence on imports for the category "machines and equipment" (86%) among all categories of imported goods [10, p. 10].

Rosstat does not provide data on the use of production capacities for the economy as a whole, but its calculations of the average annual value of this indicator by the output of individual types of products show,[20] that in 2022, capacities of only 12 out of 74 types of products were loaded at 80% or higher, with the most utilized (over 85%) being capacities in the production of sugar, paper and cardboard, sulfuric acid, ceramic tiles, and cast iron. It is hard to imagine that these productions significantly affected the level of capacity utilization across the entire Russian economy. Moreover, foreign statistics on this indicator, using the same methodology applied to the economies of the USA, China, and Russia, indicate,[21] that in 2023, the overall capacity utilization in the Russian economy was 61% (in the USA — 78.6%, in China — 75.9%), which is significantly lower than the data from the Russian regulator and more in

[18] Main directions of the unified state monetary policy for 2024 and the period of 2025 and 2026. Bank of Russia. November 2023. 193 p. URL: https://cbr.ru/about_br/publ/ondkp/on_2024_2026/ (accessed on 11.06.2024).

[19] Regional Economy: Commentary Main Department of the Bank of Russia, No. 26, March 13, 2024 P. 31, 35, 37

[20] The level of utilisation of the average annual production capacity of organisations for the production of certain types of products. 2017–2022. Rosstat. Section Industrial Production. URL: https://rosstat.gov.ru/enterprise_industrial (accessed on 11.06.2024).

[21] URL: https://tradingeconomics.com/united-states/capacity-utilization и URL: https://tradingeconomics.com/russia/capacity-utilization (accessed on 12.06.2024).

line with Rosstat statistics. At the same time, the annual volatility of this indicator rarely exceeds 5 percentage points.

Thus, it becomes evident that many sectors of the Russian economy, especially those important for meeting domestic demand for non-food goods, have not yet achieved high levels of production capacity utilization. This situation indicates the need for equipment modernization, which will allow for increased labour productivity without increasing the number of workers. This, in turn, will help increase production volume and produce high-quality goods that will meet the best global standards. They should not be inferior to the products of foreign companies that have recently left the Russian market.

Experts from the U.S. Federal Reserve System, M. Dotsey and T. Stark [11, p. 11, 16], after studying this topic for over 40 years, concluded that the relationship between capacity utilization and core inflation is unreliable. In their analysis, where core inflation was considered to be the personal consumption expenditure price index, the ability of capacity utilization to predict inflation behavior varied significantly across different periods. Sometimes capacity utilization indicators are quite useful, and sometimes they turn out to be useless.[22] Experts advise cautiously forecasting core inflation without relying solely on a simple model of the relationship between production capacity and price levels. This opinion is supported by the conclusion of E. Siklar and I. Siklar [12, p. 160] that in Turkey, 53% of inflation changes are related to supply factors, and only 13% to demand factors. Thus, the fight against inflation often depends not on limiting demand, but on increasing supply. This, in turn, often happens when companies update their production facilities. For this, debt financing is often required.

In the Russian Federation, the share of investments in fixed capital in the country's GDP, according to Rosstat, has consistently remained at the level of 19–22% from 2011 to 2023. Meanwhile, according to a study by the consulting firm McKinsey,[23] in rapidly developing economies (China, India, some countries in Central and Eastern Europe, and developing countries in Asia), it reaches 40% of GDP. This helps them significantly improve the standard of living for the population. The data from the study also indicate that the growth of investments is additionally associated with lower inflation and accounts for 4/5 of the growth in productivity per worker. In China, the best in the world in this latest indicator, it amounts to 8.3% according to the author's calculations for the period from 1997 to 2022, which is several times higher than the average annual growth rate of this indicator in the Russian Federation (2.5%). Although in the most developed economies, the dynamics of this indicator are even lower (for example, in the USA — 1.5% over the specified period). The absolute level of GDP per worker, according to the World Bank, varies significantly: $ 146.7 thousand in 2022 in 2021 prices in the USA, and $ 78.9 thousand and $ 40.0 thousand in purchasing power parity terms in the Russian Federation and China, respectively.[24] With such a gap in the absolute level of productivity, the difference in growth rates will allow China to reach the level of the USA, if they continue to develop at the indicated rates, according to the author's calculations, in 19 years. And for Russia, according to the author's calculations, it will take 50 years to achieve this, assuming the current productivity growth rates are maintained.

In mature economies, where there is sufficient production capacity and buyers (not only retail but also corporate) predominantly use bank credit to purchase goods and services, an economic overheating occurs when demand, fueled by low interest rates on loans, exceeds the supply offered by existing production capacities. It is meant that companies, in the context of competitive struggle,

[22] The author also did not find a stable relationship between these indicators: over the past 20 years, the correlation between inflation and production capacity utilization, according to the author's calculations, was 0.43 in the USA, 0.09 in China, and 0.80 in Russia.

[23] Investing in productivity growth. McKinsey global institute. March 2024. 58 p. URL: https://www.mckinsey.com/mgi/our-research/investing-in-productivity-growth (accessed on 11.06.2024).

[24] World Bank Group URL: https://data.worldbank.org/indicator/SL.GDP.PCAP.EM.KD?locations (accessed on 23.06.2024).

create production capacities that exceed normal demand, aiming for their utilization at the level of 80–85% to respond to demand surges and to manage technological disruptions in production.

Economists qualify the reduction of the specified capacity reserves as "overheating" of the economy (unlike business owners, who are pleased with the more complete use of equipment, which provides them with a better return on invested capital), which in developed markets is regulated by increasing prices for goods with limited supply and further increasing production capacity (to balance it with demand), on the one hand, and increasing the cost of credit to reduce demand, on the other.

In economies that are underdeveloped, not orientated towards meeting demand across all positions, and/or subjected to exogenous shocks that reduce import capacities or make them very expensive, the inability of supply to meet demand as a result of such circumstances can hardly be classified as "overheating". The cause of the emerging imbalance is not only the lack of production capacity but also, in most cases, the absence of proper quality of these capacities among local companies due to, as in the case of the Russian Federation, the following circumstances.

Firstly, industries that meet domestic demand lack capacity and product quality. This is due to the fact that transnational corporations have dominated the market for a long time. They possessed technological and financial resources that allowed them to meet most of their needs. Local producers could not compete with them and develop their industries due to suppressed demand.

Secondly, a significant portion of the production capacities of small and medium-sized enterprises has long been outdated precisely due to the shift in domestic demand towards the products of transnational corporations, which operated freely in the Russian Federation and were not required, as in China, to transfer technologies to local partners, since the state did not demand that they enter into corresponding agreements with local companies.[25]

Thirdly, there was no large-scale support for local producers in non-commodity sectors in the country. This put them at a disadvantage compared to foreign competitors. The latter had internal reserves for financing, access to cheap and long-term credit, as well as experience in production management and marketing in market conditions, which Russia had only recently lacked. Moreover, foreign companies often used scientific developments created with the participation of Russian scientists for practical purposes.

In other words, under the specified circumstances of endogenous and exogenous nature, physical demand predominantly does not increase, i.e., it is not excessive, provoked by cheap credit (although in certain segments of the economy this is possible if the cost of credit is subsidized). It remains roughly at the same level, but the vanished imports, along with limited or absent domestic production capacities of the required quality, create a false impression of "overheating", although in reality, this situation is more accurately characterized as a structural imbalance in the economy. The imbalance is due to the fact that there is demand for goods that the local industry cannot produce, or can produce but only in limited quantities.

Therefore, it is advisable to address this problem not only by temporarily cooling demand in those sectors where it is artificially inflated, but also through targeted measures to increase production capacity to fully meet demand in the future. From this perspective, the simultaneous increase in the cost of credit for both demand and supply appear to be an indiscriminate weapon of mass destruction, which, in addition to limiting demand — something that is temporarily beneficial only for certain sectors — prevents the increase of supply in all other sectors, which is largely possible only through debt financing, and this is detrimental in the long-term.

[25] In this regard, it is noteworthy that A.S. Kovrigin, the Deputy General Director of the analytical and consulting company "ASM-holding", remarked that "a big mistake was made when we called SPIKs import substitution… In fact, we simply funded the development of foreign technologies with our money, and when the foreign partner left, we were left without rights to the design, licenses, and technologies. Moreover, with such an approach, the Russian automotive industry found itself on the brink of losing its competencies in the design of cars and their components". [13, p. 21].

Moreover, when using an increased interest rate, which in developed economies is applied as a means to suppress price growth, in the Russian context it is necessary to take into account the following circumstances that affect domestic prices:

- export netback, when producers of exported goods, which are more than sufficient to meet domestic demand, try to align the profitability of their external supplies with domestic ones, which, at higher prices in the global market, exerts upward pressure on domestic prices;
- meet the demand through imports, when the low exchange rate of the national currency forces domestic prices to be set at a high level;
- budgetary stimulation of demand, as well as supply in certain segments, which in turn increases demand along the value chain.

The mentioned factors, along with exogenous causes, are generally beyond the control of the regulator. At the same time, budgetary infusions into the economy cannot be considered a determining factor of inflation, since, as it notes, in 2024 "the budget's contribution remains small compared to 2022–2023, and the main source of monetary mass growth remains lending".[26] If we take into account these circumstances, as well as the previously mentioned conclusions of empirical studies about the different contributions to achieving a balance between demand and supply in retail and corporate lending, the effectiveness of managing inflation in the current situation in the Russian Federation through an increase in the interest rate becomes somewhat unclear. Moreover, the high cost of credit not only negatively affects the financial results of borrowers but, in conditions of commodity shortages, increases the cost of raw materials, materials, and components, which is reflected in the higher price of finished products and contributes to inflation. It is obvious that an increased interest rate can work effectively only in a developed economy with an abundance of goods and excess production capacity.

[26] What trends are talking about: Macroeconomics and markets. Bulletin of the Department of Research and Forecasting. Bank of Russia, April 2024. 27 p.

STABILITY OF THE BANKING SECTOR OF THE ECONOMY AND THE EFFICIENCY OF THE TRANSMISSION MECHANISM

The main source of income for banks is traditionally considered to be the net interest margin (NIM), i.e., the difference between the cost of funding credit operations and the amount of interest received on the loans provided. For example, in 2023, it accounted for 63.2% of the 9.3 trillion rubles of all bank revenues in Russia, while net commission income accounted for only 20.5%.[27] The share of retail loans in the total loan portfolio in 2023 was 36%, and of the total amount of such loans, 46% was accounted for by consumer loans and auto loans (their total cost ranges from 21.5% to 59.8% per annum).[28] Considering that most of the latter is directed towards financing the purchase of imported goods, approximately 17% of the NIM is generated from providing loans amounting to around 16 trillion rubles for the payment of imported consumer goods, rather than developing their production in the country.[29]

Over the past 15 years, NIM has consistently remained in the range of 4–5 percentage points (pp)[30], despite periodically arising difficulties in the economy and strong volatility in the key rate. ACRA qualifies this situation as the ability of the banking sector to "demonstrate a very high level of resilience and adaptability to rapidly occurring changes".[31] It seems that this result is largely a consequence of the regulator's efforts to ensure the reliability of the banking sector, whose

[27] Statistical indicators of the banking sector 2022–2023. (Table 5). The structure of income and expenses of operating credit institutions. Bank of Russia.

[28] Average market values of the total cost of consumer loans (credits) in annual percentage rates for the period from 1 January 2024, to 31 March 2024. Bank of Russia. 16 May 2024.

[29] Calculated by the author using data from the following sources: "Statistical Indicators of the Banking Sector of the Russian Federation". Bank of Russia and the Banking Sector: Analytical Review. Q1 2024 Bank of Russia, June 2024.

[30] Results of the Decade 2008–2017 in the Russian Banking Sector: Trends and Factors. Series of Economic Research Reports. Bank of Russia, June 2018; (31–81):37.

[31] Double blow. Russian banking sector: forecast for 2024. ACRA. 27 December 2023. 15 p. URL: https://www.acra-ratings.ru/upload/iblock/886/7ehk2k9l9ndsg67tytdyamgiev8302vj/20231227_RFIVP.pdf (accessed on 11.06.2024).

participants are required to consistently increase their capital, loan reserves, and liquidity.

At the same time, the high interest rate, aimed at suppressing inflation and motivating the placement of money in bank deposits for passive income, simultaneously reduces the motivation of enterprises to create sources of active income by expanding their production. Increased interest payments suppress the financial results of borrowers and redistribute them in favor of creditors. This negatively affects the creditworthiness of borrowers, which, in turn, inevitably reflects in the deterioration of the credit risk assessment, which is accordingly compensated by the increase in loan reserves (in 2022–2023 alone, they grew by 4.5 trillion rubles). At the same time, there is a stable trend (from 2017 to 2023) of increasing net profit in the banking sector,[32] a significant portion of which (generated by almost half of consumer loans) does not depend on the development of the country's industrial potential.

Thus, the policy of increased interest rates, considered by the regulator as a tool to combat inflation, worsens the financial health of banks not through a reduction in their interest margin (which, in fact, reacts weakly to changes in the interest rate: according to the author's calculations, the correlation between the dynamics of this rate and NIM from 2018 to 2023 was 0.35), but through the deterioration of the borrowers' situation, whose ability to pay interest on loans and repay the principal debt is determined by their financial condition. The logic behind the measures aimed at complicating the activities of manufacturing companies, which are intended to increase the supply of goods and, in turn, create the basis for reducing price growth, is not entirely clear.

The reliability of the banking system's functioning is undoubtedly a priority for the regulator and the entire economy. At the same time, considering that the banking sector is highly dependent on the creditworthiness of its clients, and the regulator's goal is to promote the growth of the country's economy, it would be expedient to use more selective monetary policy and prudential supervision measures that, while maintaining the stability of credit institutions, would allow for a more targeted impact on inflation, as well as on the shortage of goods and services, which is its main source. The elimination of product shortages, which Russian enterprises are working on by increasing their production capacities, would create a situation more natural for a market economy of exceed of required by quality supply over the demand and would lead to a slowdown in the rate of price growth.

The concepts of counter-cyclical management of mature economies, which develop with the active use of debt financing from banks and the capital market, are based on the premise that such markets actively respond to changes in the interest rate set by the regulator. An increase in the rate in the case of an overheated economy restrains demand and increases the cost of goods production, which translates into higher prices, thereby limiting their sales opportunities. In the case of an overproduction crisis, companies themselves reduce the use of their production capacities, while a decrease in the interest rate by the regulator increases demand for goods. In both cases, market equilibrium is achieved.

Such interconnections work with a high share of debt financing in the economy (taking into account borrowings from banks and the capital market). But in the Russian Federation, it is still significantly lower than in mature markets, as indicated in *Table 2*. Therefore, it is logical to assume that the reaction of the economy, the structure of which does not correspond to the parameters of mature markets, to a change in the interest rate will be different.

The Bank of Russia assures that the transmission mechanism for conveying the signal of interest rate changes to economic agents is sufficiently effective (otherwise, there would be no point in relying on it), although it is multi-stage and involves many commercial organizations across various sectors of the economy. But it

[32] Statistical indicators of the banking sector 2022–2023. Table 5. Structure of income and expenses of operating credit institutions. Bank of Russia.

is precisely the complexity of this mechanism in terms of the distance over which the signal is transmitted and the number of various participants with their own interests that leads one to assume that the strength of the signal on its way to the final recipients will weaken. In the Russian Federation, the relationship between the interest rate and inflation, according to the author's calculations, is the highest among the three countries considered: 0.81 in the Russian Federation, 0.67 in China, and 0.44 in the United States over the past 20 years (*Table 1 of the Appendix*). It seems that the difference in this indicator reflects the varying levels of response of these economies to the cost of credit due to their greater ability to adapt to changing conditions, stemming from the different levels of development of market relations in which supply is created, and the higher competition among producers. Thus, the Russian regulator has to "overpressure" the interest rate compared to inflation: in the other two countries, the difference between them, even during crisis periods, is usually in the range of 1–3 pp., whereas in the Russian Federation, it has been 5–8 pp. in most cases over the past 10 years, and the gap of 1–3 pp. persists even in calm times.

But, on the other hand, small and medium-sized enterprises, whose development opportunities are closely linked to the availability of debt financing, which is becoming almost prohibitive for them, are located at a short distance from the source of the signal. At the same time, large companies are indifferent to the increase in the cost of credit, as they primarily have internal resources for development or export revenues multiplied by the low exchange rate of the ruble, which allow them to offset such costs when external borrowing is necessary.

The regulator itself notes that "among the factors limiting investment activity in 2023, 46% of enterprises indicated costs for machinery and equipment", the acquisition of which is generally not financed from current cash flow unless there is a payment installment plan from their supplier for several years, which is unrealistic under current conditions. Therefore, bank credit support is required. The subsequent conclusion that "the limited use of borrowed financing is due not so much to the low availability of bank credit (since only 32% of enterprises indicated it), but rather to other non-financial conditions",[33] does not take into account that for many companies, the high cost of credit means not only its low availability but also the impracticality of attracting it. Therefore, the opportunities for expanding industrial capacities and increasing productivity (to operate without increasing, and perhaps even with reducing, the servicing personnel) are postponed to an indefinite future and remain unrealized.

Thus, the issue is not that expensive credit is bad, but rather how much a high interest rate achieves its ultimate goal of more balanced and sustainable economic growth. In this regard, O.S. Sukharev's remark [14, p. 6] is fair, stating that regulators "should not strive for price stability by any means (through exchange rates and interest rates), but rather bring the economy to financial stability and steadiness, which will contribute to the growth of current production volume".

In the Russian Federation, a taxonomy of projects for technological sovereignty and structural adaptation of the economy,[34] has been developed, which is mainly focused on large projects. The Bank of Russia, accordingly, has allowed credit organizations to apply adjustments[35] to credit risk for loans provided for the implementation of such projects (only those included in the VEB.RF registry), which lead to a significant reduction in the amounts of reserves for potential losses on such loans. However, the actions of the regulator may not be very interesting to borrowers, as the reduction in costs

[33] Investment activity in industry in 2023: results of the enterprise survey. Bank of Russia. January 2024, 26 p. (24–25).

[34] On the approval of priority areas for projects of technological sovereignty and projects of structural adaptation of the economy of the Russian Federation. Government of the Russian Federation, Resolution from 15 April 2023, No. 603. 67 p. URL: http://government.ru/docs/48272/ (accessed on 20.05.2025).

[35] On amendments to the Regulation of the Bank of Russia from 6 August 2015, No. 483-P. Instruction of the Central Bank of the Russian Federation dated June 7, 2023, No. 6443-U. URL: https://cbr.ru/queries/unidbquery/file/90134/2802 (accessed on 20.05.2025).

through the implementation of these measures is unlikely to lead creditors to significantly reduce their margins, and such a reduction in costs will fundamentally not affect the cost of credit, which is largely determined by the key rate. Accordingly, the volume of lending that the regulator is counting on will not increase either. This conclusion is also confirmed by the practice of implementing the mentioned projects: the head of the Bank of Russia reports that "we estimated the potential at several trillion, but we have financed about 300 billion rubles for taxonomy projects", and the first deputy chairman of VEB.RF states that "the 'savings' on capital requirements that lenders can achieve by providing financing within the framework of the taxonomy are offset by the increased cost of money in the market".[36]

In the EU, there was an attempt in the past decade to encourage banks to provide loans to SMEs by lowering reserve requirements. However, it turned out to be unsuccessful both in terms of conditions and the volume of lending.[37] The study by B. Chamberlin and J. Evain [15, p. 31] on the effectiveness of this regulatory tool in the banking sector, aimed at supporting "green" projects, shows that it "has only a very limited impact on the financing conditions of energy transition projects and, at best, will reduce the overall project cost by only a few tenths of a percentage point". IMF experts D.G. Demekas and P. Grippa [16, p. 5] also believe that significant capital redistribution is unlikely to occur and that "the net benefits of such regulatory intervention are questionable".

Thus, the use of reserve requirements by the regulator as an additional tool to address specific tasks in the economy may prove ineffective in terms of achieving the goal of sustainable economic growth. At the same time, the associated failure to maintain sectoral neutrality by the regulator in its prudential policy may lead, as noted by F. Diluizo, B. Annicchiarico, M. Kalkuhl, J. Minx [17], to banks taking on increased risks that will not be balanced by sufficient loan reserves.

The aforementioned conclusions compel a return to the topic of the adequacy of the interest rate in relation to the circumstances that cause price increases. It seems that, aiming to suppress inflation and considering the true causes of its acceleration, it is expedient to correlate the level of the established interest rate with the degree of response from those economic actors whose activities will directly affect the price level from both the demand and supply sides. In particular, since finding compromises between the lender and the borrower on the cost of credit under conditions of a high key rate is quite difficult, and overheating in the economy is visible only in one or several sectors, it would be expedient to set the key rate at a level acceptable for the entire economy, while tightening the lending conditions for the "overheated" sectors as much as possible using macroprudential policy tools. At the same time, such an approach would reduce the contradictions between the actions of the regulator and the government, decreasing the need for budgetary subsidies.

It would probably also be logical if representatives of the state, which holds a controlling stake in the dominant state credit organizations in the Russian banking system, drew the management's attention to the need to increase lending for projects aimed at increasing the supply of goods in the country, which would likely have a much greater macroeconomic effect by reducing inflation and increasing tax revenues, than receiving dividends from these banks into the budget. A number of Western European countries, including Italy, acted in this way until the end of the 1980s [7, p. 14], and in China, such a practice still exists today.

CONCLUSION

The conducted research allows us to draw the following conclusions:

- under endogenous and exogenous circumstances in the Russian Federation, demand

[36] VEB assessed the impact of high rates on the financing of tech sovereignty. RBC, 17 June 2024. URL: https://www.rbc.ru/finances/17/06/2024/666c46609a7947be98fa25af (accessed on 20.05.2025).

[37] EEBA report on SMEs and SME supporting factor. European Banking Authority. EBA/OP/2016/04, March 23, 2016–139 p. (10–11) URL: https://www.eba.europa.eu/sites/default/documents/files/documents/10180/1359456/602d5c61-b501–4df9–8c89–71e32ab1bf84/EBA-Op-2016–04%20%20Report%20on%20SMEs%20and%20SME%20supporting%20factor.pdf?retry=1 (accessed on 20.05.2025).

predominantly does not increase, i.e., it is not excessive, provoked by cheap credit (although in certain segments of the economy this is possible if the cost of credit is subsidized). It remains approximately at the same level, but the vanished imports, combined with limited or absent production capacities in the domestic market, create a false impression of "overheating", although in reality, this situation is more accurately characterized as a structural imbalance in the economy;

- the regulator is doing an excellent job of ensuring the stability of the banking sector of the economy, but its actions to support the growth of the Russian economy are far from always effective;
- consumer loans, if they are used to purchase imported goods, do not contribute to the development of the Russian economy, but they make a significant contribution to the net interest margin of Russian banks, which makes the financial result of the banking system in this sense and in this part independent of the state of the Russian economy;
- if the increased cost of credit does not allow for the purchase of new equipment to increase supply (and it is rarely acquired through the company's own funds), equity financing is limited, budgetary incentives are aimed only at strategic industries, and non-monetary factors have a significant impact on prices, then one should consider how beneficial the increased cost of credit is for everyone;
- it's not that expensive credit is bad, but rather how much the high interest rate achieves its goal of more balanced and sustainable economic growth.

Answering the main question of the research, it seems appropriate to conclude that the fundamental stability of the banking sector cannot be achieved without the financial viability of its clients, primarily corporate ones, who, through their activities, address the issues of providing the economy with the required volumes and quality of goods and services, in order to balance supply and demand and thus eliminate the cause of inflation. Therefore, it makes sense to set the key rate at a level that targets those and in such a way that can solve the inflation problem, rather than being a weapon of mass destruction for all sectors of the economy. This would ensure an increase in the production capacities and productivity of Russian companies, which would positively reflect on their financial results, and in turn, would allow banks to reduce the reserves they create and increase their profitability. In that case, everyone would benefit: creditors, borrowers, and consumers.

The identification of specific tools to influence credit availability for different classes of borrowers and projects is the subject of further research.

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APPENDIX

Table 1

Correlation Matrix Based on Russia Data

Indicators	Key rate	Capacity utilization rate	Inflation	GDP	Bank loans
Key rate	1				
Capacity utilization rate	–0.72	1			
Inflation	0.81	–0.80	1		
GDP	–0.42	0.47	–0.57	1	
Bank loans	0.16	–0.03	–0.07	0.99	1

Source: Calculations by the author based on data from the Bank of Russia and Rosstat.

Table 2

Correlation Matrix Based on the US Data

Indicators	Key rate	Capacity utilization rate	Inflation	GDP	Bank loans
Key rate	1				
Capacity utilization rate	0.61	1			
Inflation	0.44	0.43	1		
GDP	0.06	0.17	0.32	1	
Bank loans	0.80	0.53	0.57	0.98	1

Source: Calculations by the author based on data from the US Federal Reserve, the Bank for International Settlements, the World Bank and the website tradingeconomics.com.

Table 3

Correlation Matrix Based on China Data

Indicators	Key rate	Capacity utilization rate	Inflation	GDP	Bank loans
Key rate	1				
Capacity utilization rate	–0.03	1			
Inflation	0.67	0.09	1		
GDP	–0.83	0.24	–0.17	1	
Bank loans	–0.85	0.27	–0.48	0.99	1

Source: Calculations by the author based on data from the US Federal Reserve, the Bank for International Settlements, the World Bank and the website tradingeconomics.com

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Financing Patterns of Russian Innovative Enterprises: Empirical Evidence

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ABSTRACT

Different financial resources are used to finance the operational and innovative activities of enterprises, forming the structure of their capital. Many studies have been conducted on the topic of businesses' access to external financial resources, such as loans. However, the topic of the relationship of financing patterns with the results of innovation activity and the innovative potential of enterprises is still insufficiently studied. **The aim** of this article is to identify patterns of financing Russian enterprises, as well as the specifics of financing innovative enterprises. As the main research method, we used cluster analysis, which was conducted for two groups of Russian enterprises — large and small and medium-sized (SMEs) businesses. The study is based on data from a survey of Russian companies conducted by the World Bank. **The results** show that large enterprises use five financial patterns: equity, trading, loans, mixed financing, and government subsidies. SMEs, on the contrary, are limited to the first four patterns. Special attention was paid to innovative companies, among which most large enterprises rely on their own funds as the main source of financing. At the same time, small and medium-sized innovative enterprises demonstrate a more flexible financial strategy, using a wider range of sources to ensure their innovation activities. The data obtained is of great importance for the development of effective tools to support innovation. Taking into account the identified features of the financial structure of companies, it is necessary to develop measures aimed at stimulating innovation, taking into account the specifics of various types of enterprises. This will not only increase the innovative potential of Russian companies, but also strengthen their positions in the domestic and global markets.

Keywords: capital structure; financial resources; financial patterns; cluster analysis; innovation activities; Russian enterprises; large enterprises; small and medium enterprises

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INTRODUCTION

New products and services are essential for competitiveness and growth of businesses. Therefore, companies carry out various innovation activities in order to release new products [1]. Increasing innovation activities in national companies could have an impact on the growth of the national economy in general [2, 3]. Therefore, enlarging the share of innovative enterprises and their support are considered to be the main objective in plans and strategies to achieve the transformation to the innovation economy [4].

The Russian economy is one of the emerging economies where the government has developed many strategies to increase the innovation activity of Russian enterprises [5]. However, the share of innovative enterprises in Russia remains tiny. Expenditure on research and development (R&D) forms around 1% of the national gross domestic product (GDP).[1] Moreover, only 9.1% of Russian enterprises were engaged in innovative activities in 2021. The share of small and medium enterprises (SMEs) that engaged in innovative activities in 2019 is around 5.8%.[2] Nevertheless, SMEs account for around 22% of the Russian GDP[3] with government strategies to enlarge their share to 40% by 2030.[4]

Innovative activities require many human, financial and technological resources. Access to finance is

[1] Ditkovskiy K., Evnevich E., Fridlyanova S. et al. Data Book. National Research University Higher School of Economics. Moscow: HSE; 2021:352.

[2] Ditkovskiy K., Evnevich E., Fridlyanova S. et al. Data Book. National Research University Higher School of Economics. Moscow: HSE; 2021:276.

[3] OECD, Financing SMEs, and Entrepreneurs 2020: An OECD Scoreboard, OECD Publishing. Paris; 2020.

[4] PWC, doing business and Investing in the Russian Federation. February 2017.

considered to be one of the main resources that could foster innovative projects in enterprises. However, innovative enterprises' access to external financial resources could be hindered by many factors. The main reason for hindered access is the high risks inherent in innovative activities. These risks are caused by the sunk cost of innovative projects and the lag between investing the resources and getting a return on them. Another kind of risk is related to the nature of the results of innovative activities. Innovative projects end mainly with intangible assets that could not be used as collateral for credits and could be used by rivals in case of no protection of intellectual property [6, 7].

All the aforementioned factors could influence innovative access of enterprises to external financial resources. Correspondingly, these factors influence the enterprises' capital structure which reflects the share of different internal and external resources in enterprise capital. Therefore, understanding the capital structure of enterprises and its relationship with their innovative performance and innovation potential could boost the development of government strategies by decision-makers that work on enhancing the access of enterprises to external financial resources and their innovation activities.

This article is dedicated to identifying different patterns in the capital of Russian large enterprises and SMEs and the distribution of innovative enterprises on these patterns. This is a relevant issue for Russian businesses, where credit financing is seen as one of the main external financial resources [8]. Therefore, it is critically important to develop effective financial measures to stimulate the innovation activity of the Russian enterprise [9, 10]. Our article contributes to the economic literature by first defining the financing patterns of Russian enterprises and differentiating between the financing patterns of large enterprises and those of Russian SMEs. Moreover, the distribution of innovative enterprises on these patterns was identified. Hence, it is possible to develop related policies and measures to support access of enterprises to external financial resources and to stimulate their innovation activity.

The research starts by introducing a literature review of the major works in this field and their approaches to defining the capital structure of enterprises. Further, a clustering analysis has been conducted to define Russian enterprises' financing patterns is explained in the methodology. The results of this analysis were discussed and compared to the results of other studies in different countries in the discussion.

LITERATURE REVIEW

In recent years, there has been a growing interest in studying capital structure. More studies were dedicated to exploring the structure of different resources (internal funds, credits, and equity) that form the enterprise capital. Some studies focus on the determinants of capital structure [11], while others focus on the specifics of different sectors or different countries by making a cross-country comparison [12]. Another aspect of research studies the influence of financial systems on the financing patterns of enterprises [13, 14].

Many articles were dedicated to the problem of restricted access of innovative enterprises to finance, its rationales, and consequences on the innovative development of enterprises. Fewer studies aimed to analyze the demand for external financial resources and the influence of national economic development on choosing the external financial resource [15–19]. Other studies have examined the capital structure of innovative enterprises to different identify enterprises financing patterns and their relationship with enterprises characteristics, such as enterprise size, sector, and age [20–23].

Cluster analysis is one of the main methods to study the capital structure of enterprise. This method is used to identify a few groups (clusters) that differ from each other by the share of external financial resources. These clusters form different financing patterns of enterprises. The characteristics of enterprises in each cluster are also identified to understand their relationship with enterprise capital structure. Mortiz et al. [24] studied the capital structure of European SMEs and identified six financial patterns. These patterns are (mixed financed SMEs, state-subsidized SMEs, debt-financed SMEs, flexible debt-financed SMEs, trade-financed SMEs, and internally financed SMEs). Around 40% of European SMEs are internally financed and 20% are debt-financed. The results of the following research confirmed Mortiz's results and identified an additional financing pattern — active financed enterprises. Furthermore, the results confirmed the use of credits among SMEs to a greater

extent compared to the use of equity sales in enterprises' capital [25].

The financial patterns of R&D in German companies were studied by Belitz and Lejpras in their papers [26, 27], where they identified four clusters. The majority of German enterprises finance their R&D activities with their internal resources. Mainly, they are large enterprises that conduct R&D in-house and do not cooperate with other sides. Further research by Masiak et al. confirms that small enterprises' access to government grants and other financial resources (credits and equity) is restricted in comparison with large enterprises' access. Small enterprises depend mainly on their internal resources even in comparison with medium enterprises. However, they receive short-term credits more than the last [28].

The relationship between SMEs' financing patterns and enterprises' innovation activities in Europe was studied by Błach et al. [29]. The results confirmed that loans are the main external financial resources of European SMEs. However, the research has not explored the relationship between the kind of innovative results and the financial resources. SME dependence on loans as the main external financial resource contradicts the results of Hall and Lerner [30] which implies that equity is the main external financial resource of SMEs. However, their findings are consistent with those of Kerr and Nanda [31] who noted the growing importance of loans as a source of innovation financing.

This article can contribute to economic literature by exploring the difference in financing patterns between large enterprises and SMEs in Russia and by comparing the financing patterns of Russian and European SMEs. Furthermore, the financing patterns of enterprises with elements of innovation potential, for instance, using foreign technologies or purchasing intangible assets are discovered.

METHODOLOGY

To study the relationship between innovation activities, innovation potential, and enterprise capital structure cluster analysis has been conducted. The analysis was carried out in two stages. Firstly, hierarchical clustering (ward algorithm) was applied to identify the cluster number [32]. In addition, k-means clustering was used to divide the enterprises into clusters and define the main characteristics of each cluster. Thus, it is possible to conduct a taxonomic analysis of Russian enterprises' capital structure and its relation to the results of innovation activities and innovation potential [33]. Our data are the results of the World Bank enterprises survey that has been conducted in Russia in 2019.[5] The sample includes 1283 observations of large, medium, and small Russian enterprises. The sample was divided into 2 groups: large enterprises and small and medium-sized enterprises (SMEs) differ in their financing methods, as suggested by economic literature. Analysis variables contain active clustering variables which are the variables that are used in clustering and passive clustering variables which are used to describe the clusters' characteristics. Active variables reflect the capital structure of enterprise, while passive variables reflect the enterprise's innovation potential and results of innovation activities.

Passive variables include control variables that describe the enterprise's general characteristics, for instance, sector, government share, and holding membership. A full list of active and passive clustering variables is in *Table 1*.

Result Analysis

Descriptive Statistics

Our sample includes 1,283 observations which have been divided into two groups. The first group consists of large enterprises (382 observations), and the second group contains small and medium-sized enterprises (SMEs) (901 observations). The descriptive statistics for each group are presented in *Fig. 1*.

Characteristics of SMEs and large enterprises are different in many aspects though we had to divide the sample into two groups before clustering. More large enterprises tend to have written strategies and obtain external knowledge than SMEs. Moreover, 28.8% of large enterprises spent on R&D in the last 3 years while this figure for SMEs is 15%. Regarding the results of innovation activities, large enterprises that have participated in the survey tend to introduce product innovation more than the participating SMEs, while for process innovation activity the difference is small. Correspondingly, the share of large enterprises that obtained external knowledge is two times more than that for SMEs. Furthermore, around 11% of large enterprises

[5] World Bank, Enterprise Survey 2019. The Russian Federation. URL: https://microdata.worldbank.org/index.php/catalog/3564 (accessed on 19.11.2022).

Table 1

Clustering Analysis Passive and Active Variables

Variable	Description
Passive clustering variables	
Control variables	
Sector	Variable takes 2 values – 0 for manufacturing enterprises and 0 for service enterprises
Part of a multi-establishment Firm	Variable takes 2 values – 1 if the enterprise is a part of a multi-establishment Firm and 0 otherwise
Owned by government	Variable takes 2 values – 1 if the government owns 10% of the enterprise or more and 0 otherwise
Exporting enterprise	Variable takes 2 values – 1 if enterprise export its products to other countries and 0 otherwise
Applying on credits	Variable takes 2 values – 1 if enterprise applies on credit in the last fiscal year and 0 otherwise
Innovation activities results variables	
Product innovation	Variable takes 2 values – 1 if the enterprise developed a product innovation in the last 3 years and 0 otherwise
Process innovation	Variable takes 2 values – 1 if the enterprise developed a process innovation in the last 3 years and 0 otherwise
Innovation potential variables	
Written business strategy	Variable takes 2 values – 1 if the enterprise has a written business strategy and 0 otherwise
Acquisition of external knowledge	Variable takes 2 values – 1 if the enterprise spent on acquisition of external knowledge and 0 otherwise
R&D	Variable takes 2 values – 1 if the enterprise spent of R&D in-house or out-house in the last 3 years and 0 otherwise
Using of foreign technology	Variable takes 2 values – 1 if the enterprise uses technology licensed from a foreign-owned company and 0 otherwise
Buying intangible assets	Variable takes 2 values – 1 if the enterprise has purchased any trademarks, copyrights, patents, or other intangible assets in the last fiscal year and 0 otherwise
Active clustering variables	
Capital structure variables	
Internal funds share	% of working capital financed from internal funds/retained earnings
Bank financing share	% of working capital borrowed from banks
Non-bank financial institutions share	% of working capital borrowed from non-bank financial institutions
Suppliers/customers funds share	% of working capital purchased on credit/advances from suppliers/ customers
Government grants share	% of working capital in government grants
Bonds share	% of working capital in issued bonds

Source: Compiled by the authors.

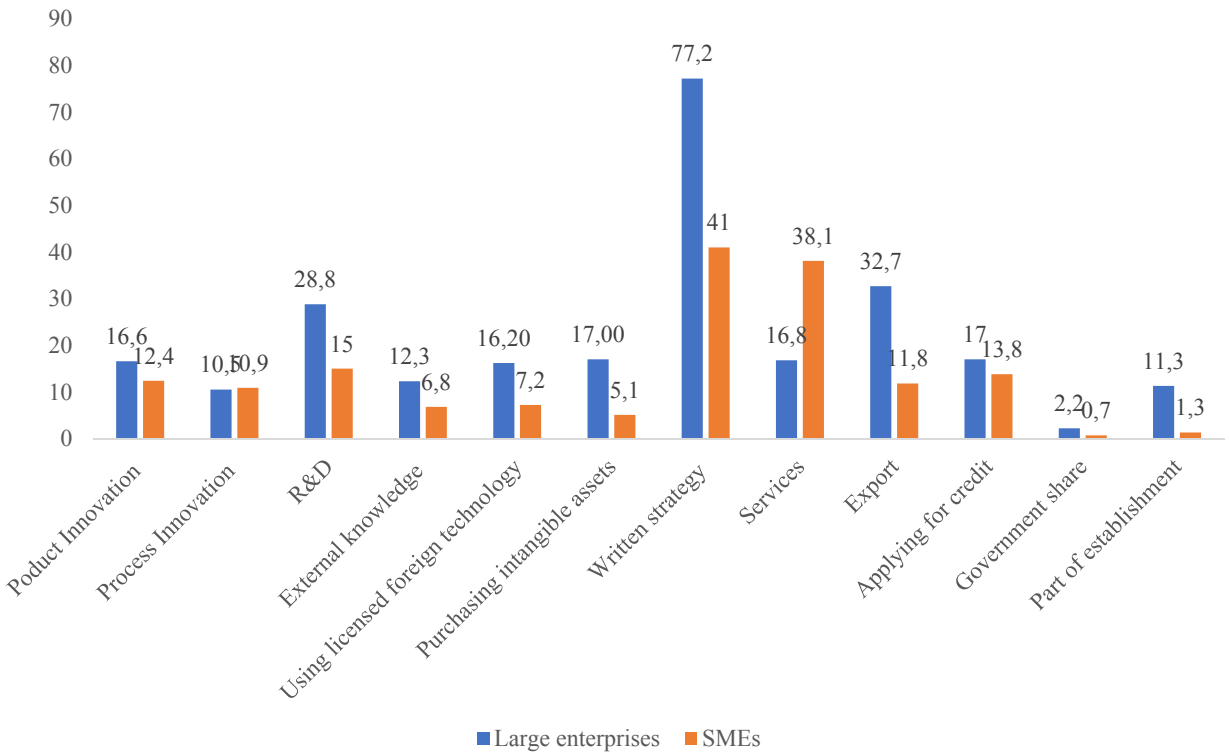

Fig. 1. **Descriptive Statistics of Large Enterprises and SMEs Participating in the Survey, %**

Source: Compiled by the authors using the data of WB Enterprise Survey 2019 — the Russian Federation.

are part of establishments, while this figure is only 1.3% among SMEs. Also, government share is more popular among large enterprises than among SMEs. SMEs that operate in the service sector are twofold more than large enterprises.

The main financial resource for Russian large enterprises and SMEs remains their internal funds. This resource on average consists of more than 73% of the capital structure of large enterprises and more than 78% of SMEs' capital structure. However, the standard deviation of financial resources share is large. Thus, enterprises are different in their capital structure. The second main resource is the credits from suppliers and customers. This resource forms around 13% of the capital structure for both enterprises type. Large enterprises' access to credits from the bank and non-bank institutions is better than SMEs' access, which compiles the mainstream economic literature. Other external financial resources (government grants and bonds) consist of a tiny share of the capital structure of enterprises (*Table 2*). Clustering large enterprises and SMEs enable us from defining different groups of capital structure in both enterprise types and reveal their main characteristics.

Clustering Results

Depending on the results of hierarchical clustering large enterprises are distributed onto five financing patterns (clusters), while SMEs are distributed on 4 patterns. The distribution of both large enterprises and SMEs among the patterns is not even which means that there are dominant financing patterns for both types of enterprises. To obtain a more representative image of the Russian enterprises the observations' weights were taken into account when calculating the distribution of enterprises on clusters and cluster characteristics.

Large Enterprises

Most of the large enterprises 57.5% are internally financed enterprises. The internal financial resources equal more than 92% on average for internally financed enterprises. Internal resources for the four other clusters consist of around half of their financial resources on average. The second large cluster (27.5% of all Russian large enterprises) is trade-financed enterprises. These enterprises depend on loans they get from suppliers and customers as their main external financial resources (36%). The third large group is the credit-financed

Table 2

Capital Structure of Russian Large Enterprises and SMEs (%)

Type of Recourses	Large enterprises		SMEs	
Financial resource	mean	standard deviation	mean	standard deviation
Internal funds	73.8	23.4	78.8	22.3
Bank credits	9.1	14.6	6.3	11.6
Non-bank financial institutions	1.3	6.4	0.5	4.5
Suppliers/ customers	12.6	16.8	13.0	17.2
Government grants	0.9	4.5	0.2	2.1
Bonds	0.9	4.4	0.1	1.4
Other	1.4	6.6	1.1	5.4

Source: Compiled by the authors using the data of WB Enterprise Survey 2019 — the Russian Federation.

enterprises, and which consist of around 12.5% of large businesses. Credits from financial and non-bank financial institutions form more than 41% of their financial resources (*Fig. 2*).

The other two clusters contain around 2.8% of Russian large enterprises. These clusters consist of state-subsidized and mixed-financed enterprises. Mixed financed enterprises use different external financial resources. For these enterprises, bonds form 18.8% of financial resources, while credits from banks and non-bank financial resources form more than 22% of financial resources. State-subsidized enterprises depend on government subsidies for 23% of their financial resources on average, while bank credits form the main part of external financial resources (*Fig. 3*).

SMEs

Most of the Russian SMEs (around 60%) are internally financed where the internal funds consist of around 94% for these enterprises on average. Other SMEs' clusters depend on internal resources for more than 50% of their financial resources.

The other two main clusters are credit-financed and trade-financed enterprises. Trade-financed SMEs depend in around 39% of their financial resources on credits from customers and suppliers. Bank and non-bank credits in credit financed SMEs for more than 31% of their financial resources. The smallest cluster is the mixed-financed SMEs that depend on a mix of external financial resources including bonds (7.5% on average) (*Fig. 4, 5*).

Large Enterprises Clusters Description

1. **Internally-financed:** the largest cluster of large enterprises that contain more than 57% of them. More than 60% of service large enterprises are internally financed and around half of the enterprises have a government share. This cluster contains more than 70% of enterprises that introduced product innovations in the last three years and more than 83% of those that introduced process innovation. Regarding the innovation potential, this cluster includes more than 81% of enterprises that spent on R&D in the last three years, 65% of enterprises that obtained external knowledge, and more than 71% of enterprises that have written strategy.

2. **Trade-financed**: the second largest cluster, which contains more than 8% of innovative product enterprises and more than 6% of innovative process enterprises. Around 39% of government-owned enterprises and 25% of large service enterprises have this funding pattern. This pattern is typical for around 12% of companies that spend on R&D, 20% of large companies with a written strategy, and 27% of those who obtain external knowledge

3. **Credit-financed:** more than 12% of large enterprises are credit financed. The number of enterprises that introduced product innovation in this cluster is comparable to that of trade-financed large enterprises (around 8%). Less than 5% of large enterprises with process innovation have this financing pattern. Around 13% of service large enterprises are

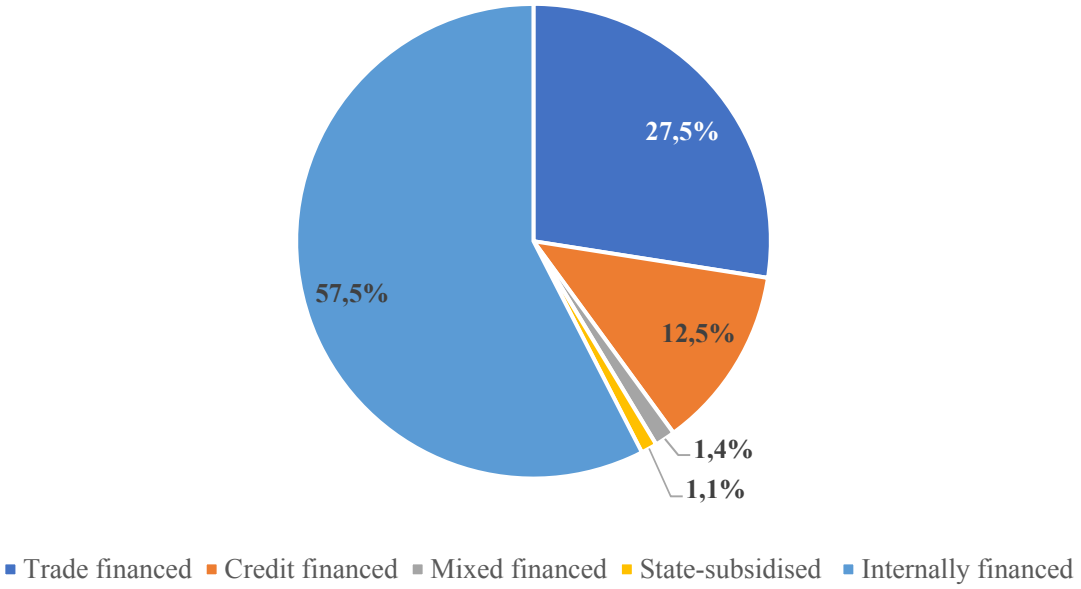

Fig. 2. **Large Enterprises Distribution on Clusters**

Source: Compiled by the authors using the data of WB Enterprise Survey 2019 — the Russian Federation.

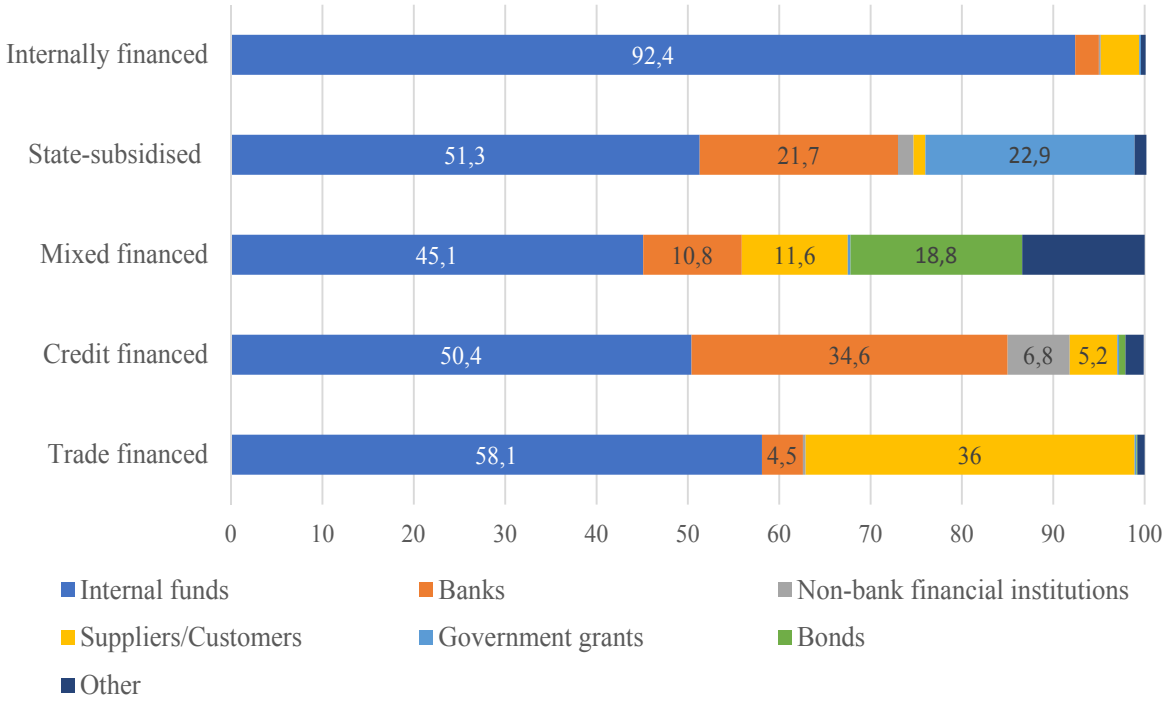

Fig. 3. **Large Enterprises Financing Resources, %**

Source: Compiled by the authors using the data of WB Enterprise Survey 2019 — the Russian Federation.

in this cluster. However, the cluster does not contain any enterprises with government shares. Regarding innovation potential, less than 3% of large enterprises that spend on R&D are in this cluster. Additionally 4% and 5% of large enterprises that obtain external knowledge and have written strategies, respectively.

4. **Mixed-financed:** these enterprises are few (around 1.4% of large enterprises). Enterprises in this cluster are manufacturing enterprises that do not have a government share. Around 4% of large enterprises that obtained external knowledge have this financing pattern. More than 8% of enterprises

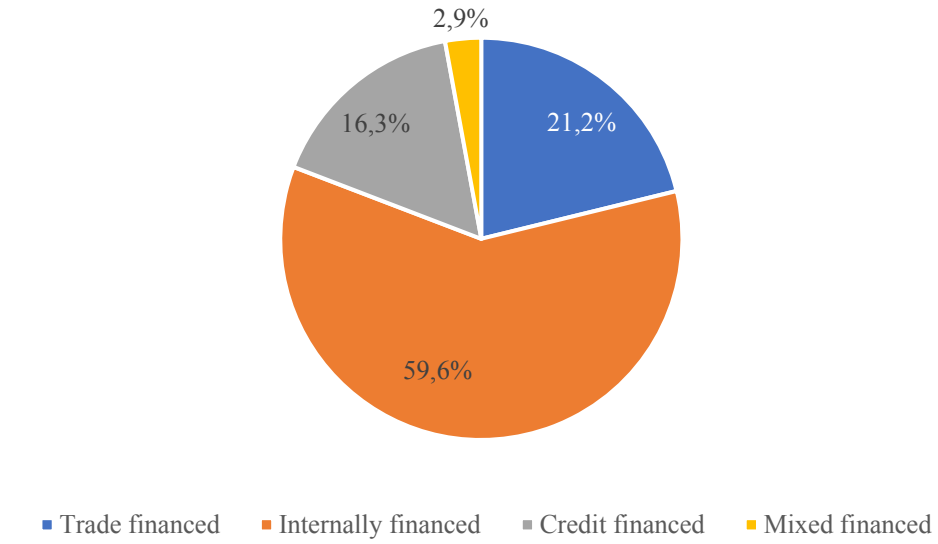

Fig. 4. **SMEs Distribution on Clusters, %**

Source: Compiled by the authors using the data of WB Enterprise Survey 2019 — the Russian Federation.

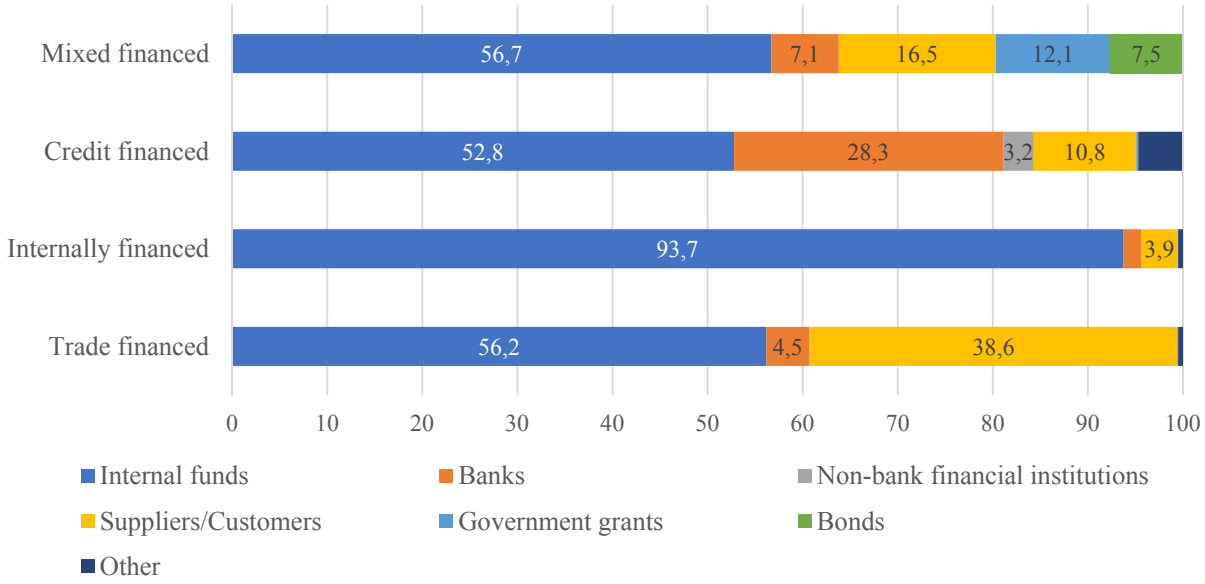

Fig. 5. **SMEs Financing Resources, %**

Source: Compiled by the authors using the data of WB Enterprise Survey 2019 — the Russian Federation.

that introduced product innovation and 5.6% of those that introduced process innovation are in this cluster.

5. **State-subsidized:** the smallest group of large enterprises for which government grants consists of 23% of their capital structure on average. 13.2% of enterprises with this financial pattern are with government share. Less than 5% of enterprises with product innovations are in this cluster. Nevertheless, only around 2% of enterprises that spent on R&D and that have written strategies are in the state-subsidized cluster (*Fig. 6*).

SMEs Clusters Description

1. **Internally-financed**: the largest cluster for Russian small and medium-sized enterprises (SMEs). Approximately 60% of SMEs use this financing scheme. It is worth noting that more than 62% of SMEs in the service sector are part of this cluster. With regard to the

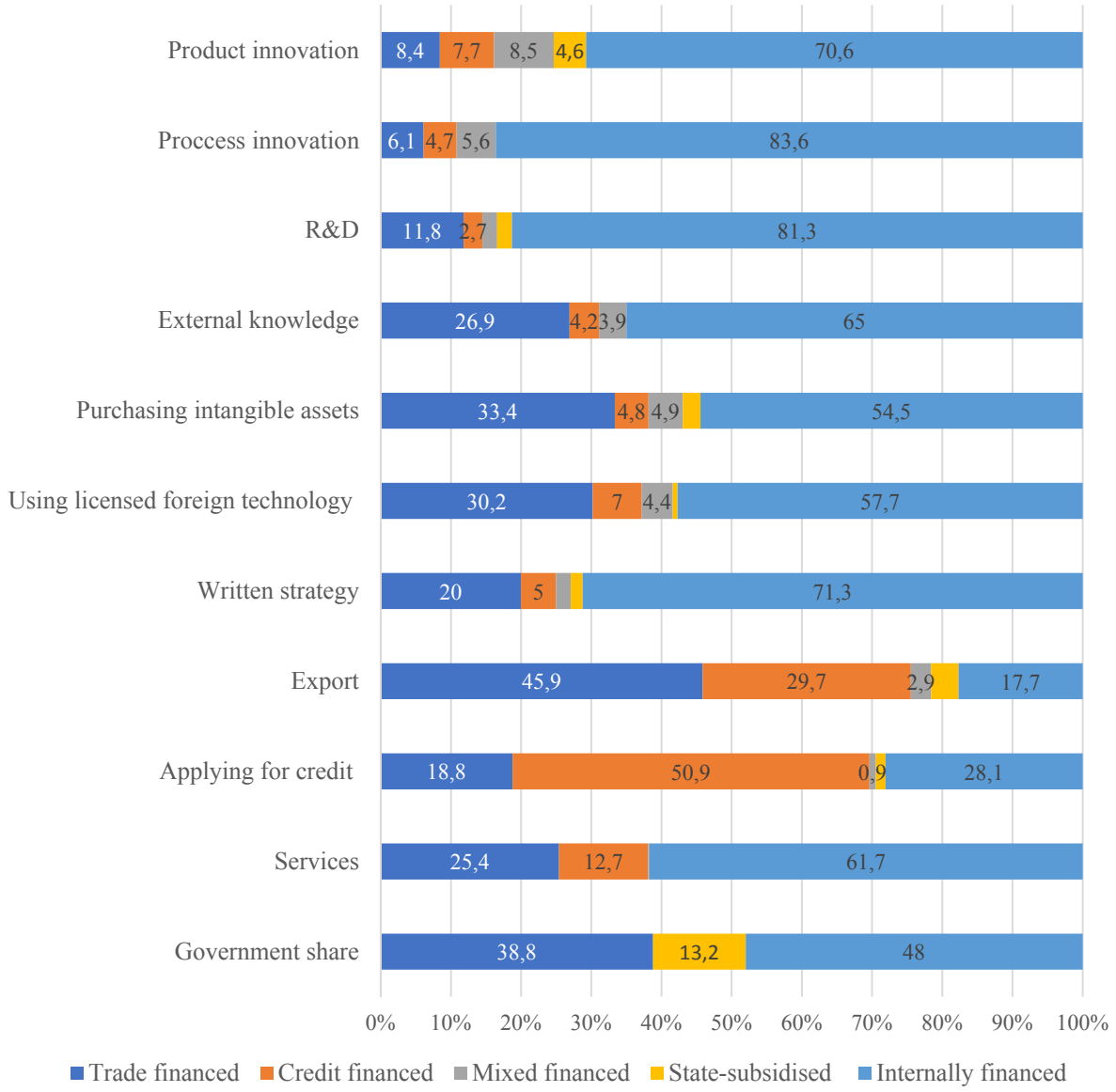

Fig. 6. **Large Enterprises Characteristics Distribution on Clusters, %**

Source: Compiled by the authors using the data of WB Enterprise Survey 2019 – the Russian Federation.

results of innovation activities, approximately 35% and 50% of SMEs that have introduced product and process innovations, respectively, use this funding model. Less than half of SMEs that have spent on research and development (R&D) in the past three years are part of this group. Moreover, around 60% of both SMEs with written strategy and that have obtained external knowledge is internally financed.

2. **Trade-financed:** the second large cluster for SMEs, in which present around 19% of SMEs in the service sector. 15% of both SMEs with written strategy and that have spent on R&D in the last three years are trade financed. Furthermore, 20% of product innovative SMEs and 23% of process innovative SMEs use this financing pattern.

3. **Credit-financed:** this cluster includes around 16% of SMEs in the service sector. The share of product innovative SMEs in this cluster is more than that in trade financed clusters (more than 22%), while process innovative SMEs are two folds less in this cluster than in trade financed SMEs. More than 18% of SMEs that spent on R&D and developed written strategies have these financing patterns. However, 13.4% of SMEs that obtained external knowledge are credit financed.

4. **Mixed-financed:** SMEs in this cluster are mainly manufacturing firms with government shares.

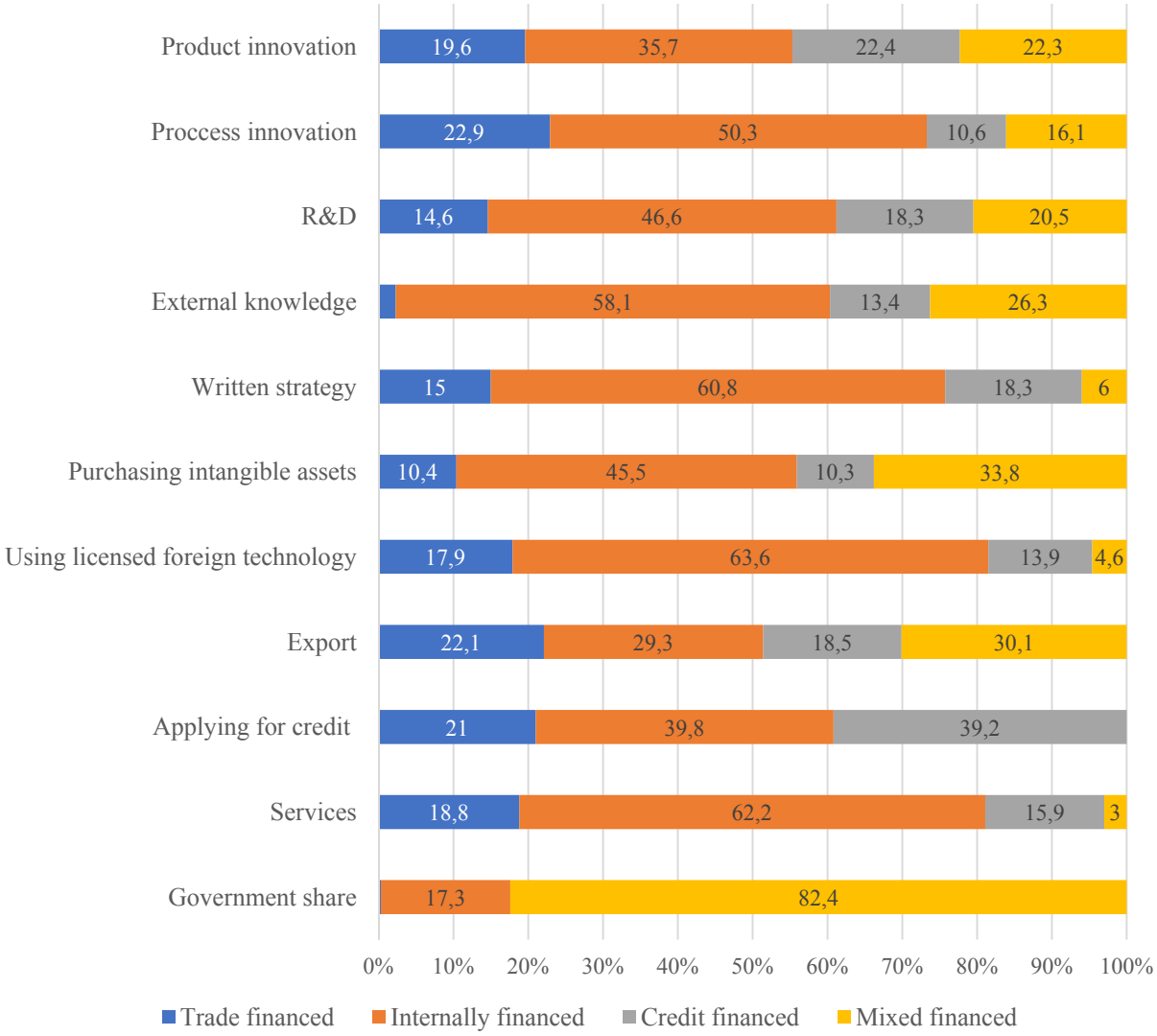

Fig. 7. **SMEs Characteristics Distribution on Clusters, %**

Source: Compiled by the authors using the data of WB Enterprise Survey 2019 – the Russian Federation.

Many of them introduced product and process innovation in the last three years (22.3% of SMEs with product innovations and 16% of SMEs with process innovation). Furthermore, 20% of SMEs that spent on R&D have this financing pattern (*Fig. 7*).

DISCUSSION

Russian large enterprises and SMEs differ in their capital structure. The financing patterns of large enterprises are more diverse than those of SMEs. Nevertheless, Russian SMEs have fewer financing patterns than European SMEs. Internal funding remains the main pattern for Russian enterprises. However, more Russian large enterprises and SMEs (around 58% and 60%, respectively) have this pattern while only 40.6% of European SMEs are internally funded [33]. Russian enterprises are more reliant on loans from their suppliers and customers than Europeans. More than 20% of large enterprises and SMEs are financed through trade.

Other patterns of financing, mainly, credits and bonds are less familiar for Russian enterprises than Europeans. This could mean that these two instruments are less developed and the access of Russian enterprises to these instruments is limited. Regarding the relationship between innovation results and financing patterns, most of the large innovative enterprises and internally funded. It is noteworthy that around 30% of large enterprises with product innovation are not internally funded while this figure is around 20% for large enterprises with process innovation.

However, innovative SMEs have more diverse financing patterns. Only 35% of SMEs with product innovation are internally financed, while this figure is more than 50% for SMEs with process innovation.

Although the largest share of Russian innovative large enterprises is internally funded, most internally funded enterprises that have enough resources did not introduce product or process innovation in the last three years. This is also the case for Russian SMEs. European innovative enterprises are better represented in the internally funded pattern (34%). Furthermore, the share of European SMEs that are credit-financed is more than credit-financed Russian SMEs [24].

Regarding the innovation potential elements larger share of not internally financed large enterprises and SMEs in Russia have elements of innovation potential, in particular purchasing intangible assets and using foreign licensed technology. These companies could potentially become innovative enterprises and they should be encouraged to introduce product and process innovations.

Large enterprises that purchased intangible assets or use foreign licenses are mainly distributed on internally financed and trade financed clusters. Enterprises of other financing patterns are less represented among these enterprises. The situation is different for Russian SMEs where around 45% of not internally financed or trade-financed enterprises purchased intangible assets. However, this figure is lower for SMEs that use foreign licensed technology (approximately 18%).

It is noteworthy that around 50% of large enterprises and 60% of SMEs that applied for credits in the last financial year were not credit-financed. Russian enterprises with different financing patterns require external financial resources for their activities from banks even if these resources are not their primary source of funding.

CONCLUSION

The financing patterns of enterprises reveal their capital structure and the main financial resources that they use. The financing patterns of large Russian enterprises and SMEs were discovered using cluster analysis. This method is used to divide enterprises into groups based on their similarities in their capital structure.

Most Russian large enterprises and SMEs, almost 58% and 60% respectively, are in the group of internally funded enterprises. This means that internal funds consist, on average, for more than 90% of their capital structure. The second large cluster for both large enterprises and SMEs are trade funded enterprises. These enterprises depend on loans from suppliers and customers, on average, in more than 35% of their capital structure. More than 12% of large enterprises and 16% of SMEs are credit financed. Enterprises of this cluster use bank and non-bank credits as a resource for more than 40% of their capital for large enterprises and for more than 31% of their capital structure for SMEs. Other financing patterns, for instance, bond-financed and mixed financed are not popular. They consist of no more than 3% of large enterprises and SMEs' capital structure.

Studying the distribution of innovative enterprises on clusters reveals that the majority of large enterprises with product innovation and with process innovation are internally funded. However, this is not the case for Russian SMEs, where internally funded SMEs that have introduced product innovation in the last three years account for around 35% of all Russian innovative SMEs. However, innovative large enterprises and SMEs consist of a tiny part of internally funded enterprises. Furthermore, it is important to stimulate innovative activities in Russian SMEs mainly by financial instruments while this is not the case for large enterprises that need other kinds of instruments to stimulate them to introduce new products. This conclusion is supported by the fact that more than 50% of Russian SMEs that have spent on R&D over the last three years have not been internally funded.

Stimulating the innovativeness of not internally funded large enterprises could be done by supporting them in purchasing intangible assets of foreign licenses. These instruments that enhance enterprises' innovation potential are mainly used by large enterprises that are internally financed or trade-financed. However, many credit-financed and mixed-financed SMEs use these instruments. This fact could partially explain their innovative activities.

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ORIGINAL PAPER

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Current Trends in Digitalization of Banking Business in Russia

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ABSTRACT

Currently, digital technologies are being actively implemented in all sectors of the economy, including the banking industry. This process is influenced by various factors that either stimulate or limit its development. The subject of the research is innovative digital developments that can help banks become more efficient and competitive; protect them from risks, and improve the quality of their banking services. The object of the study is digital banking, a promising form of banking service provision. The relevance of this research is due to the rapid digital transformation and the introduction of innovative technologies, which are radically changing the paradigm of customer service and risk management. The purpose of the work is to identify current trends in the digital banking, to systematize the benefits of digital technologies and to identify key areas of banking practice that are affected by them. The study of the development of digital banking business models is based on the methods of chronological cognition and expert assessments. The scientific article is interdisciplinary in nature, based on the fundamental works of leading domestic and foreign economists, as well as analytical materials from the Bank of Russia. The author concludes that banks are conquering new markets by providing mainly remote services and contactless payment options. The scientific novelty of the paper lies in the author's interpretation of the process of digitalization in the banking industry, highlighting the various stages of its development and providing a comprehensive analysis of Russian digital banking practices. The practical significance lies in the development of recommendations for optimizing the digital transformation of banks, which is useful for financial professionals and developers of digital solutions. A promising area for further research is a more in-depth study of the factors that hinder digitalization and the methods for minimizing them.

Keywords: banks; digitalization; blockchain; cryptocurrency; artificial intelligence; mobile banking

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INTRODUCTION

Currently, all sectors of the economy are characterized by the integration of modern digital technologies. The process of digitalization in the banking business is more dynamic than in other sectors of the economy. Recent decades have been accompanied by increased interest in the topic of digitalization of business models, including from the banking and scientific communities, as well as from technical and information institutions. In the scientific works of Russian economists, much attention is paid to the topic of innovation in banks [1–7].

In a broad sense, digitalization refers to the rapid integration of new digital and trending technologies into the business context of financial intermediaries in order to increase their profits and expand opportunities. According to the author, the term "digitalization" implies the introduction of affordable new technologies into the business process of companies to bring them to a high-quality and efficient level.

Based on the global and domestic experience in the development of digitalization of the banking business, a number of models of digital banking organization have been formed (*Fig. 1*).

1. *The Anglo-American model* was formed during the COVID-19 pandemic in the context of widespread coverage of territories by Internet resources and the spread of marketplaces, as well as constant consumer demand for services from digital providers and trust in them for personal data protection (in the UK, the cybersecurity index was 0.931; in the USA — 0.926). This model is characterized by the presence of independent platforms such as Apple Pay, Google Pay, and the merging of banking services with customers' digital devices, which allow users to freely access their banking services in the "here and now" format. Such a banking business model is actively integrated into the daily lives of customers.

2. *The Russian model* was formed as part of the implementation of the state program for the digitalization of the economy[1] and the achievement of the strategic objectives of the mega-regulator for the creation of national digital banking systems. The formation of the domestic model was significantly influenced by the active innovation policy of the TOP 3 Russian banks[2] and the expansion of the niches of the Internet service provider[3] market. However, the business models of digital banking in Russia do not have a single transparent customer base.

3. *The European model* of digital banking reflects the specifics of national guidelines. Some countries (Sweden, Denmark) actively use digital technologies in financial services, while others (Italy, Spain) have traditional banking systems. The European Commission actively supports the development of digital financial services by creating conditions for competition and innovation, as well as developing new rules and regulators to protect consumers and ensure security.

Digitalization of the banking business is the process of introducing new technologies and digital tools to improve the quality of customer service, optimize business processes and increase the efficiency of the bank.[4]

The initial stage of digitalization of the banking business began with the introduction of automation of routine and monotonous processes. Banks began using computer programs, which made it possible to speed up transactions and reduce costs [9].

With the spread of the Internet, banks were able to provide their services online, which

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[1] National Program "Digital Economy of the Russian Federation" dated 04.06.2019 No. 7. URL: https://digital.gov.ru/target/naczionalnaya-programma-czifrovaya-ekonomika-rossijskoj-federaczii (accessed on 05.02.2024).

[2] PJSC "Sber". URL: https://www.sberbank.ru /; PJSC "T-Bank:. URL: https://www.tbank.ru /; Alfa-Bank JSC. URL: https://alfabank.ru / (accessed on 05.02.2024).

[3] PJSC Rostelecom. URL: https://www rt.ru / (accessed on 05.02.2024). MTS PJSC. URL: https://www.mtsbank.ru / (accessed on 05.02.2024).

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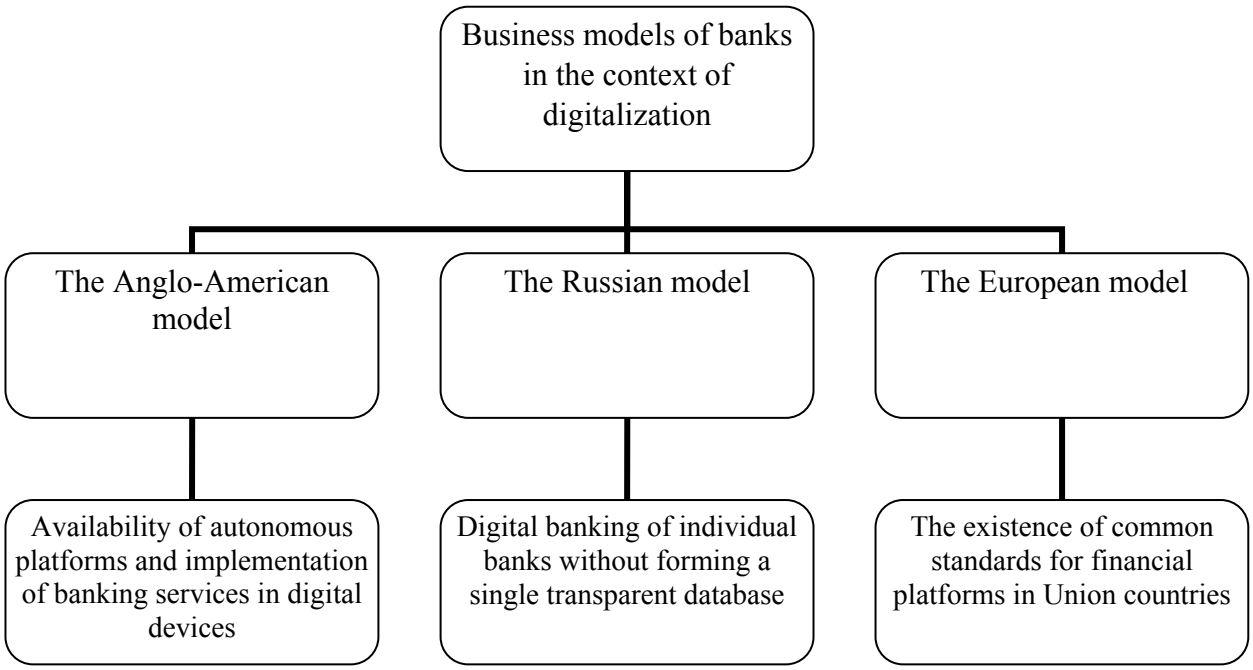

Fig. 1. **Business Models of Banks in the Context of Digitalization**

Source: Compiled by the author based on the data [8].

significantly expanded the customer audience and reduced operating costs.

The development of artificial intelligence and machine learning has revolutionized the approach to the organization of banking. Banks began to actively implement it to analyze transactions, customer behavior, and market conditions in order to provide personalized products, process data, and make informed decisions. This allows you to increase revenue, improve customer service, and reduce risks.

The emergence of blockchain technologies has allowed banks to ensure the security and transparency of transactions, as well as to develop the latest financial instruments based on cryptocurrencies. In banks, it is advisable to use it for transaction security and optimization of international payments [10].

The integration of virtual and augmented reality (VR/AR) into the banking business is characterized by the creation of interactive presentations of their products and services, providing customers with the opportunity to virtually "visit" the bank, as well as develop distance learning courses to improve the skills of their employees.

Banks have recently started using the Internet of Things (IoT) to monitor and control their equipment and systems. The Internet of Things allows banks to analyze data received from various devices to optimize business processes and improve the quality of service.

Banks are actively developing digital channels of interaction with customers, offering a wide range of their services and products through them.

In order to expand the customer base and explore new market segments, banks are forming ecosystems that combine various services and offerings, which allow them to meet consumer demand for integrated solutions.

For example, Sber, being one of the largest banks in Russia, has its own ecosystem, including many different services that manage finances, pay for goods and services, transfer funds, etc. Sber has its own chain of stores, actively develops areas of medicine, education and tourism.

Table 1

The Latest Stage in the Development of Digital Technologies in the Banking Business

Late 1990s — early 2000s	2010s	Modernity (2020 s)
Introduction of information technologies for remote banking (Internet banking and online services for customers)	"Mobile banking": Banks actively developed mobile applications for customer service on smartphones and tablets	Banks are actively implementing artificial intelligence, process automation, data analytics and blockchain technologies

Source: Compiled by the author.

The Yandex ecosystem is characterized by many useful services for users.[5] Banks and Yandex interact through various platforms, and users can make payments and transfers through Yandex.Money, as well as open bank accounts. Financial intermediaries are constantly striving to develop new technologies to automate processes and improve the quality of customer service. New "unmanned" technologies allow banks to evaluate large amounts of data, maintain transaction security, improve customer service, and minimize risks.

Digitalization of banking involves the robotization (RPA) of banks' core business processes to perform routine tasks and operations, which significantly reduces task completion time, reduces the likelihood of errors, and optimizes resource usage and increases the efficiency of the bank as a whole. Over the past 20 years, digitalization has completely covered the banking process (see *Table 1*).

These conditional time frames illustrate the desire of banks to take a leading position in the use of modern technologies to optimize their work.

[5] For example, Yandex.Taxi allows you to order a taxi, Yandex.Food — order food from restaurants, Yandex.Health — get a doctor's consultation, Yandex.Real Estate — find a place to buy or rent, Yandex.Travel — book a hotel or buy plane tickets, Yandex.Afisha — buy tickets to concerts and performances, and so on.

OVERVIEW OF DIGITAL BANKING TECHNOLOGIES IN RUSSIA AT THE PRESENT STAGE

At the current stage of functioning in Russia, the main trends of the banking business have already been formed. There is a tendency to increase the role of virtual branches and minimize physical presence in the market: through ATMs, without the participation of bank staff, documents are signed with personal electronic signatures.

At the same time, physical branches of banks provide their clients with a full range of not only banking services, but also products of financial intermediaries (insurance policies, pension products, etc.). Most banks have cafeterias for meetings with partners for meetings and business events, as well as halls for video conferences with clients.

Banks are often installed in various locations (for example, in shopping malls and car dealerships) both their representatives and fully automated kiosks (in the form of a video screen and an ATM, through which customers can independently receive banking services) [11].

Banks are also developing social banking: they send personal financial offers to their clients using social networks and messengers (Odnoklassniki, VKontakte, etc.).

The expansion of the possibility of offering banking services has become possible thanks to the "digital footprint" of the client.

Table 2

The Number of Users of Banking Applications

Bank	The number of installations since 01.01.2015, including App Gallery, App Store, Google Play	The number of installations excluding AppGallery	Increase in installations 2021–2022/2020–2021	The number of sessions per day	Average user time per day
Sberbank	440 384 599	10 033 999	7 226 761	0.97	190
VTB	32 346 864	4 909 367	1 863 609	101	230
Tinkoff	60 896 001	14 632 274	2 898 965	1.4	200
Alpha	31 615 616	5 439 042	–391 571	0.96	190
PostOffice Bank	24 907 343	4 326 659	391 982	1.3	190

Source: Compiled by the author on the basis of data from: Mobile Banking Application Survey in Russia, 2022. URL: https://goahead.ai/goawards/gobanking2023/cases/Go_Banking_2022.pdf (accessed on 05.02.2024).

Thus, when searching for financial services necessary for clients or communicating on social networks, their "digital footprint" remains [12]. Financial intermediaries constantly analyze it and determine the preferences of the client in order to form personal recommendations and ensure the safe use of the Internet.

Statistical data on digital banking services in Russia can be quite extensive and diverse. There are about 370 banks operating in Russia in 2024, and each of them has its own mobile application and online banking. The total number of such services can reach several hundred. The number of active users of mobile applications and online banking is constantly changing, as users can install and delete applications, as well as change banks (see *Table 2*).

In addition, the number of "mobile" customers of the older generation is growing every year, as well as people with disabilities who find it difficult to understand the functions of banking applications. According to some estimates, the share of mobile payments in Russia exceeds 70% of the total volume of non-cash transactions.[6]

Let's take a look at the trends in the number of accounts and the volume of transactions through mobile applications and online banking services. This indicator is dynamic and can be expressed in various currencies (in rubles, dollars, or euros). During the period under review, there has been a steady increase in the volume of transactions conducted through digital channels (see *Table 3*).

Contactless payment systems are widely used in Russia, and alternative methods of non-cash payment are actively developing. Thus, after the termination of the service of foreign cards, the national payment system "Mir" rapidly conquered the market in

[6] Mobile Banking Application Research in Russia, 2022. URL: https://goahead.ai/goawards/gobanking2023/cases/Go_Banking_2022.pdf (accessed on 05.02.2024).

Table 3

The Number of Accounts and the Volume of Payments with Remote Access Opened in Credit Institutions of the Russian Federation, 2021–2023, Thousand Units

Date	Total amount of payments	Total number of accounts	Including those opened to clients:					The share of using mobile subscriber devices of individuals in the total volume
			Legal entities, not included, total	Of them	Individuals, total of them:	Of them	With access via messages using mobile subscriber devices	
				With access via the Internet		With access via the Internet		
1	2	3	4	5	6	7	8	9
2023	x	356.6	8.9	8.2	348.4	334.2	254.8	0.73
2022		333.2	7.8	7.9	325.2	311.9	242.5	0.75
2021		293.4	6.6	6.5	286.7	276.1	210.8	0.74
2023	523.4	x	799.6	694.9	35.2	27.0	13.5	0.00
2022	1339.6	x	1306.3	1165.6	33.3	18.1	1.2	0.04
2021	881.6	x	859.6	707.2	21.9	12.0	0.8	0.04

Source: Compiled by the author on the basis of data from: URL: https://cbr.ru/statistics/nps/psrf/ (accessed on 05.02.2024).

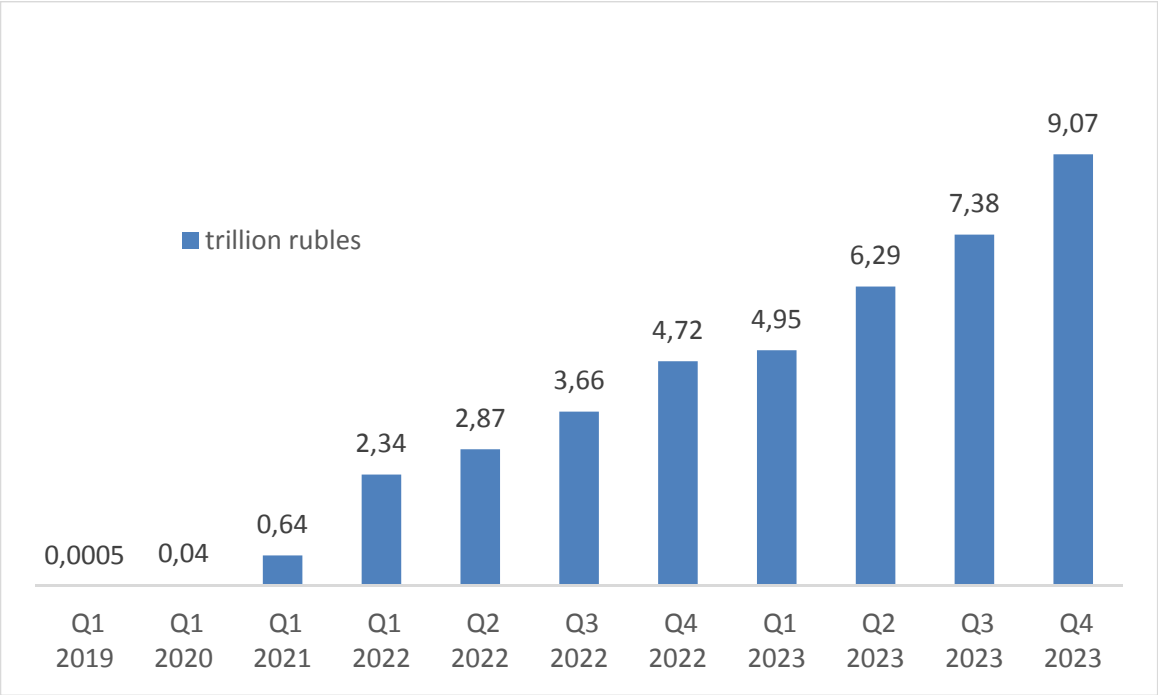

Fig. 2. **Dynamics of the Volume of Purchases of Goods and Services in the Total Number of Transactions in the SBP Trillion Rubles**

Source: Compiled by the author.

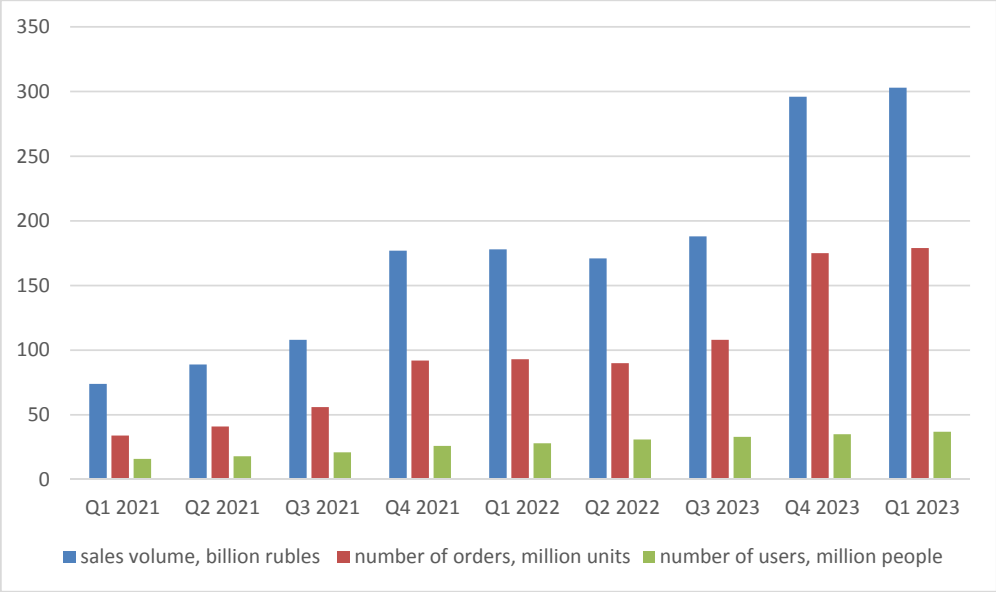

Fig. 3. **Ozon's Operational Performance**

Source: Compiled by the author on the basis of data of Ozon press releases. URL: https://ir.ozon.com/ru/news/4510/ (accessed on 05.02.2024).

Russia. NPC Mir offers its own application for contactless payments — Mir Pay.

Payment services Yandex.Money and Qiwi and others are actively developing their technologies for contactless payments.

Sberbank, Russia's largest bank, has developed the Cyberpay Online application for contactless payments using NFC technology, which allows you to quickly pay for online purchases. For example, in March 2022, the population made payments from Cyberpay Online in the amount of 28.8 billion rubles, and in 2023 — by 169.7 billion rubles. Payments increased almost 6 times, and the number of customers increased from 6.8 million to 25.6 million people. The share of online payments for the analyzed period is almost 45% of Sber's online acquisition.[7]

In June 2022, the MIR payment system introduced an alternative method of making payments using QR codes, in which the seller reads the code created by the customer in the Mir Pay application and deducts the required amount from his account.

Banks constantly monitor customer demand in order to improve their products and develop new financial products and services for all categories of customers [13].

At the same time as using "traditional" payment tools, banks are developing new payment mechanisms that are more attractive to customers and stable to external factors. Thus, the quick payment system (SBP)[8] has become in demand (*Fig. 2*).

Current trends in Russia include: growing demand from sellers and a franchising network of financial product pick-up points, as well as increasing confidence in "quasi-banks". Clients are ready to use Big Tech companies as a provider of financial services [14]. Platforms and the marketplace compete for their attention, time, and the functionality of applications that allow them to receive services quickly and efficiently. The emerging technology of embedded finance in the banking service makes it possible to integrate payment instruments, lending, insurance, as well as investing in any non-financial service or product.[9]

[7] More than 25 million Russians use Cyberpay every month. URL: https://dzen.ru/a/ZEfCjwVoDBX74pL_ (accessed on 05.02.2024).

[8] URL: https://cbr.ru/analytics/nps/sbp/4_2023 (accessed on 05.02.2024).

[9] Russian FinTech-2023: payment in messengers and electronic wallets 2.0. Read more on RBC. URL: https://trends.rbc.ru/trends/industry/6438feb49a7947f538487af6?from=copy(accessed on 05.02.2024).

Table 4

Dynamics of the Number of Devices Used for Transactions with and Without Payment Cards for the Period 2017–2023 (Thousand Units)

Date	The number of ATMs						The number of terminals				
	In total	With a cash withdrawal function		With the function of accepting cash			Electronic terminals	Cashless payment terminals	Electronic terminals at cash	Withdrawal points of imprinters installed in trade (service)	Organizations of imprinters at cash withdrawal points
		In total	Total of them	In total	Total of them:						
			With the functi/on of paying for goods and services		Without using payment cards (their details)	With the function of accepting cash from					
1	2	3	4	5	6	7	8	9	10	11	12
1.10. 2023	149.2	112.9	105.3	122.4	6.9	115.4	3967.6	343.3	163. 6	0	0
1.01. 2023	179.7	114.3	107.4	149.7	6.2	143.4	3809.5	272.4	165.3	0	0
1.01. 2022	190.4	120.7	114.5	148.3	6.2	142.1	3546.8	201.3	178.9	0.4	0.3
1.01. 2021	200.0	124.6	121.5	151.6	5.9	145.7	3598.7	121.3	185.9	0.47	0.6
1.01. 2020	202.6	131.9	128.6	145.8	7.0	138.8	2913.0	92.6	194.4	1.2	0.2
1.01. 2019	200.9	129.3	127. 3	135.1	9.9	125.1	2588.8	5.1	218.8	16.2	0.9
1.01. 2018	206. 4	125.6	123.7	134.5	1.1	123.1	2189.1	3.9	179.0	16.7	1.0
1.01. 2017	208.9	126.7	123.8	131.5	7.4	124.07	1761.3	5.7	190.2	16.6	0.7

Source: Compiled by the author on the basis of data from: URL: https://cbr.ru/statistics/nps/psrf/ (accessed on 05.02.2024).

Table 5

Sbercoin Roadmap

2020	2021	2022	2023	2024
Creating the SbercoinOne project Registration of a legal entity (sole proprietor) in the Russian Federation Deploying a smart contract on the Ethereum Blockchain	The fixed value of one coin is 200 rubles. Listing on decentralized exchanges.Enabling online payment by bank cards on the website. Migration of 10% of coins to BSC.5,000 coins to eth addresses of Holders. Online promotion	Indexing the value of the coin by 50% Listing on a centralized exchange Offline promotion 50,000 coins on Holders' eth addresses Changing the form of ownership of an LLC	Indexing the value of the coin by 50% Obtaining a crypto license Listing on a major API exchange Adding Coins to CoinMarketCap Attracting investors of 300,000 coins on eth addresses of Holders	Establishing the market value of the coin. Creating an ecosystem and deploying decentralized SbercoinOne applications 100% coins in free circulation

Source: Compiled by the author.

Ozon Bank provides express loans or installments to pay for purchases, issues cards with favorable terms and high cashback (*Fig. 3*).

The M. Video–Eldorado group[10] provides credit brokerage services, develops its own fintech platform focused on electronic payments and consumer lending, and also offers its customers the BNPL ("buy now, pay later") service.[11]

MTS Corporation has formed a personal fintech ecosystem by combining MTS Bank and MTS Money.[12]

The Tinkoff service also mediates marketplaces. An actual advantage for consumers of modern services is the ability to pay for online purchases in equal installments over a short period of time.

In order to increase sales, financial intermediaries are expanding online lending, including on marketplaces. An important indicator of the development of contactless payments is the number of contactless terminals and POS terminals (*Table 4*).

A wide range of devices, and their availability in large numbers, allow for fast and convenient transactions.

The expansion of the range of financial services and the appearance of numerous financial intermediaries on the market obliges the Bank of Russia to improve legislation and introduce modern legal mechanisms that increase the degree of liability of credit institutions for damage caused to the client due to illegal actions of third parties and technical failures. According to the Center for Strategic Research (CSR), the information security market in Russia, despite the expected decline due to the departure of foreign vendors, grew by 4% in 2022 and is expected to further increase to 24% by 2027. The positive aspect is the fact that the Russian growth rate of the cybersecurity market is much higher than the global average.[13] Investments in cyber defense are economically more profitable than the costs that the bank will have to incur to cover the negative consequences of illegal actions.

[10] The M. Video — Eldorado group is the leader of the Russian retail market for household appliances and electronics. Combining two leading Russian retail brands, the company operates the largest online platform for the sale of household appliances and electronics and more than 940 stores in all regions of Russia.

[11] Russian FinTech-2023: payment in messengers and electronic wallets 2.0. Read more on RBC. URL: https://trends.rbc.ru/trends/industry/6438feb49a7947f538487af6?from=copy (accessed on 05.02.2024).

[12] Electronic payment systems in Russia. URL: https://www.tadviser.ru/index.php/(accessed on 05.02.2024).

[13] URL: https://www.vedomosti.ru/investments/articles/2023/08/30/992513-kuda-investirovat-na-rinke-kiberbezopasnosti (accessed on 05.02.2024).

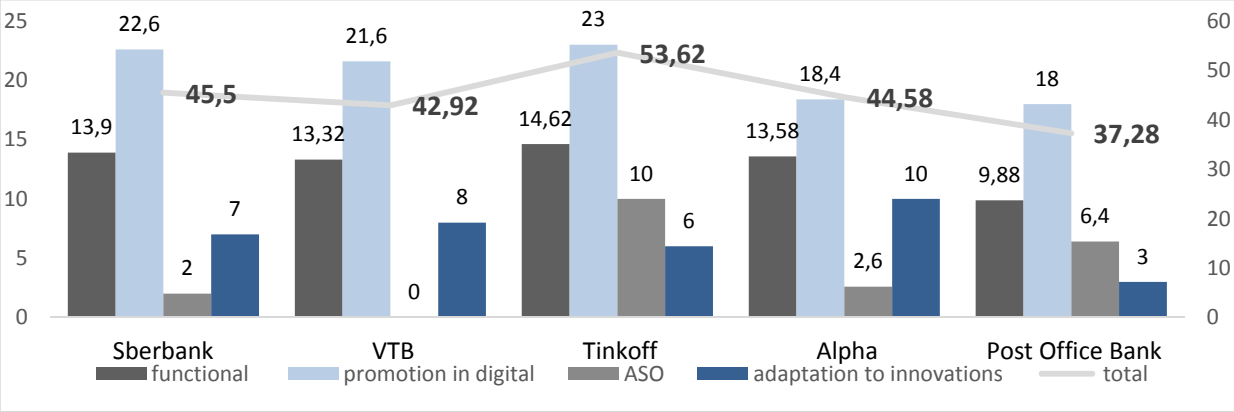

Fig. 4. **The Best Mobile Bank in 2022**

Source: Compiled by the author on the basis of data from Research of mobile banking applications in Russia. URL: https://goahead.ai/goawards/gobanking2023/cases/Go_Banking_2022.pdf (accessed on 05.02.2024).

To ensure the protection of the legitimate interests of customers, banks will receive legal grounds for the creation and use of the Central Bank's "Know Your Customer" information service.

This service processes information on a daily basis "on the level of risk of customer involvement in suspicious transactions and uses it in the implementation of anti-legalization control procedures".[14]

Transactions with a new digital form of money are an urgent area in the financial market [15]. After the introduction of the digital ruble,[15] which the Bank of Russia issued in 2023, banks are required to make payments and transfers in a third form of money, similar to non-cash payments. In January 2021, Sber submitted an application to the Bank of Russia for the registration of a blockchain platform and the issuance of its own digital asset Sbercoin. The Sbercoin development strategy is outlined in the form of a roadmap (see *Table 5*).[16]

According to CoinMarketCap, Sbercoin began trading on March 17, 2022 at $ 0.0003617, and as of January 2024, the price of Sbercoin was $ 0.0115034987.[17]

Currently, there are a limited number of statistical and analytical reviews on the use of blockchain technology by banks in Russia, as this is a relatively new area of development [16]. Based on the results of the presented study, it is possible to determine the level of customer satisfaction with the digital services of financial intermediaries (*Fig. 4*).

Analytical and informational reports show that most Russian bank customers are satisfied with the quality and functionality of their mobile applications and internet banking systems.

PROBLEMS OF DIGITALIZATION OF BANKING SERVICES IN RUSSIA

The rapid development of digitalization of banking services is accompanied by numerous limitations and difficulties.

Firstly, the lack of qualified specialists in the field of IT and digital transformation is a serious problem for the banking sector. With the development of technology and digitalization of banking processes, more and more specialists with relevant knowledge and skills are required [17, 18].

Banks face competition from other industries, such as technology companies,

[14] The Central Bank's draft of the main directions of digitalization of the financial market for the period 2022–2024. URL: https://cbr.ru/press/event/?id=12518 (accessed on 05.02.2024).

[15] The Law on Digital Financial Assets and Digital Currencies dated 31.07.2020 No. 259-FZ, which entered into force on January 1, 2021, allows the Russian citizens to buy digital analogues of securities and gives digital assets a legal status.

[16] URL: https://sbercoin.one/#start (accessed on 05.02.2024).

[17] URL: https://coinmarketrate.com/ru/currency/sbercoin/ (accessed on 05.02.2024).

which also need IT specialists. This creates a shortage of qualified personnel and increases competition in the labor market.

To solve this problem, banks can motivate banking specialists to improve their knowledge in the field of modern digital technologies; cooperate with educational organizations for high-quality professional retraining of bank employees; use outsourcing services.

Secondly, consumer demand places high demands on the convenience, speed and security of banking services. This forces banks to constantly improve their technological processes. It is not enough for banks to use their own funds accumulated from profits or other sources. They can interact with other financial intermediaries in order to obtain consortium loans or borrowed funds to finance digital projects.

Government support is important for solving the problem of insufficient resources. In some countries, governments may provide grants or subsidies to support digital transformation in various industries, including the banking industry.

Banks can use crowdfunding platforms to raise funds from a wide audience interested in developing digital innovations in the banking sector.

Third, the digital transformation of banking services is accompanied by data security and cybersecurity risks. Responsibility for uncontrolled transactions is generally assigned to the bank [19]. Digitalization potentially increases the frequency of fraud and unauthorized break-ins. To solve this problem, banks can apply:

1. Multi-factor authentication, data encoding and monitoring of network activity, which timely identifies potential threats and prevents cyber attacks.

2. Systematic training and improvement of security policy to reduce the risk of data leakage.

3. Clear action plans (strategies) in the event of a cyberattack or data leak, which will allow banks to quickly respond to the incident and restore customer data.

Fourth, many banks have limited access to modern developments. European economic sanctions have a negative impact on the digitalization of the banking business directly (a ban on the use of services) or indirectly (restrictions on imported programs and other equipment). At the same time, the sanctions applied have become an incentive for the production of domestic software equipment for banks.

Fifth, customer adaptation to new digital banking technologies is a complex process due to a variety of factors: insufficient technical literacy, little experience with digital devices; lack of constant Internet access; distrust of digital services and the threat of cyber attacks or fraud. Some clients, typically of the "silver" age, may be accustomed to traditional methods of banking, such as visiting a physical branch or interacting with a bank representative in person, and may not see the value in switching to digital services. This can create barriers to adopting new technologies.

To mitigate the difficulties of adapting customers to new digital technologies, banks can take the following steps:

- training and support: providing training materials, trainings and consultations on the use of digital services for customers, especially for those who are experiencing difficulties;
- improving user demand: developing user-friendly and intuitive interfaces for mobile applications and online services to make the use of new technologies easier and more convenient;
- offline support: providing alternative service methods for customers who prefer traditional ways of interacting with the bank, for example, through branches or contact centers;
- encouraging the use of digital services: offering bonuses, discounts or other incentives to customers who actively use the bank's digital services [20].

Sixth, the late adoption of regulatory documents and the lack of relevant laws and regulations can slow down the process of digital transformation of the banking business and create obstacles to the introduction of new technologies.

In order to contribute to the digital modernization of the banking business, it is necessary to develop new laws and regulators that will meet the realities of the digital economy and provide support for:

- minimizing cybersecurity threats: legislation should include data encoding requirements, fraud prevention measures, and obligations to notify about security breaches;
- legal regulation of digital payments, ensuring the security and efficiency of electronic payments, including the use of blockchain technologies and cryptocurrencies;
- consumer protection when using digital banking services, including transparency of the terms of service, protection of personal data and the possibility of contacting law enforcement agencies;
- stimulating innovation in the banking sector, for example, by creating special programs to support startups and technological innovations, as well as simplifying procedures for innovation;
- development of laws and regulations that will comply with international standards and promote global cooperation between countries in the field of digital modernization of the banking business.

Seventh, banks are forced to incur significant costs for the introduction of digital technologies into their operations. In our opinion, the formation of a single transparent customer base of banks will improve the efficiency of financial services, improve the quality of customer service, and create broader opportunities for personalization of offers.

Thus, the issue of creating a unified, transparent customer database in the context of digital banking can be seen as a balancing act between competition and collaboration, where each bank must individually determine the best course of action for its strategy.

Also, in order to solve the tasks of national projects on the digitalization of the economy, we recommend that banks form common standards for financial platforms for conducting banking operations. This will reduce costs, increase the efficiency and transparency of the banking system, as well as ensure the safe handling of customer personal data and counteract fraudulent schemes.

An integrated approach to solving these tasks will help develop digital processes in the banking business at all stages — from short-term to long-term.

PROSPECTS FOR THE DEVELOPMENT OF DIGITALIZATION OF BANKING SERVICES IN RUSSIA

The prospects for the digital transformation of the banking sector in Russia are determined by the following strategic directions:

1. Development of mobile and online platforms. It is expected that by 2025, more than 80% of the Russian population will use mobile devices with the ability to use contactless payment technologies.

2. Widespread adoption of artificial intelligence and machine learning to continuously repeat banking business processes in order to reduce costs and improve customer service.

3. Cloud solutions will reduce banks' infrastructure costs, increase business flexibility and accessibility.

4. Biometric identification will help to build a psychological profile of the client and form a unified system of their identification.

5. Providing a range of banking products with cryptocurrencies based on blockchain technology can provide more efficient and secure financial transactions, improve access to financial services, and increase customer confidence. In our opinion, such products will be the most promising. Financial intermediaries can open digital wallets that will allow customers to store, send, and

receive cryptocurrencies. This can provide convenience and security for customers who want to manage their digital assets. Banks can offer loans secured by cryptocurrencies, which will allow customers to use their digital assets to obtain financing. Banks are able to provide cryptocurrency trading services to their clients, who will be able to invest them in digital assets through a reliable intermediary. However, it is necessary to take into account the risks associated with the volatility of the cryptocurrency market, the security of digital asset storage and compliance with legislation. Banks should develop risk management strategies and ensure a high level of security to protect the interests of their customers.

Thus, the prospects for the development of digitalization of the banking sector in Russia look promising, due to the growing demand for digital services from customers and the innovative technologies that banks are implementing to improve their business.

CONCLUSIONS

The process of digitalization is transforming all sectors of the economy, including the banking industry, and is progressing rapidly. Through the study of domestic and international experiences in the field of banking digital transformation, we have identified three models of digital banking. The Anglo-American model involves the operation of autonomous platforms that integrate banking services with customers' digital devices for immediate access. The Russian model was developed as part of the government's digitalization program and is implemented by individual banks. The European model reflects national priorities and operates based on common standards adopted across European countries.

With the development of information technology, banks are actively introducing computer technology, banking equipment and ATMs, and software, which makes it possible to increase the efficiency and accuracy of work. Monotonous banking operations are performed by robots and artificial intelligence. Machine learning is used to analyze transactions, customer behavior, and market trends. Virtual and augmented reality allow for interactive presentations of banking products. The Internet of Things provides fast and high-quality analysis of data received from various devices in order to optimize banking activities and improve the quality of customer service. The use of blockchain technologies allows banks to carry out secure and transparent transactions, as well as offer customers new financial instruments based on cryptocurrencies.

Banks are abandoning traditional customer service and offering virtual branches and self-service points without the help of a banking specialist. If it is necessary to design more complex financial or investment products and services, video banking consulting is provided. Banks also offer boxed products — banking products with integrated services of other financial intermediaries (insurance, pension provision, investments). Bank employees can also serve clients in their partners' offices (in shopping malls, car dealerships, etc.) and place fully automated video kiosks.

The development of the Internet has allowed banks to carry out social banking, analyze consumer demand, and develop new banking products.

The Mir national payment system has been actively developed in Russia to replace the banned international payment systems. Due to the use of contactless payment features, payments through the Quick payment system (SBP) and QR codes turned out to be the most in demand. The development of marketplaces has become a modern trend in Russia. Banks mediate online sales platforms for non-financial products by providing customers with installments and online loans. At the same time, the total number of active users of digital technologies is constantly changing. Customers under the age of 25 have become active users of credit cards issued through online banking and mobile applications. Currently, the Central Bank has given

permission to carry out transactions with the digital form of money. One of the first banks in the Russian Federation, Sber has registered a blockchain platform and is issuing Sbercoin.

The analysis revealed that the majority of Russians are pleased with the quality and usability of digital banking services. However, there are some challenges related to the lack of qualified IT professionals and the delay in the digital transformation process. Significant investments are needed in technology development, modernization of banking infrastructure, ensuring data security, and access to advanced European digital solutions. Customers also need to adapt to new digital banking technologies and regulatory regulation of the digital transformation of the banking sector. Solving these priorities will accelerate the digital transformation of the banking sector and apply advanced financial instruments, including cryptocurrencies and blockchain.

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Towards a Sustainable Future: The Emerging Role and Far-Reaching Impact of Green Finance Instruments in Russia-China Trade Relations

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ABSTRACT

In today's context of globalization, the trade relationship between China and Russia has become increasingly close, and with the rising global concern for environmental sustainability, green finance, as an emerging financial model, is gradually becoming an important factor in Russia-China trade cooperation. This article explores the role and impact of green financial instruments in trade relations between China and Russia. It empirically analyses the relationship between the volume of exports to Russia from 22 Chinese provinces and variables such as the level of development of green financial instruments (green insurance, green credit, green bonds, green funds), GDP and population in each province. The results show that green credit, bonds and funds have no significant impact on export volume, while green insurance has a damping effect on export growth. China and Russia need to deepen cooperation in green finance, optimise green insurance policy formulation, reduce the burden on enterprises, and strengthen the market promotion and innovation of green financial instruments. It is recommended that both governments strengthen policy coordination, provide tax incentives and financial support, and promote the green transformation of trade structures to achieve synergistic development of the economy and the environment.

Keywords: green finance; China-Russia trade; sustainable development; green insurance; green credit; green bonds; green funds; empirical analysis; trade structure optimisation; economic cooperation

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INTRODUCTION

Current status of trade development between China and Russia

The relevance of the study is due to the growing role of Russia and China in international relations. The importance of economic and trade connections between China and Russia as neighboring countries is self-evident. Countries' trade and investment cooperation is not only deepening, but also injecting a constant impetus into their economic future. This is not only due to the growing status of the two countries in international relations, but also because the cooperation between them is based on a deep geographical, historical and cultural background. Since the signing of the Treaty on Good-Neighborly Relations, Friendship and Cooperation between China and Russia in 16.07.2001, China-Russia relations have skyrocketed and consolidated, becoming one of the most dynamic and promising bilateral liaisons in the world. Russia-China logist Yu. V. Tavrovsky writes: "The geopolitical future of Russia is connected with China as closely as the past. Over the course of 400 years of neighborhood and interaction between two countries-civilizations, they have clashed more than once, but never really fought in a large-scale military confrontation. Allied relations were maintained and fixed by secret and open treaties in 1896, 1937, 1945 and 1950. During the Second World War, China and Russia took turns becoming each other's "second front," drawing off the forces of the common enemy [1]. This interaction was based on national interests and commonality, the interpenetration of the two countries' value codes, which ultimately predetermines their trade, economic, financial, insurance, and technical and technological cooperation, which has sharply

increased in recent years. Obviously, there are reasons for such relationships that exceed situational political interests. Russia and China belong to large cultural and civilizational systems, each of which has formed a civilizational model of its own, among the advantages of which is a multi-thousand-year history, impossible without a strategic understanding of the value of national unity, coherence, and consolidation. Increasing anxiety in relation to the planetary future dictates the need to understand the mechanisms of self-determination of peoples united by enormous civilizational centers of rising countries-giants.

China and Russia share a long common border,[1] which provides unique conditions for economic and trade cooperation between the two parties. This geographical proximity gives the two countries significant advantages in trade and logistics, reducing transport costs and time and improving the efficiency of cooperation. China and Russia have a long history of interaction, and this historical origin has laid a solid foundation for the development of economic and trade relations between the two sides. Since the Soviet period, China and Russia have established close economic and trade ties, which have continued to develop and grow in the following decades. Even after the collapse of the Soviet Union, China and Russia have continued to maintain and promote good, far-reaching bilateral economic, investment and trade cooperation momentum that has enabled both countries to have a better understanding of each other's needs and future interests. Although China and Russia have different cultural backgrounds, they both have a long history and splendid culture. This cultural exchange and integration provide a good humanistic environment for economic and trade cooperation between the two sides. The increasing exchanges and interconnection between China and Russia in the fields of culture, education, science and technology have not only enhanced the understanding and friendship between the two peoples, but also provided more opportunities for economic and trade cooperation. China and Russia have become important trading partners as their bilateral trade volume continues to grow in recent years (see *Fig.*). China-Russia trade has maintained a steady development, with the scale of trade expanding and the trade structure being optimized [2]. China and the Russian Federation will continue to strengthen economic cooperation and promote the development of practical cooperation in various fields to a higher level.

According to China's General Administration of Customs, the trade volume between China and Russia reached 240.11 billion dollars, up 26.3% year-on-year, and the target of 200 billion dollars was reached ahead of schedule. Russian exports to China rose 12.7% to about $ 129.14 billion, while Russian imports of Chinese goods rose 46.9% to $ 110.97 billion. Experts predict that trade turnover between Russia and China will continue to grow in 2024 and may reach a record $ 250 billion by the end of the year.

Sustainable development is a concept that focuses on the balanced development of the economy, society and the environment. It stresses that, in the process of economic development, due consideration should be given to the carrying capacity of resources, the environment and the stability of the ecosystem to ensure the rational use of natural resources and the good protection of the environment, so as to achieve a harmonious coexistence of the three mentioned elements: the economy, society and the environment. Against the backdrop of the growing awareness of the sustainability narrative, green finance has become a new driving force in promoting economic development and sustainable development, mainly because it integrates consideration of environmental protection and social responsibility into financial activities, making it possible to harmonize economic development with environmental protection [3]. Green financial instruments, such as green bonds, green loans and green funds, provide financial support for renewable energy projects, energy storage technologies and clean energy supply and distribution [4]. These funds help promote the research and development and application of green energy technologies, reduce carbon emissions, and improve energy efficiency, thus achieving a win-win situation for both the economy and the environment [5]. Co-operation and development in the field of green finance between China and Russia is not only related to the countries' sustainable economic development but also plays a big role in the global environmental protection provision [6].

LITERATURE REVIEW

In recent years, China-Russia economic and trade cooperation, as an important part of international

[1] Chinese-Russian border length is 4209,3 km second after Kazakhstan-Russian border — 7512,8 km.

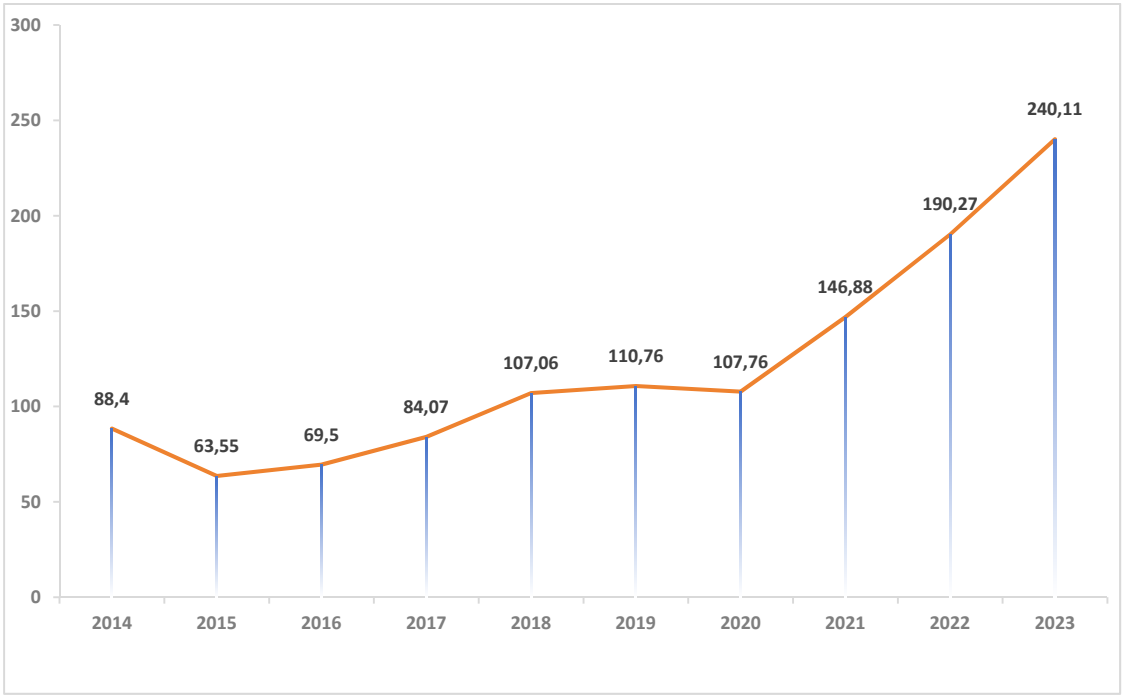

Fig. **Trade Volume Between China and Russia (Mlrd Doll. USA)**

Source: Statistical data from the general administration of customs of China.

relations, has received extensive research and attention. Ch. H. Li [7] emphasized the importance of China-Russia comprehensive cooperation for the real interests of both sides and the stable development of the world economy. He points out that in the context of glocalization and economic integration by deepening economic and trade cooperation, China and Russia can not only promote the economic growth and prosperity of both sides, but also make a positive contribution to world peace and stability [7]. This view provides important theoretical support for our understanding of the importance of China-Russia economic and trade cooperation. G. Ch. Xing [8] examines the challenges and opportunities facing China-Russia cooperation from a political and economic perspective. He argues that in the ever-changing global environment, China and Russia need to further strengthen their cooperation to address jointly various challenges and achieve mutual benefits and win-win results [8]. This view emphasizes the strategic significance of China-Russia cooperation in the global environment and provides an important context for the application of green finance in China-Russia economic and trade cooperation. H. Q. Liu [9] discusses in detail the development trends, modes and prospects of China-Russia economic and trade cooperation. He argues that China-Russia economic and trade cooperation is an important resource for future cooperation between the two countries, and is of great significance in promoting the economic growth and prosperity of both sides [9]. H. P. Kuznetsova, et al. explored specific examples of energy cooperation between the two countries at the micro and macro levels, which also provides an important reference for the application of green finance in energy cooperation [10]. Z. J. Wang et al. provide an overview of the historical trend of global carbon emissions and analyse the characteristics of carbon-neutral policies in key countries, emphasizing the importance of international cooperation in promoting the global low-carbon transition [11]. Q. Sun [12], M. Feng [13] and P. L. Xu et al. [14–16] provide an in-depth analysis of Russia's low-carbon development strategy under the global climate agenda in light of its carbon neutrality target, emphasizing the key role of green financial instruments in guiding financial flows to green projects and promoting low-carbon transition. Meanwhile, the study by M. H. Dan [17], F. Liu [18] and L. Wang [19] further outlines Russia's low-carbon development path and stable pursuit of carbon neutrality targets, emphasizing the important role of green finance in promoting sustainable development.

The importance of green finance in China-Russia trade cooperation has been studied by scholars. H.B. Xiao and X.R. Ge [20], in discussing the development of new energy and green economy in Russia, emphasize the key role of green finance in promoting the transformation of energy structure and the development of green economy. They argue that through the development of green finance, Russia can better respond to the challenges of global climate change and achieve sustainable economic development goals [20]. Y. Shang and Y. S Han [21] further analyse Russia's Green New Deal in addressing the challenges of a carbon-neutral era. They point out that green finance, as an important means to achieve green transformation, is of great significance in promoting trade cooperation between China and Russia [21]. By strengthening cooperation in the field of green finance, the two countries can jointly promote the development of a green economy and achieve mutual benefits [18]. Some scholars have also focused on the potential of green finance in the context of China-Russia trade cooperation. For example, Y. Wang et al. [4] analyzed the historical trend of carbon emissions and the characteristics of carbon-neutral policies in key countries, and put forward proposals for Russia-China cooperation in the areas of carbon emission reduction and green finance [4]. Z.W. Kang and X.S. Cao [22] on the other hand, explore the new development of Russia's environmental policy in the context of carbon neutrality and its impact on China-Russia cooperation and emphasize the important role of green finance in promoting environmental cooperation between the two countries. I. Grazilina and I. Zabelina [23] point out that the Silk Road Economic Belt offers new opportunities for green growth in the Russian economy's Far-Eastern region, emphasizing the importance of green growth in promoting economic development sustainability. This study provides a macro context for understanding the role of green finance in regional China-Russia trade cooperation [23]. D.M. Chu [24] noted that Russia has deeply recognized the importance of a green economy for the country's sustainable development and has taken a series of policy measures to promote the green economy. This provides potential opportunities for cooperation between China and Russia in the field of green finance. In the face of changes in the international political and economic environment, the choice of Russia's low-carbon development path in the energy sector has become a research hotspot [25]. V.I. Voloshin, O.E. Nazarova and S.X. Chen [26] show that, in the face of external sanctions, Russia needs to accelerate the transformation of its energy structure and promote the development of low-carbon energy, in order to ensure energy security and sustainable development of the economy. This provides an important practical basis for the application of green finance in China-Russia energy cooperation. Some scholars — Y.C. Ji [27], P. Zhou, L. Ma [28], R. Bao [29] and Y. Liu [30] have emphasised the role of the Green Belt and Road Initiative in promoting global green development. Together, these studies reflect the positive contribution of the Belt and Road Initiative in promoting energy cooperation, the development of environmental protection industries, and ecological cooperation, providing strong theoretical support and practical guidance for achieving sustainable development.

In terms of the relationship between green finance and economic growth, several scholars have conducted in-depth discussions. J.H. Gong further discusses the relationship between green finance development and industrial structure adjustment as well as China's economic growth, revealing the positive role of green finance in promoting industrial structure optimization and economic growth model upgrading [31]. Specifically on the impact of green finance in China-Russia trade cooperation, the study by Y.J. Xiang, W.F. Zhang and B. Zh. Shi provides us with the perspective of empirical analysis. They found out through empirical analysis that the development of green finance can promote the growth of China's export trade, which provides data support for the application of green finance in China-Russia trade cooperation [32]. Zh. Wang emphasises the key role of green finance in promoting high-quality economic development [33]. B. Li on the other hand, puts forward a proposal to create a specialised insurance institution in the field of science and technology green finance to support scientific and technological innovation and green development [34]. Q.J. Zhang and R.'s Chen study examines the impact of green financial policy innovation on energy consumption carbon emission intensity, revealing the importance of the resource allocation effect and the green innovation effect [35]. Y. Yu on the other hand, points out that the insurance industry has made continuous efforts in continuously improving the quality of green finance [36].

This study will focus on the role of green financial instruments in promoting China-Russia trade. For

example, the impact of the development level of green financial instruments such as green insurance, green credit, green bonds and green funds on the volume of trade between China and Russia. Through in-depth analysis of the application of green financial instruments, we will explore how to better use green financial instruments to promote the green development of China-Russia trade and contribute to the sustainable development of the two economies.

RESEARCH METHODOLOGY AND DATA SOURCES

Research methodology: this study mainly adopts quantitative analysis methods, combining statistical analysis and econometric modelling, to explore in depth the impact of the development level of green financial instruments on China-Russia trade relations. Firstly, through literature review and theoretical sorting, it determines the measurement indexes of the level of green financial development, including green insurance, green credit, green bonds and green funds; secondly, it collects relevant data, constructs econometric models, and carries out empirical analyses on the relationship between the level of development of green financial instruments and Russia-China trade turnover; and lastly, based on the empirical results, it draws conclusions of the study and puts forward policy recommendations. In this study, a multiple linear regression model is used to carry out regression analyses with China-Russia trade volume as the dependent variable and independent variables such as the level of development of green financial instruments, GDP and population. In the process of model construction, considering the availability and completeness of data, this study selected 22 provinces in China as samples, which have more frequent trade transactions with Russia and can better represent the overall situation of China-Russia trade. In the model construction, this study takes the trade volume between China and Russia as the dependent variable and the development level of green financial instruments, GDP and population as the independent variables. Considering the differences in economic development, resource endowment and industrial structure of different provinces, the study will introduce province fixed effects to control these potential influences. Meanwhile, in order to test the robustness of the model, the study will also use other econometric methods, such as panel data analysis and time series analysis, for further validation.

Data sources: The data in this study are mainly from the public data of official statistical agencies, financial institutions and academic research institutions. Among them, the data on China-Russia trade volume are mainly from the official statistics of the General Administration of Customs of China and the Russian Federal Customs Service; the data on the level of development of green financial instruments are mainly from the reports and statistical data released by financial regulators such as the People's Bank of China, the Banking and Insurance Regulatory Commission and the Securities Regulatory Commission, as well as annual reports of financial institutions, such as major commercial banks, insurance companies, and securities firms; the data on the macro-economy, such as the GDP and population, are from the National Bureau of Statistics and provincial statistical bureaus. Macroeconomic data, such as GDP and population, come from the official releases of the National Bureau of Statistics and provincial statistical bureaus.

It should be emphasized that due to the limitations of data collection and collation in the development of green financial instruments, their statistics may be incomplete or difficult to access. In this case, the study will combine the existing research results and expert opinions to make reasonable extrapolations and supplement the missing data. Meanwhile, for the imputed data, the study will cautiously assess their error rates and make clear explanations in the text. According to the imputation and assessment, the error rate of the data is roughly around 5% to 10%. Despite this margin of error, the study will endeavor to ensure the reliability and validity of the findings through scientific methods of analysis and a rigorous process of justification.

TYPES AND ROLE OF FINANCIAL INSTRUMENTS

With the gradual increase in awareness of environmental protection, green financial instruments are playing an increasingly important role in promoting global sustainable development. In Russia-China trade relations, green finance has not only injected new vigor into the economic cooperation between the two countries, but also promoted the green transformation of trade structures.

Green credit, green insurance, green bonds, and green funds, as the four pillars of green finance, each have a unique role to play in promoting sustainable development provision. Green credit promotes the development of clean energy, energy conservation, and emission reduction through the provision of loans to environmental protection projects. Green insurance, on the other hand, reduces the risks faced by enterprises due to environmental pollution by providing products such as environmental pollution liability insurance. Green bonds provide a channel for enterprises and governments to raise funds to support the construction of green projects. Green funds, on the other hand, bring together social capital and focus on investing in green industries, promoting the innovation and application of green technologies.

In order to quantitatively assess the level of development of these green financial instruments, the following four indicators are used in this paper:

1. G_Credit: the credit share of environmental protection projects. The credit share of environmental protection projects refers to the proportion of environmental protection projects in the total credit of the province. The total credit of environmental protection projects in the province indicates the total amount of loans provided by all banks and other financial institutions for environmental protection projects within the province, which is formulated as follows:

$$\text{G\_Credit} = \frac{\text{The total amount of credit loans of environmental protection projects}}{\text{The total amount of loans}}.$$

The G_Credit indicator assesses the extent of financial institutions' support for environmental projects by calculating the proportion of total credit for environmental projects to total credit in the province. This indicator reflects the relative importance of environmental projects in the credit market.

2. G_Insurance: the degree of promotion of environmental pollution liability insurance. The degree of promotion of environmental pollution liability insurance indicates the proportion of environmental pollution liability insurance in all the business of the insurance company, reflecting the degree of promotion and acceptance of the insurance. The environmental pollution liability insurance income refers to the premium income that the insurance company receives from the environmental pollution liability insurance business, and the total premium income refers to the sum of premium income received by all the business of the insurance company. And total premium income refers to the sum of premium income received by the insurer from all its businesses.

The formula is:

$$\text{G\_Ins} = \frac{\text{The total environmental pollution liability insurance}}{\text{The total premium}}.$$

G_Insurance assesses the prevalence of environmental pollution liability insurance in the insurance market by calculating the ratio of environmental pollution liability insurance revenue to total premium revenue of insurance companies. This indicator reveals the level of attention and management of environmental risks by insurance companies.

3. G_Bond: the degree of green bond development, which indicates the share of green bonds in the bond market, reflects the scale of green bond issuance and market acceptance. Total green bond issuance is the total amount of all green bonds issued in the market. The total amount of all bonds issued means the total amount of all types of bonds issued in the market. The formula is:

$$\text{G\_Bond} = \frac{\text{Total green bond issuance}}{\text{Total bond issuance}}.$$

G_Bond, on the other hand, measures the extent to which green bonds have grown in the bond market by calculating the ratio of total green bond issuance to total issuance of all bonds. This indicator reflects the activity and market acceptance of the green bond market.

4. G_Fund: Green Fund Share, Green Fund Share indicates the relative size and importance of Green Funds in the fund market. Total Green Fund Market Capitalization is the sum of the market value of all Green Funds, and Total Market Capitalization of All Funds means the sum of the market value of all types of funds in the market, which is given by the formula:

$$\text{G\_Fund} = \frac{\text{Total market capitalisation of green funds}}{\text{Total market capitalisation of all funds}}.$$

5. The G_Fund indicator assesses the relative size and importance of green funds in the fund market by

Table 1

Variable Interpretation

Name (of a thing)	Variable	Indicate	Unit (of measure)
Implicit variable	Exp	Exports to Russia	Million dollars
Independent variable	G_credit	Percentage of credit loans for environmental projects	–
	G_ins	Extent of promotion of environmental pollution liability insurance	–
	G_bond	Extent of green bond development	–
	G_fund	Percentage of green funds	–
Control variable	Gdp	Gross Domestic Product	Billions yuans
	Exall	Total exports	Million dollars

Source: Calculations based on data compiled by China's General Administration of Customs, financial institution statistics and the National Bureau of Statistics, among others.

calculating the total market capitalization of green funds as a proportion of the total market capitalization of all funds. This indicator reflects the level of activity and influence of green investments in the capital markets.

The calculation of these indicators is based on actual business data, and by comparing the proportionality of the numerator and denominator, it is possible to intuitively understand the development status and market performance of various areas of green finance. In green finance policymaking, investment decision-making and market analyses, these indicators have important reference value, providing all parties with a quantitative basis for measuring the level of green finance development.

EMPIRICAL ANALYSIS

In this study, data from 22 provinces in China for the past 11 years were selected as a sample, and the data on export value to Russia from these 22 provinces were used to analyse statistically the multiple linear regression model used in conjunction with the share of green credit, green insurance, green bonds, and green funds, which is capable of analyzing the combined effect of multiple independent variables on the dependent variable. By collecting and analyzing the data of 22 provinces for the past 11 years, and analyzing the impact of the proportion of green financial instruments on the export volume. It not only helps to deeply understand the role of green finance in international trade, but also provides reference information for policy improvement. The variables used in the model and their explanations are shown in *Table 1*.

The model equation is $Exp = G\_credit + G\_ins + G\_bond + G\_fund + Gdp + Exall + \varepsilon$.

In the sample of 22 provinces in the last 11 years, as presented in *Table 2* the data after logarithmic treatment show that the export value (exp) to Russia of each province shows certain distributional characteristic, with a mean value of 2.99 and a standard deviation of 0.62, indicating that the export value still has some differences among different provinces, but it may be smoother compared with the original data. Meanwhile, the green financial indicators such as green credit index (G_credit), green insurance (G_ins), green bond (G_bond) and green fund (G_fund) after logarithmic treatment, their mean values are 0.044, 0.086, 0.136 and 0.062 respectively, which also show a certain range of distribution, suggesting that differences between provinces in green financial development still exist on the logarithmic scale. In addition, the logarithmically processed GDP (Gdp) and overall total exports (Exall) of the provinces have a mean value of 4.75 and 4.70, respectively, showing a relatively stable level.

Through logarithmic processing, we can not only better capture the proportional changes in the data, but also reduce the influence of heteroskedasticity to a certain extent, making the subsequent data analysis and model building more accurate and reliable. Further research

Table 2

Descriptive Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
Exp	242	2.989256	0.6199467	1.4	4.28
G_credit	242	0.0441065	0.0048521	0.0345973	0.0571173
G_ins	242	0.0861214	0.0113201	0.0660977	0.1140673
G_bond	242	0.1355989	0.0178379	0.1085581	0.1852994
G_fund	242	0.0617719	0.0088382	0.0470035	0.0883868
Gdp	242	4.747667	0.5072041	3.64831	5.90307
Exall	242	4.701118	0.2305556	4.1345	5.54284

Source: Calculations based on data compiled by China's General Administration of Customs, financial institution statistics and the National Bureau of Statistics, among others.

Table 3

Relevance Analysis

Variable	Exp	G_credit	G_ins	G_bond	G_fund	Gdp	Exall
Exp	1						
G_credit	0.2532	1					
G_ins	0.2811	0.8311	1				
G_bond	0.318	0.8413	0.9591	1			
G_fund	0.3126	0.8118	0.9317	0.959	1		
Gdp	0.7714	0.1071	0.1739	0.1909	0.1773	1	
Exall	0.3226	−0.0342	0.0336	0.0155	−0.0017	0.3726	1

Source: Calculations based on data compiled by China's General Administration of Customs, financial institution statistics and the National Bureau of Statistics, among others.

can explore the potential relationship between these logarithmized financial indicators and export value, thus providing a more scientific basis for policy formulation.

In the sample of 22 provinces examined over the last 11 years, as presented in *Table 3* data processed by logarithmic processing show that the variables show linear correlations of varying degrees. Export value (Exp) is positively correlated with green credit index (G_credit), green insurance (G_ins), green bond (G_bond) and green fund (G_fund), although the correlation coefficients are relatively low, suggesting that there is a certain degree of positive linkage between green financial development and export trade. In addition, the correlation between export volume (Exp) and GDP (Gdp) is strong at 0.7714, indicating a strong relationship between export trade and economic growth.

On the other hand, there are also significant positive correlations between various green financial indicators, such as the high correlation coefficients between the green credit index (G_credit) and green insurance (G_ins), green bond (G_bond) and green fund (G_fund), suggesting that the development trends of these green financial indicators are similar and mutually reinforcing among different provinces. However, the correlation between GDP and some of the green finance indicators is low, implying that the direct contribution of the current green finance development to economic growth may not be significant.

It is worth noting that total exports (Exall) are

Table 4

Regression Analysis

Source	SS	df	MS Number of obs =	242
			F(6, 235) =	69.2
Model	59.148293	6	9.85804884 Prob > F =	0
Residual	33.4761773	235	.142451818 R — squared =	0.6386
			Adj R — squared =	0.6294
Total	92.6244703	241	.384333902 Root MSE =	0.37743
Exp	Coef.	Std. Err.	t P > t [95% Conf.	Interval]
G_credit	14.58968	9.454546	1.54 0.124 –4.036818	33.21617
G_ins	–16.21939	7.809899	–2.08 0.039 –31.60575	–0.8330291
G_bond	6.199036	6.425136	0.96 0.336 –6.459189	18.85726
G_fund	13.88051	9.842529	1.41 0.160 –5.510357	33.27138
Gdp	0.8758277	0.0529292	16.55 0.00 –0.7715513	0.9801041
Exall	0.1801542	0.1147914	1.57 0.118 –.0459975	0.4063059
_cons	–2.960479	0.5536341	–5.35 0.000 –4.051199	–1.869759

Source: Calculations based on data compiled by China's General Administration of Customs, financial institution statistics and the National Bureau of Statistics, among others.

positively correlated with the value of exports (Exp), but have lower or even negative correlations with other green finance indicators, which may reflect the fact that the current direct link between total exports and specific green finance indicators is not strong.

The matrix of correlation coefficients after logarithmic processing provides us with a preliminary understanding of the linear relationships between the variables, but a deeper understanding of the mechanisms behind these relationships still requires further research and analysis.

The relationship between exports to Russia (exp) and green credit index (G_credit), green insurance (G_ins), green bonds (G_bond), green funds (G_fund), GDP (Gdp), and total exports (Exall) was explored through regression analyses in a sample of 22 provinces over 11 years of study.

In terms of the model's goodness of fit, as presented in *Table 4* the R-squared is 0.6386, indicating that the model explains about 64% of the variation in export value, while the adjusted R-squared is 0.6294, which is still high, indicating that the model's explanatory power is strong. In explaining the effects of the variables, the coefficients of green credit index (G_credit), green fund (G_fund) and green bond (G_bond), although positive, have low t-values and p-values greater than the commonly used significance level (e.g., 0.05), and thus the effects of these three variables on export value are not significant. This may be due to the lack of popularity, limited market acceptance and insufficient policy guidance of green credit, green fund and green bonds. Meanwhile, the impact of green bond (G_bond) on export volume is smaller that of green credit (G_credit) and green fund (G_fund) may be due to the fact that the issuance and use of green bond in the market is relatively small.

The coefficient of green insurance (G_ins) is negative and significant (t-value is –2.08, P-value is less than 0.05), which indicates that the increase of green insurance inhibits the increase of export volume to Russia, which may be due to the implementation of green insurance increases the operating cost of enterprises, which to some extent leads to higher prices of products and reduces the competitiveness of the products, thus affecting the export volume. The regression coefficient of Gdp (GDP) is positive and significant (t-value of 16.55, P-value less

than 0.001). GDP is a key indicator of the economic scale and production capacity of a country or region. When GDP grows, it indicates that China's production capacity is also increasing and it is able to provide a wider variety of goods and services, thus increasing exports to Russia. The coefficient on total exports (Exall) is positive but not significant, probably because exports to Russia account for a small share of China's total exports (around 3 per cent in 2023), but this effect should gradually increase as China-Russia trade continues to deepen and grow in size.

The results of regression analysis show that GDP is the most influential factor on export amount in the sample of 22 provinces in the last 11 years examined, while green insurance has a significant negative correlation with export amount. The green credit index, green bonds, and green fund amount indicators do not have a significant impact on the export volume. Among them, green credit index and green fund amount have a greater impact on export value than green bond on export value.

CONCLUSIONS AND RECOMMENDATIONS

The paper uses quantitative methods of analysis, combining statistical analysis and econometric modelling to explore in depth the impact of the level of development of green financial instruments on trade relations between China and Russia, and draws the following conclusions:

1. The cultures of Russia and China often reveal a commonality of the initial principles of the world order and worldview ("world-project integrity"). Similar semantic foundations of Russian and Chinese civilizations can be considered as a factor of influence in the modern world and the basis of Eurasian cooperation and sustainability. Subject to certain conditions and prerequisites, the most obvious characteristic of this cooperation is reflected in the construction of a system of trade and economic cooperation ties between the countries in question.

2. The strategic importance of China-Russia economic and trade relations is not only reflected in the cooperative position of the two countries in the international arena, stemming from deep geographical, historical and cultural ties. This relationship has injected a constant impetus into the economic development of both sides, while realizing the sharing of resources and complementing each other's advantages. With the global emphasis on green finance and sustainable development, China-Russia economic and trade cooperation should strengthen the green concept and jointly explore the road of green transformation, so as to promote the development of the two economies in a greener and more sustainable direction.

3. Green insurance has dampened the growth of exports to Russia, probably because it makes products more costly and affects firms' export competitiveness.

4. The impact of green financial instruments such as green credit, green bonds and green funds on Russia's exports is relatively small, mainly due to the lack of popularity, limited market acceptance, and the lack of Chinese and Russian research on the application of green financial instruments in export trade, which makes it impossible to fully explore and make use of the potential of these financial instruments to promote the greening of trade between the two countries, and other reasons.

5. The impact of total exports versus exports to Russia is insignificant; the size of China-Russia trade has grown in recent years, but Russia's share of China's total export market remains relatively small.

Strengthening China-Russia economic and trade cooperation, especially promoting the application of green finance in the trade between the two countries, is of great significance in promoting the sustainable development of both economies. In response to the analysis of the findings, the following recommendations are made:

1. To deepen China-Russia economic and trade cooperation and incorporate the concepts of green finance and sustainable development, the two Governments should strengthen communication and cooperation on green economic and trade policies, promote the innovation of green financial products by financial institutions and encourage in-depth cooperation in the fields of green technology and environmental protection. At the same time, they should optimize the trade and investment environment, reduce tariff barriers and strengthen humanistic exchanges to enhance mutual understanding and friendship between the two peoples, so as to lay a solid foundation for green and sustainable economic and trade cooperation.

2. Optimizing green insurance policies and product design. The Government should conduct an in-depth study of the impact of green insurance on the costs of enterprises and consider ways to alleviate the burden of increased costs due to green insurance on enterprises through financial subsidies and tax incentives.

Encourage insurance companies to develop more green insurance products that meet the actual needs of enterprises and increase the popularity and market acceptance of green insurance. Strengthen publicity and training on green insurance, and raise awareness and understanding of green insurance among enterprises and the public.

3. Promote the development and application of green financial instruments. The Government should increase its efforts to promote green financial instruments such as green credit, green bonds and green funds, and increase their popularity in the market. Strengthen policy guidance, provide preferential policies and convenient conditions for enterprises using green financial instruments, and reduce their financing costs. Encourage financial institutions to innovate green financial products to meet the diversified financing needs of enterprises. Strengthening research in related areas and exploring the mode of application of green financial instruments in China-Russia trade.

4. Deepening China-Russia trade co-operation. The government should continue to strengthen trade cooperation with Russia and promote the expansion of the scale and optimization of the structure of bilateral trade. Strengthen research on the Russian market to understand the needs and preferences of Russian consumers and provide enterprises with more targeted market information. Encourage enterprises to expand their export business to Russia and increase the share of Chinese products in the Russian market.

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The Hypothesis of a Different Nature of the Phillips Curve and Its Impact on Financial Flows

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ABSTRACT

The Phillips curve is one of the most widely debated economic patterns. Its practical application, including for adjusting monetary policy, still causes significant disagreement among economists. In this regard, understanding the nature (essence) of the Phillips curve is an urgent task. The **purpose** of the study is to substantiate the hypothesis that the Phillips curve is based on a different pattern than is currently believed among economists. **Methods** of analysis and synthesis, system and logical analysis, were used. The empirical basis of the study is based on statistical data of the US economy for the period from 1980 to 2022. The essence of the study: real analysis of economic indicators (real wages, real GDP, etc.) in the vast majority of cases takes precedence over nominal analysis of economic indicators (nominal wages, nominal GDP, etc.). These two analyzes are the same if prices remain constant. It was during this period of Phillips's study of the British economy (1862–1913) that prices remained virtually unchanged. The rest of the Phillips curve (1914–1957) was heavily influenced by non-economic factors and may therefore be less significant. Since Phillips originally defined his curve as an inverse relationship between nominal wages and unemployment, at constant prices this means that there is an inverse relationship between real wages and unemployment. This dependence is explained by the author by the fact that the UK economy already had a cyclical pattern, when during economic growth real wages rise and unemployment falls, and vice versa. **Conclusion**: It is quite reasonable to believe that the above curve shows an inverse relationship between fluctuations in unemployment and fluctuations in real wages.

Keywords: finance; unemployment; economic cyclicality; real wages; Phillips curve; modern US economy

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INTRODUCTION

A large number of scientific works are dedicated to the analysis of the Phillips curve — both in the second half of the 20th century and in the early 21st century. This is due to the fact that unemployment and inflation in the modern market economy will always be highly relevant topics, and therefore the relationship between these economic indicators will constantly attract the close attention of economists. Therefore, the *relevance* of studying the Phillips curve will remain for a long time. The *novelty of the research* lies in the fact that the author proposes their own hypothesis that the Phillips curve is based on a different relationship. In other words, the Phillips curve has a different nature. Therefore, if the author's hypothesis is confirmed, the *scientific significance* of this hypothesis will be substantial, as it will allow for the exploration of the relationship between wages, inflation, and unemployment from different perspectives. Hence, the *practical significance* of the research follows, as the change in the theoretical concept will also lead to certain adjustments in practical activities (for example, in monetary policy).

The *degree of development* of this topic in the scientific field is quite high. Since the publication of the famous article by A. Phillips (1958) and up to the present time, thousands of articles on this issue have been published. At the present stage, many scholars use the Phillips curve for economic analysis. Thus, Russian economists D. Averina, T. Gorshkova, E. Sinelnikova-Muryleva, D. Orlov, E. Postnikov, E. Gurvich, E. Vakulenko, A. Zubarev, A. Gorodnov, and A. Andrjukhin use this curve to study the modern Russian economy [1–5].

I. Shevchenko and M. Korobeinikova investigate the impact of macroeconomic indicators of the Phillips curve on economic growth [6]. The chief economist of the monetary policy department of the Central Bank of Russia, D. Shestakov, discusses the correct choice between inflation and unemployment [7].

A number of contemporary Western scholars (P. Beaudry, C. Hou, F. Portier, A. Auclert, R. Rigato, M. Rognlie, L. Straub, E. Rubbo, R. Lucas) have focused primarily on the interaction of this curve with modern monetary policy [8–11]. In an earlier period, the well-known economist Milton Friedman wrote about the issue of the relationship between unemployment and inflation [12].

The purpose of the study: justification of the hypothesis about the possible different nature of the Phillips curve.

Research objectives:

- identify the conditions under which A. Phillips statistically justified the inverse relationship between nominal wages and unemployment;
- determine what other relationship the Phillips curve indicates under these economic conditions;
- justify the hypothesis;
- analyse statistical data in the US economy (1980–2022) to confirm (or refute) the author's hypothesis.

The article applies methods of analysis and synthesis, systemic and logical analysis.

RESULTS AND DISCUSSION

As the initial basis for the research, the widely known article by Alban William Phillips "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861–1957" was used [13].

From this period, the most important for analysis, according to the author, is the pre-war period of 1862–1913, as the data for the subsequent years (two world wars, the interwar period, and the recovery period) were influenced by many serious non-economic factors. In other words, the presence of a long-term peaceful period (1862–1913) with respect for private property rights and the absence of serious military and social conflicts in the country allows

for a more rigorous and balanced economic analysis of the Phillips curve.

The importance of analysis. The author believes that the foundation of the research should primarily be based on real analysis. This analysis in economics represents an analysis of economic indicators (wages, profits, etc.) adjusted for changes in the price level, i.e., the calculation is done in constant prices (often the prices of the base year). At the same time, nominal analysis is based on the study of economic indicators at current prices. Almost all specialists agree that the real analysis is more important when comparing these two types of research. The indicator of real wages undoubtedly takes precedence over nominal wages, and the indicator of real GDP is significantly more important for society compared to nominal GDP. When analyzing economic cyclicality, the wave-like nature of this cyclicality is based precisely on fluctuations in real (rather than nominal) GDP.

In economics, the nominal and real analysis of economic indicators coincide if prices remain unchanged. Thus, in the SNA (System of National Accounts), the indicators of real and nominal GDP for the base year coincide, as the calculation is conducted in constant (unchanged) prices of the base year.

Real analysis and the Phillips curve. Based on the above, the author believes that, first and foremost, the Phillips curve should be examined from the perspective of real analysis. As previously noted, the most significant period for analysis is 1862–1913. What is characteristic of this period? For this period (as well as generally for the 19th century), a typical phenomenon was unchanged (stable) prices, which could fluctuate within a few percent.

In this situation (with stable prices), nominal and real analysis go in the same direction, which means that the inverse relationship between unemployment and nominal wages can confidently be interpreted as the inverse relationship between fluctuations in real wages and unemployment.

The presence of economic cyclicity. To continue the analysis, it should be recalled that the economy of the United Kingdom during that period was characterized by economic cyclicality (the UK entered economic cyclicality in the early 19th century), i.e., approximately every 10 years an economic cycle was observed, during which economic growth was followed by an economic downturn, with the duration of the downturn (from six months to 1.5 years) being significantly shorter than the duration of the economic upturn (here we are talking about Juglar's medium-term economic cycles).

How does economic cyclicality affect real wages and unemployment? It is quite obvious that (all else being equal) during economic growth, real wages should rise and unemployment should decrease, and conversely, during an economic downturn, real wages should fall and unemployment should rise [14, 15].

(*Note*. In reality, as noted by specialists in economic cyclicality, at the beginning of an economic upturn, there is no such strict dependence between economic growth and changes in unemployment, but this can be disregarded when analyzing the picture as a whole.

Therefore, the aforementioned real analysis with constant prices coincides with the nominal analysis, where an increase in nominal wages leads to a decrease in unemployment, and conversely, a decrease in nominal wages leads to an increase in unemployment. The Phillips curve, based on statistical data, precisely illustrates this situation from the perspective of nominal analysis.

From the author's reasoning, based on real analysis, it follows that in the upper left part of the Phillips curve (during the period 1861–1913), there should be years characterized as periods of economic growth, i.e., periods with low unemployment and rising nominal (real) wages [13, p. 285]. The opposite situation is observed in the lower right part of the Phillips

curve — there should be years of economic downturn with rising unemployment and falling nominal (real) wages. This author's assumption is confirmed by statistical data: 1879, 1884, 1885, 1892, 1893, 1903, and 1908 are periods of economic decline.

The situation with the year 1900. This year, at first glance, contradicts the author's approach. It was a crisis year, but it is positioned in the upper left on the Phillips curve, as unemployment this year was quite low (2.5%) with a slight increase in nominal wages (around 1%).

The first to propose a logical resolution to this unclear situation was Evgeny Solovyov (a student at the Financial University under the Government of the Russian Federation). He suggested that this period of time coincided with the Second Anglo-Boer War, which took place from 1899 to 1902. So many potential unemployed avoided this unpleasant fate and became the foundation for the sharp growth of both the British Army and military production.

The author found that this assumption by E. Solovyov is fully confirmed. Thus, British troops at the beginning of hostilities in this region numbered 24 000 to 28 000 people. Over the next 9 months, the army increased to 200 000, and a total of approximately 400 000 people were sent to South Africa during the war.

In addition, it is worth considering the increase in the workforce involved in the rear, which had to meet the needs of the army and the demands of military logistics. This situation also explains the increase in real wages for these individuals during the mobilization period. Therefore, this exception (1900) is based on non-economic reasons and can be considered quite justified.

The consequences of the divergence between real and nominal analysis in the study of the Phillips curve. Now it is worth transitioning from the analysis at stable prices to the analysis at changing prices. In the Western economy, price stability existed until the First World War. Later, world wars followed, the interwar period (when, for example, the United Kingdom would alternate between returning to the gold standard and abandoning it), and the final break with the gold standard by the leading countries of the world. This inevitably led to price instability in Western countries in the second half of the 20th century.

When prices fluctuate, the results of real and nominal analysis begin to differ significantly from each other. Thus, an increase in nominal wages can occur simultaneously with a decrease in real wages. Now, these values with changing prices could move in opposite directions with different unemployment rates. Many economists (including P. Samuelson) preferred the path of nominal analysis. As a result, this led to the initial formulation by A. Phillips of the aforementioned relationship being replaced by the assertion that there is an inverse relationship between inflation and unemployment.

However, based on statistical data, economists quickly realized that such a dependency (at least in the long term) does not exist. Thus, Milton Friedman in his Nobel lecture in 1976 directly pointed out (referring to economic data from the then British Prime Minister) that in the economy, situations are often observed where rising prices correspond to high unemployment, and falling prices correspond to low unemployment. (One can add that in modern Russia, during the COVID epidemic, both inflation and unemployment increased simultaneously).

At present, economists, relying on extensive statistics, have reached a unanimous conclusion about the absence of an inverse relationship between inflation and unemployment in the long term. But the question has become quite pressing: does this relationship exist in the short term? Opinions among specialists were roughly divided.

Research in this area is currently yielding contradictory results. The Phillips curve takes on a positive slope, then a negative one, then

Table 1

US Unemployment Rate (% of Total Working Population)

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988
%	7.2	7.6	9.7	9.6	7.5	7.2	7.0	6.2	5.5
Year	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
%	5.3	5.6	6.9	7.5	6.9	6.1	5.6	5.4	4.9
Year	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
%	4.5	4.2	4.0	4.7	5.8	6.0	5.5	5.1	4.6
Year	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
%	4.6	5.8	9.3	9.6	8.9	8.1	7.4	6.2	5.3
Year	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
%	4.9	4.4	3.9	3.7	8.1	5.4	3.6	–	–

Source: IMF. URL: https://svspb.net/danmark/bezrabotica.php?l=ssha (accessed on 15.10.2023).

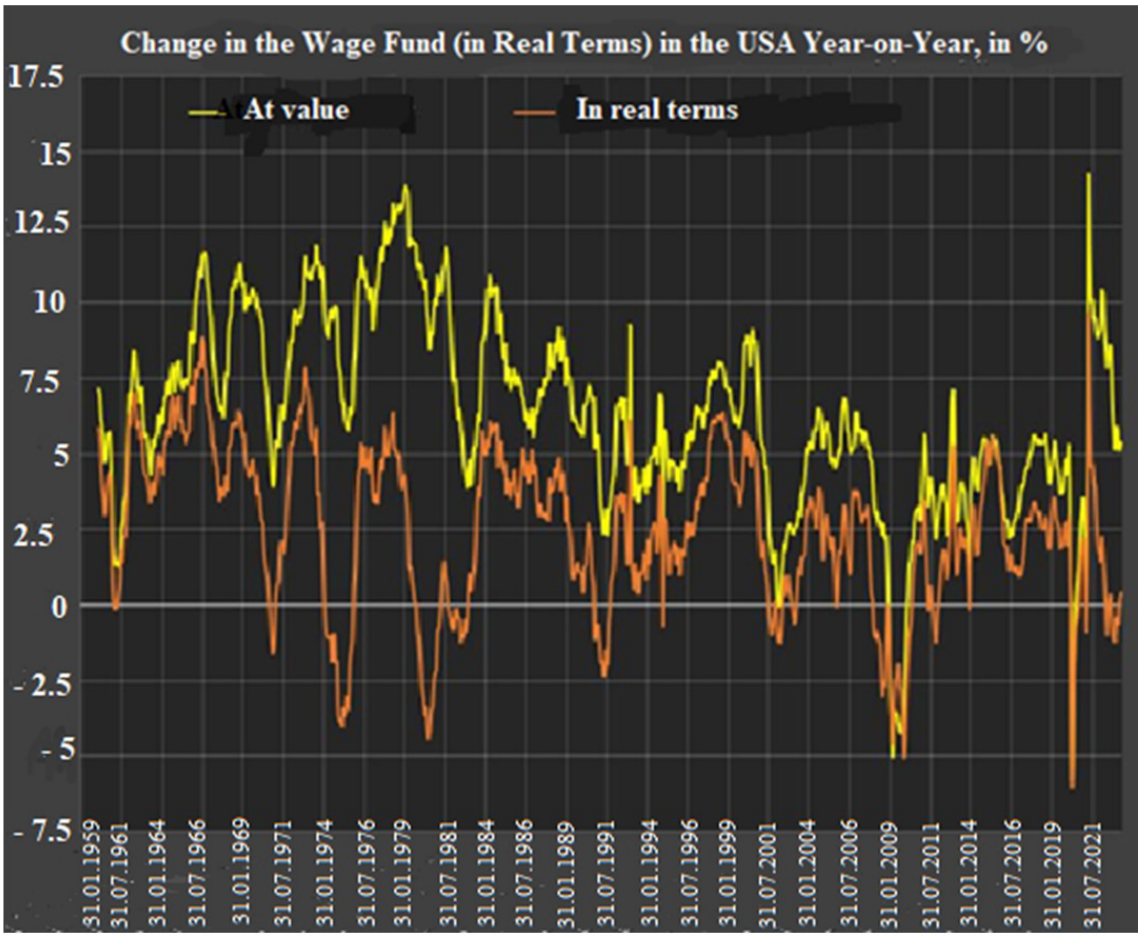

Fig. 1. **Change in the Wage Fund (in Real Terms) in the USA Year–on–Year, in %**

Source: Analytical center TAdviser (TAdviser) URL: https://www.tadviser.ru/index.php/%D0%A1%D1%82%D0%B0%D1%82%D1%8C%D1%8F:%D0%97%D0%B0%D1%80%D0%BF%D0%BB%D0%B0%D1%82%D1%8B_%D0%B2_%D0%A1%D0%A8%D0%90 (accessed on 15.10.2023).

Table 2

Changes in the Wage Fund (in Real Terms) in the USA (1980–2022) from the End of the Year to the End of the Previous Year, in %

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988
%	–2,7	–0,7	0	+5	+4,5	+3	+3,8	+3,7	+2,5
Year	1989	1990	1991	1992	1993	1994	1995	1996	1997
%	+0,5	–2	+1,3	+0,5	+1	+2	+1	+3	+6,2
Year	1998	1999	2000	2001	2002	2003	2004	2005	2006
%	+5	+4	+2	–1,2	–0,5	+3,2	+2,5	+2,5	+2,7
Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
%	–1	–4,7	–5	+3	0	+1	–0,2	+4,5	+2
Year	2016	2017	2018	2019	2020	2021	2022	2023	2024
%	+1,2	+3,3	+2,5	+2	–6 (1st half of the year) +9.5 (2nd half of the year))	+2	0	–	–

Source: Compiled by the Author Based on the Chart of the TAdviser Analytical Center. URL: https://www.tadviser.ru/index.php/%D0%A1%D1%82%D0%B0%D1%82%D1%8C%D1%8F:%D0%97%D0%B0%D1%80%D0%BF%D0%BB%D0%B0%D1%82%D1%8B_%D0%B2_%D0%A1%D0%A8%D0%90 (accessed on 15.10.2023).

becomes flat, then represents a chaotic set of points [5, 8, 10].

The author believes that it is necessary to start the analysis of this dependency (formulated by O. Phillips) from the perspective of real, rather than nominal, analysis. In other words, it is necessary to analyse the relationship between real wages and unemployment, which, under stable prices, acted as the relationship between nominal wages and unemployment.

HYPOTHESIS TESTING

This author's hypothesis needs to be tested on contemporary statistical data [16].

Based on the above, for the analysis, it is necessary to choose an economy that meets the following conditions:

1) the presence of a modern developed market economy with economic cyclicality, in which mid-term Juglar economic cycles are regularly observed;

2) the presence of stable prices in the economy for conducting real analysis. In the absence of this price stability, there is an opportunity to convert the necessary economic indicators from nominal to real indicators;

3) the presence of a long period of time (preferably several decades) during which the country is free from serious military actions, significant social conflicts, and technological disasters.

These conditions correspond to the US economy in the post-war period. The author took data on the dynamics of unemployment and real wages from 1980 to 2022. Data on unemployment in the US economy for the specified period is shown in *Table 1*.

Since the U.S. Department of Labor's data on real wage dynamics is currently unavailable

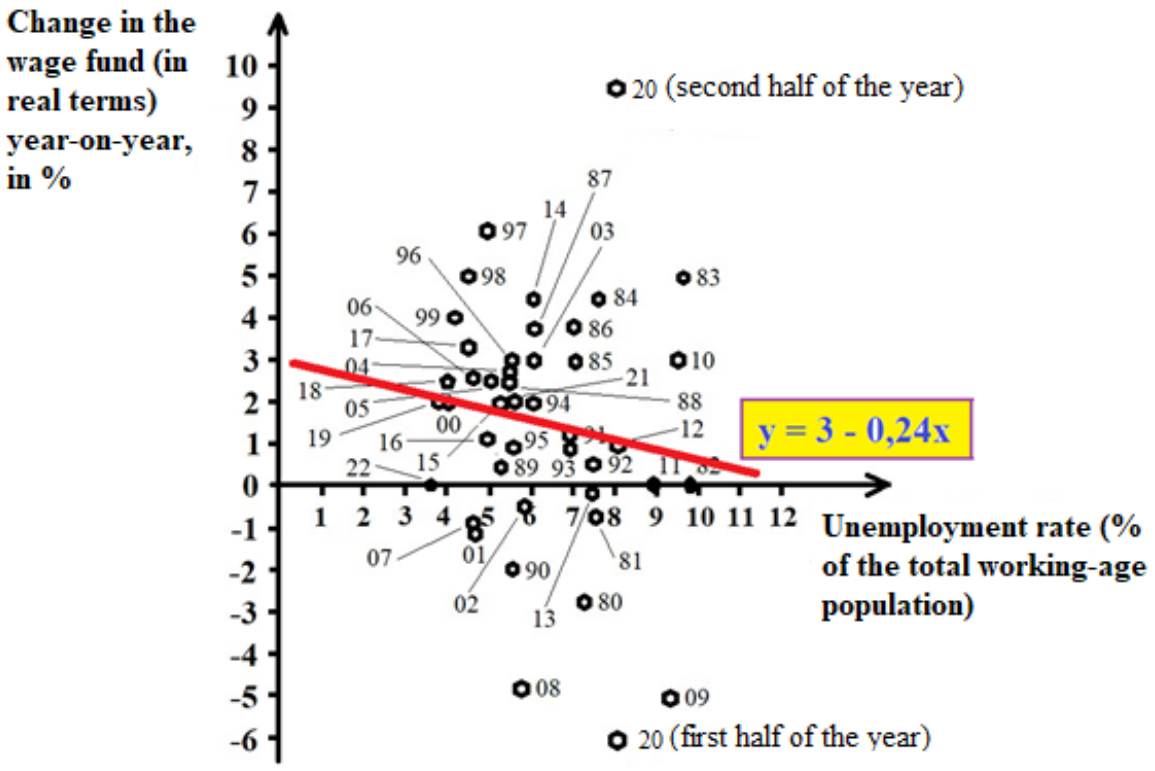

Fig. 2. **The Relationship Between the Dynamics of the Real Wage Fund and Changes in the Unemployment Rate in the United States (1989–2022)**

Source: Compiled by the author based on IMF data and data based on the chart of the TAdviser analytical center (TAdviser) URL: https://svspb.net/danmark/bezrabotica.php?l=ssha; URL: https://www.tadviser.ru/index.php/%D0%A1%D1%82%D0%B0%D1%82%D1%8C%D1%8F:%D0%97%D0%B0%D1%80%D0%BF%D0%BB%D0%B0%D1%82%D1%8B_%D0%B2_%D0%A1%D0%A8%D0%90 (accessed on 15.10.2023).

to the Russian user, the author has compiled the data from *Fig. 1* into *Table 2*.

In *Table 2*, 2020 is examined in more detail (there are indicators for half-year periods), as a result of two quarters of economic decline in 2020, real wages fell, but subsequent anti-COVID compensatory government payments in the same year significantly increased the level of real wages.

Using this statistical data, the author created the following graphical scheme showing the relationship between fluctuations in real wages and unemployment *(Fig. 2)*. To determine the mathematical relationship between these indicators, the least squares method (LSM) was applied. The results of the calculations using this method show that in the U.S. economy (1980–2022), there is an inverse relationship between changes in real wages and unemployment. Mathematically, this relationship when applying LSM can be represented by a line: $y = 3–0.24x$.

POSSIBLE CHANGE IN FINANCIAL FLOWS WITH THE EXISTENCE OF A REVERSE DEPENDENCE BETWEEN REAL WAGES AND UNEMPLOYMENT

If the author's hypothesis is justified, it can be tried out in practice by managing the unemployment rate through changes in real wages. This is an approach that many economists have previously used, believing that there is a connection between inflation and unemployment. For this, it is necessary

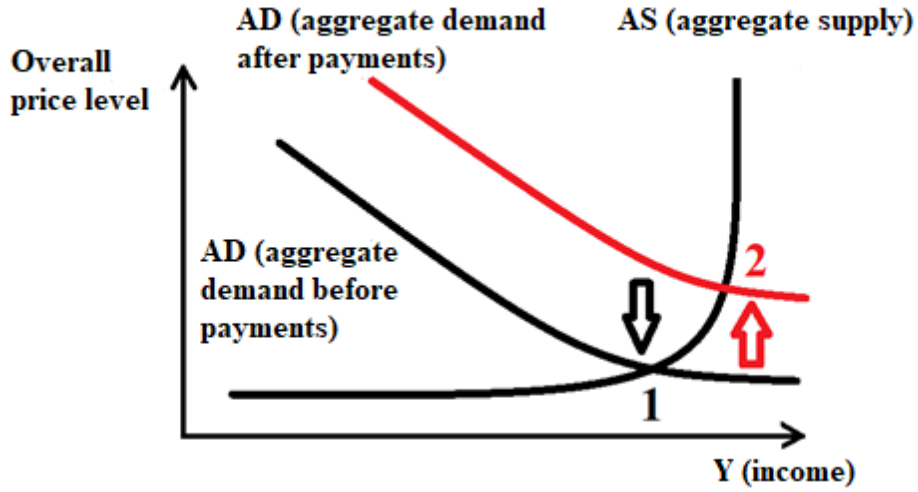

Fig. 3. **Dynamics of the AD Curve with an Increase in Payments to Employees from the Budget**

Source: Compiled by the author.

to determine the conditions under which this attempt will be correct, i. e., the necessary "frameworks" of the analysis. According to the author's hypothesis, the key factor that is not taken into account when analyzing the relationship between real wages and unemployment, but is their main cause and causes fluctuations in these indicators, is economic cyclicality. For understand the dynamics of these economic indicators, it is necessary to take into account the medium-term economic cycles in a market economy.

In turn, the normal progression of the medium-term economic cycle requires certain conditions, namely:

- the presence of a developed market economy;
- respect for private property rights;
- the absence of serious military conflicts, significant social upheavals, and technological disasters.

If these "framework" conditions are met, an analysis based on the author's hypothesis can be conducted. Currently, the author is considering two main options.

1. If an increase in real wages reduces cyclical unemployment, then an increase in government payments will lead to a reduction in this type of unemployment. In this scenario, we will also assume that the increase in various payments is not financed by the issuance of additional money, but by changing the structure of budget expenditures at different levels (federal, regional, municipal), i.e., budget expenditures on other needs will be correspondingly reduced. Therefore, such redistribution will occur with stable prices in the economy.

From the perspective of macroeconomic analysis using the AD-AS model (aggregate demand and aggregate supply model), the situation will also remain unchanged, as the increase in aggregate demand from hired workers will be offset by an equal decrease in aggregate demand from various budgets (*Fig. 3*). The increase in payments will shift the AD curve upward from point 1 to point 2, while the reduction in budget expenditures on other needs will again decrease aggregate demand and return the AD curve to point 1.

Therefore, the aggregate demand curve (AD) in the AD-AS model will remain in place, which, with an unchanged aggregate supply curve (AS), will give the same intersection point of these curves. This point will show that both before and after

the specified government payments, the overall price level in the country's economy will remain the same.

But it is quite likely that entrepreneurs will start reducing salaries (for example, by underreporting bonuses), as employees will receive payments from various budgets. For entrepreneurs, this will mean a reduction in costs, and therefore an increase in profit and profit margins.

This will further encourage them to expand production, which will affect the reduction of unemployment. How long will this process take?

Economic practice shows that as one approaches the peak of an economic upturn, the rate of profit decreases. From the author's perspective, whose dissertation topic was modern economic cyclicality, this inevitably occurs due to the law of diminishing returns, which operates when using previous unchanged technologies.* It is precisely the action of this law, in the presence of unchanged technologies, that determines the emergence of extensive growth approximately from the beginning to the end of the upswing in the medium-term economic cycle [17]. It should be noted that currently, a number of papers by Western scholars are dedicated to the issue of economic cyclicality and its associated various economic indicators [18–21].

From the author's perspective, the aforementioned increase in the rate of profit and the production volume stimulated by it (and thus the reduction in unemployment) will temporarily suspend the law of diminishing returns for entrepreneurs in the short term. In other words, there will be a temporary decrease in unemployment, but the next economic crisis will only be postponed, and this will have to be paid for by reducing budget expenditures in other areas (social security, education, healthcare, defense, etc.).

2. Let's assume that the increase in real wages for employees will occur exclusively through monetary emission, rather than through budget expenditures. This will lead to inflationary processes starting in the economy. Let's also assume, as in the first case, that entrepreneurs will start reducing their employees' salaries, believing that this reduction will be more than compensated by additional payments.

Entrepreneurs will find themselves in a dual situation: on one hand, reducing wage costs will increase their profits, on the other hand, inflation creates an inflation tax that will decrease their profits. Which of these two opposing forces will prevail is impossible to say in general terms; much depends on specific indicators in a particular situation. Accordingly, fluctuations in the rate of profit and the level of unemployment towards an increase or decrease will turn out to be quite different. In other words, an increase in the real wages of employees solely through monetary emission will lead to inflation in the economy, resulting in an inflation tax on the rest of the country's population (including entrepreneurs). The reduction of the unemployment rate in this case is not guaranteed.

Overall conclusion on the two options. Increasing the real wages of employees by the state to reduce the unemployment rate is a highly controversial issue and can have ambiguous effects. The potential decrease in unemployment could very well lead to inflation in the economy and a reduction in the share of expenditures in the budgets of various levels for other needs.

The author consider that a more significant approach in this direction is as follows: since the growth of real wages and the reduction of unemployment are caused by economic growth, it is the stimulation of economic growth that produces the necessary effect, simultaneously improving these two economic

* Petukhov V.A. Features of Economic Cycles in the Context of Global Technological Shifts: PhD Thesis in Economic Sciences: Specialisation 08.00.01. Moscow: RGB; 2013. 192 p.

indicators. Currently, there are a number of proven tools in fiscal and monetary policies that stimulate economic growth. A broader basis for developing methods and approaches for this stimulation is created by various theories of economic growth and economic cyclicality. Thus, contemporary Russian scholars O. Sukharev and E. Voronchikhina in their work investigate the impact of inflation targeting policy in Russia on the rate of economic growth [22].

CONCLUSION

1. The author's hypothesis that the Phillips curve reflects an inverse relationship between fluctuations in unemployment and fluctuations in real wages is well supported by data from the modern U.S. economy over a period of more than 40 years — from 1980 to 2022.

However, for a more serious justification, studies on the economies of other countries are necessary.

2. If the hypothesis is thoroughly confirmed and proves to be true, the use of the Phillips curve to establish the relationship between inflation and unemployment will become a futile endeavour. For several decades now (up to the present time), researchers have noted that the Phillips curve behaves ambiguously and quite strangely. It shows a positive slope, then a negative one, then it becomes flat, then it is a chaotic set of points.

3. The practical application of the inverse relationship between real wages and unemployment is very controversial and ambiguous. It is preferable to focus on stimulating economic growth, which simultaneously increases real wages and reduces unemployment.

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Increasing the Financial Performance of B2C Companies by Implementing Existing Customer Capital Reserves

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ABSTRACT

The article considers the impact of changes in the field of information technology on the financial performance of B2C organizations of various sizes. The relevance and practical significance of the study is due to the growth of information accessibility for consumers, as well as the emergence of a large number of new marketing tools that bring opportunities and threats. The **aim of the article** is to identify, systematize and evaluate the mistakes that B2C organizations make during the formation of customer capital, as well as when interacting with it. The purpose of the article is to analyze the impact of the following factors: the growth of information accessibility; the increasing influence of "word of mouth" and the company's business reputation; the development of IT as well as software and hardware systems for Big data analysis. The article uses: theoretical, empirical, general logical, special **research methods** and content analysis. The issue of identifying inefficient spending on marketing activities through the use of the most relevant metrics and KPIs is touched upon. The author **concludes** that increasing the financial performance of an organization through more efficient use of client capital is possible with the help of: a) savings in the marketing budget by changing approaches to attracting and retaining individual segments of consumers; b) gaining a competitive advantage in the market through rational cooperation with competing enterprises; c) increasing the profitability of sales through the introduction of a system for collecting information about consumers, as well as its interpretation. During the course of this work, the need to maintain the business reputation of the organization by creating a system for encouraging customers to leave positive feedback about the company or reviews of the company's products on online platforms was identified. The importance of a system of rewarding customers for their active promotion (recommendations) of the company's products to their acquaintances was also considered.

Keywords: Customer equity; impact of goodwill on financial performance; Big data; financing of marketing activities; goods and services promotion policy; communication channels; loyalty program; financial cooperation

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INTRODUCTION

Recently, the field of communications and information technology has undergone drastic transformation processes that affect the tools for managing client capital. The development of technologies for collecting and processing Big Data, the growing importance of the company's business reputation, as well as the emergence of diverse marketing tools that automate many aspects of the formation of marketing strategies and advertising campaigns. On the one hand, this creates new opportunities to improve the financial result of the company, and on the other hand, it reveals a problem in the most rational management of client capital. This also affects the required set of competencies and determines the list of requirements for the head of the organization and the marketing department, affecting the staff [1].

The urgency of the problem of managing the client capital of an organization is caused by a significant increase in information accessibility associated with the widespread use of the Internet, which gave consumers the opportunity to evaluate a significant number of products on the market without significant time expenditure. This significantly reduced the effectiveness of a number of advertising tools, as well as dramatically increased the importance of the company's business reputation. The opportunity to review public customer reviews and publish your feedback has had a significant impact on many business areas. At the same time, the reviews themselves are not always objective [2].

The biggest problems with building a positive online reputation are usually experienced by small companies, as they are not always able to support lawyers and IT specialists with the necessary competencies to solve such issues.

The Internet space is not limited to review sites, the widespread use of social networks and the degree of involvement of people in them also affects the company's business reputation. In addition, companies have the opportunity to increase their efficiency by analyzing an array of Big Data concerning consumer preferences (behavior) and internal processes of the organization [3, 4].

At the moment, even large TNCs are using fundamentally different strategies to respond to the challenges outlined above. Medium and small businesses are often unable to even comprehend the scale of opportunities and threats posed by the modern information space and technology.

This article examines promising areas and the most likely problems in improving the financial performance of companies that have arisen as a result of the emergence of modern technical tools and telecommunications channels, but have not received sufficient distribution due to a lack of understanding of the potential of new technical tools.

AVAILABLE APPROACHES TO THE SELECTION OF MARKETING GOALS, TOOLS AND KEY PERFORMANCE INDICATORS OF B2C COMPANIES

A significant number of scientific papers have been devoted to the issue of choosing marketing tools and calculating their effectiveness. First of all, the relevance of marketing management can be judged based on the financial statements of companies. So, according to the WebStrategies marketing agency, companies usually spend from 9 to 11 percent of the total company budget on marketing (*Table 1*). And small companies operating in the B2C market, up to 20 percent.[1]

[1] The report of the WebStrategies marketing agency. URL: https://www.webstrategiesinc.com/blog/how-much-budget-for-online-marketing (accessed on 20.08.2022).

The issue of the impact of social media marketing (SMMA) on brand equity, brand commitment, and company image has been repeatedly raised in a number of scientific papers. For example, an article by Eun-Ju Seo and Jin-Woo Park described the impact of SMMA on airline brand awareness and image, as well as customer commitment [5]. And the Smart Insights report reports that more than 44% of the adult audience uses the Internet to express their dissatisfaction with a product or service, thereby scaring off a potential audience [6].

The development of information technology also leads to the emergence of new advertising channels, the effectiveness of which in relation to certain types of business or the promotion of various product groups also requires study [7, 8]. The issue of the audience's transition to network communications and the symbiosis of online video and classical television is described in sufficient detail in the article by A.N. Krylov [9]. The reputation of the company begins to play a very important role, on which the level of sales, market share, and the value of the company's shares largely depend [10].

The main tools, goals, and functions of marketing are defined in the works of N.V. Fedorova, M. Singh, S. Hunt, and S. Madhavaram, as well as M. Gorji and S. Siami, and are summarized in *Table 2*.

A good attempt to assess the impact of implementing a loyalty program on short- and long-term sales and gross profit of an organization was made in the work of M. Chaudhuri et al. [15]. And the issue of identifying inefficient spending on marketing activities by using the most relevant metrics and KPIs (*Fig.*) is considered in the works of J. Saura, A. Petersen [16] and O.I. Grinko [17]. The problem of unprofitable clients is described in sufficient detail in the article by J. Birnes and J. Wais [18].

However, in our opinion, the issue of fundamental analysis of ways to respond to the challenges facing B2C organizations has not been considered in sufficient depth. Practical recommendations are also poorly systematized and have a fragmented character.

Table 1

The Share of Marketing Costs (As a Percentage) of the Total Cost of the Organization and Its Revenue

Economic sector	Organization's costs, %	Revenue volume, %
B2B Products	9.6	6.7
B2B Services	9.0	7.5
B2C Products	19.5	13.7
B2C Services	17.7	8.4

Source: Compiled by the author based on data from the WebStrategies marketing agency. URL: https://www.webstrategiesinc.com/blog/how-much-budget-for-online-marketing (дата обращения: 20.08.2022) / (accessed on 20.08.2022).

WAYS TO INCREASE THE EFFICIENCY OF USING THE ORGANIZATION'S CUSTOMER CAPITAL

The analysis of modern approaches to choosing the most relevant marketing goals and tools, as well as the study of modern technical capabilities in the field of data analysis and the latest communication channels made it possible to identify and classify the most significant errors in the formation and management of client capital. As a result, five key ways to improve marketing activities were identified, which, according to the author, should contribute to the growth of the company's financial performance.

1. Inefficient spending on attracting and retaining consumers.

First of all, it is necessary to identify a group of erroneous actions related to obviously inefficient spending on attracting consumers. The issue of evaluating the effectiveness of advertising campaigns is not new, as there are many approaches to solve it. According to statistics, firms most often use such marketing indicators as: number of sales, profit, profitability, customer satisfaction, market share, brand awareness, number of visitors, ROI, brand loyalty and retention percentage [20, 21]. Either the effectiveness is assessed based on KPIs established by the organization's management. However, the problem with the above approaches to assessing the cost effectiveness of attracting consumers is that the following factors are not taken into account or insufficiently taken into account:

a) Significant costs of attracting consumers who would have become the company's customers anyway due to a number of objective reasons. At the same time, when formally evaluating the effectiveness of an advertising company, the values obtained almost always exceed the minimum threshold of key performance indicators, which is why it is quite problematic to find them. A prime example is a situation in which a wired Internet provider has no direct competitors, but at the same time uses expensive targeted advertising, or pays high agency fees for concluding contracts. In a less explicit form, this situation may manifest itself when selling certain specific goods or services in a market with no or very little competition.

b) Attracting and retaining obviously unprofitable clients. In an attempt to pass the maximum number of consumers through the sales funnel, a company can spend a large amount of money to attract obviously unprofitable customers, which, according to some researchers, can be up to 30 percent [18]. Based on the research of J. Brins and J. Vassa, usually all the company's clients are divided into three segments, depending on the amount of profit they generate. Moreover, if we divide the most profitable and least profitable segments into four equal parts (quartiles), we can see the trend presented in *Table 3*.

It is not easy to determine the preferences of a particular potential consumer in advance, but

Table 2

The Main Tools, Functions and Goals of Marketing in an Organization

Marketing Tools	The main functions	Objectives
Product policy	Formation of the product line (assortment)	– expanding market share; – increase the organization's revenue
	After-sale and warranty service	– minimization of warranty service costs; – generating income through the sale of consumables
	Rotation of the product matrix and withdrawal of product items from the assortment	– withdrawal of low-margin products from the range; – selection of new products in accordance with the changing preferences of consumers
Pricing policy	Choosing a strategy for market behavior	– achieving a stable financial position; – ensuring the survival of the company or maximizing its current profits, depending on the chosen behavior strategy
Distribution	Sales channels and logistics	– building effective marketing logistics; – creation of a reliable logistics chain
	Management of the sales department and methods of working with the client	– sales growth while maintaining profitability of sales; – increase in the average receipt; – increased sales of related products
	Merchandising	– efficient use of the trading floor; – determining the location of the Product line items
Promotion Policy	Advertising activities	– The growing number of consumers; – Promotion of a specific (usually new) product
	Sales promotion, creation and improvement of a loyalty program	– Increased sales; – CLV growth
	Communication with the consumer	– Increase the level of brand loyalty; – Product promotion through a recommendation system

Source: Compiled by the author based on [11–14].

it is often quite possible to identify consumer segments that are economically impractical to attract and retain. This is realized both through the introduction of certain metrics containing a number of different criteria, each of which (or a set of which) will indirectly indicate the entry or non-entry of a consumer (potential consumer) into the target segment, as well as by introducing changes to the system of remuneration (bonuses) for sales department employees [22]. As in the first case, not every reporting and KPI system generally accepted in

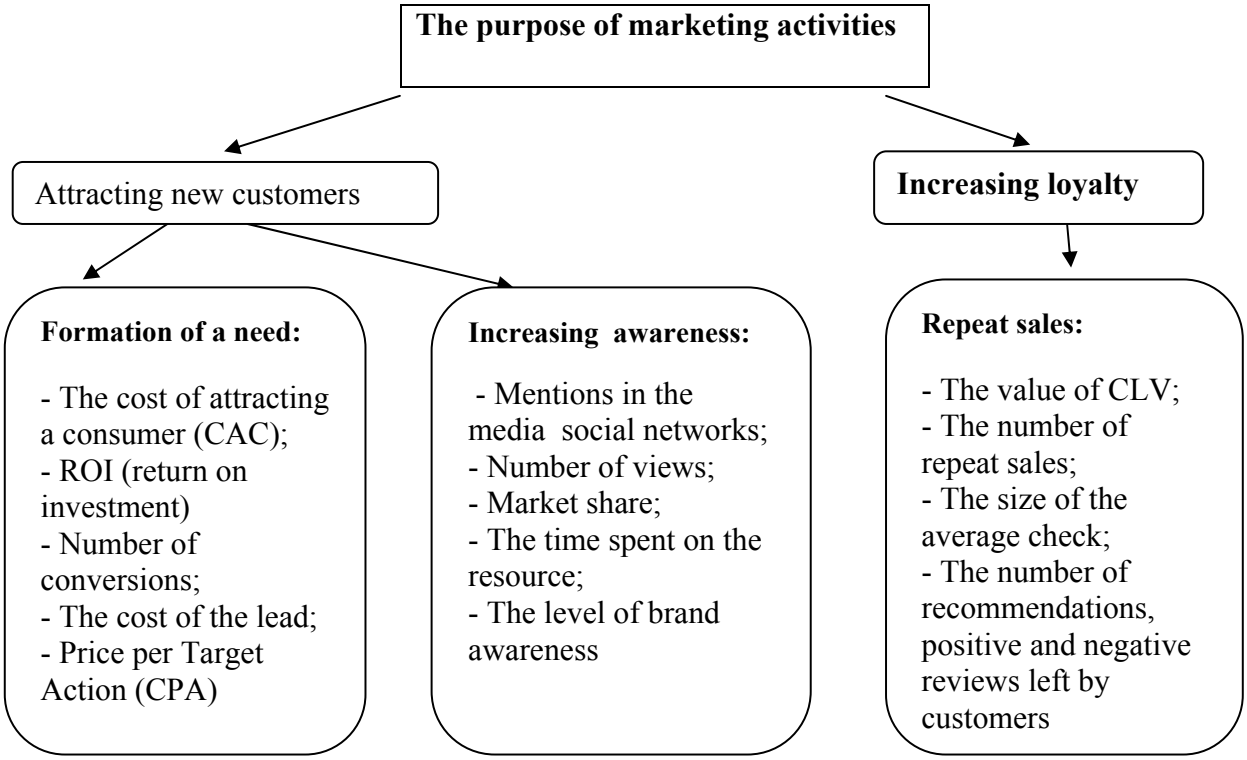

Fig. **Key Performance Indicators of Marketing Activities**

Source: Compiled by the author based on [16–19].

the market is able to show the weaknesses of an organization's marketing policy. In this case, it requires not only the formation of criteria for the target buyer, but also the search for criteria that help identify a consumer who is obviously unprofitable for the company. Sometimes it will be a better decision to abandon actions to retain, consult and stimulate the consumer at an early stage. The ideal option would be to sell this buyer to another company specializing in servicing such consumers.

Identification of such consumers is possible by analyzing aspects such as the range and volume of goods purchased, as well as the location of the consumer. A proper analysis will help to avoid excessive expenses for servicing an inappropriate category of customers, disproportionate logistical and transaction costs.

At the same time, it is most difficult to identify non-target customers, since it is quite problematic to identify a set of criteria that are generally applicable, even within the same industry. Moreover, not every organization can clearly define its target consumer segment. However, even small organizations can work out a number of criteria for evaluating consumers. To do this, it is necessary to:

- calculate the marginality of their products;
- identify the importance of repeat sales;
- clearly understand at which stage (at the time of the sale of the product, its maintenance, etc.) the main profit is generated.

Having received answers to all three groups of questions, as a rule, it is possible to define your target audience quite clearly and identify the criteria inherent in unprofitable clients.

At the same time, small organizations from a wide variety of fields may also have the opportunity to receive basic income not from the sale of the main product, but from the provision of related services or additional sales. For example, catering organizations often receive the main profit not from the sale of main dishes, but from the sale of drinks, sauces and additional ingredients in the dish. Companies that specialize in installing video surveillance,

Table 3

Segmentation of the Most and Least Profitable Customer Groups

Most profitable customers			
Quartile	**Number of consumers**	**Net profit, USD**	**Net profit per customer, USD**
Upper	2 800	124 000 000	44 300
Above average	2 800	32 000 000	11 400
Below average	2 800	20 000 000	7100
Lower	2 800	13 000 000	4 600
Total	11 200	189 000 000	-
Least profitable customers			
Quartile	**Number of consumers**	**Net profit, USD**	**Net profit per customer, USD**
Upper	62 000	58 000 000	900
Above average	62 000	5 000 000	100
Below average	62 000	–1 000 000	~0
Lower	62 000	–37 000 000	–600
Total	248 000	25 000 000	–

Source: J. Byrnes, J. Wass. Choose Your Customer: How to Compete Against the Digital Giants and Thrive [18].

selling office equipment, or coffee machines can often sell a product at a loss in order to obtain a service contract for a new customer.

Ignoring the principle of "not attracting obviously unprofitable customers" almost always guarantees low profitability of the organization and in some cases can cause significant financial damage. In our opinion, the canonical example of ignoring this principle is the positioning policy of the "PlayStation 3" game console, chosen by Sony at the start of sales. Trying to attract as large an audience as possible, the company decided to position its device not only as a game console, but also as a fairly cheap Blu-ray disc player, as well as a productive workstation. This allowed for a significant increase in sales, but additional sales brought Sony only losses. Due to the fact that the game consoles were sold slightly below cost, as the company's marketing strategy was to extract the main amounts of profit from the sale of games or accessories. And consumers who purchase devices for watching movies on Blu-ray discs or for using consoles as workstations practically did not use the game console for its intended purpose. The apogee was the creation of a supercomputer from 1,760 "PlayStation 3" consoles for the needs of the US Air Force.[2] As a result, Sony was forced to block some of the console's functions, which led to a class action lawsuit from console owners and additional financial and reputational losses for the company.

2. Incomplete satisfaction of consumer needs.

A low level of profitability may also be associated with an excessively narrow assortment or an incorrect presentation to the customer. This usually indicates the presence of the following types of problems in an organization's marketing strategy:

[2] US Air Force connects 1,760 PlayStation 3's to build supercomputer (ВВС США подключили 1760 PlayStation 3 для создания суперкомпьютера). URL: https://phys.org/news/2010–12-air-playstation-3s-supercomputer.html (accessed on 20.08.2022).

a) Excessively narrow product range. As a rule, a clear positioning in the market allows you to reduce costs and build a customer base that contains almost no unprofitable customers. However, the expansion of the product range and the provision of related services do not always lead to an increase in the costs of the organization. In some cases, the provision of additional services may even lead to cost reductions due to the sale of low-liquid goods.

Another argument in favor of a possible expansion of the product range is outlined by E. Noah, who argues that the strategy of occupying a narrow niche can be profitable in the short term, but subsequently this strategy may become unprofitable due to a decrease in the market, the arrival of a stronger player on the market, or due to a change in consumer preferences. In this regard, one of the ways to maintain its market share is closer integration with counterparties [23].

b) Insufficient level of consumer information about available products. The situation arises if the company's sales policy does not take into account the level of profitability of the products sold, or in the case of an incorrect organization of the work of the sales department or an irrelevant remuneration system that does not take into account the marginality of the product or all the difficulties experienced by an employee of the sales department when selling a product.

This problem arises, as a rule, due to the lack of necessary relationships between the sales department and the marketing department. A recent study conducted by K. Menier-Fitzhugh and G. Massey showed that the main problems associated with the interaction of the marketing department with the sales department are:

- insufficient communication between departments;
- lack of incentives for cooperation;
- conflict of interests between different departments of the organization.

In addition, the planning horizon and competencies of the employees of these departments differ significantly [24].

3. Lack of mutually beneficial cooperation with competitors.

Initially, cooperation between competing companies arose due to the inability to develop a high-tech product by one company. Later, cooperation began to be applied by small organizations. The most obvious way to collaborate is to reduce costs through economies of scale. However, this type of cooperation is not so easy to implement in practice, because over time, tension may arise between firms due to differences in views on how to develop joint production [25]. In this regard, in our opinion, it is most rational to develop cooperation with competitors in areas where the likelihood of conflict is low, and if it occurs, the breakdown of relations will not lead to significant consequences.

Even not the toughest competition can have a significant impact on the financial results of the companies involved in it. It is not always possible to avoid direct confrontation with competitors due to the existing antimonopoly legislation or the large number of enterprises operating in this market. But even in this case, it is usually possible to reduce marketing costs by:

a) jointly conducting marketing and other research in order to obtain information necessary for all parties financing this research;

b) selling clients or their contact information to a competing organization, if it is impossible to satisfy the client's needs on their own or it will require excessive costs.

The effectiveness of this method of increasing financial performance may not be high enough in all areas of activity, but at the same time there is practically no risk of losses when using it.

4. Lack of information about the consumer and his preferences.

Modern technical means allow us to collect large amounts of data about our customers, including the socio-demographic characteristics of the buyer, data on purchases made, and technical information about consumer devices. However, not all organizations fully utilize the capabilities of modern communication channels and the Big Data array analysis system, even though tools are available for this purpose.

A review of the literature on modern marketing shows the importance of two types of web analytics data. Firstly, these are quantitative analytical indicators that demonstrate formal information about the actions of buyers. Secondly, qualitative analytical indicators are necessary to analyze the entire consumer decision-making process and the purchase process [16]. Having this information helps:

- create a more relevant product offer for existing and new customers of the company;
- collect more complete information about the general situation in the market;
- get additional communication channels with the consumer.

And combining communication channels with the collected consumer data will increase the efficiency of the whole firm [26]. This is confirmed by a number of studies that have established a link between the financial result of a company and the degree of satisfaction of its customers [27].

5. Ignoring the media resource of its consumers.

In the modern world, social networks and small blogs (video blogs) that host content created by one person or a small group of authors are becoming increasingly important.

Word-of-mouth is also becoming increasingly important, the influence of which has greatly increased with the advent of social networks [28]. The influence of recommendations and professional online communities in the field of expensive products and special equipment is especially strong [29]. For example, a consumer who wants to buy a digital camera will primarily look for independent reviews or product reviews. In the process of searching for information, he can not only find out whether the product he initially selected is reliable, but also adjust his requirements for the product [30]. These circumstances, in the author's opinion, create prerequisites for the use of the following marketing tools:

a) building a system to encourage consumers to actively recommend a product to their social circle. Depending on the nature of the company's activities and the type of its product, the action for which the reward is offered may be either the direct sale of the product or the very fact of a recommendation to a certain circle of friends on social media networks;

b) creating a relevant system to encourage customers to write positive reviews about the company or its product. The best option would be to create a system in which the reward received is not just a discount on the next order, but a discount on a new product or a sample of this product. This will not only allow you to receive positive feedback, but will also become an advertisement for a new product [31].

The above suggestions are supported by studies evaluating the importance of word of mouth marketing, as well as the importance of user-generated content [32, 33]. In general, recent research in the field of Internet marketing shows that not only famous people can influence the opinions of potential consumers. Authors who do not have a tangible media weight can also have a great influence on consumers through their reviews or even participate in the creation of viral content. The field of user-generated content (UGC) is also of considerable importance, which allows us to get not only another additional channel of communication with consumers, but also to better understand their needs, as well as strengthen our relationship with it [34].

CONCLUSIONS

The analysis demonstrates the active development and improvement of marketing tools, as well as marketing channels of communication with consumers. However, only a small number of organizations make full use of modern marketing tools to improve their financial performance. At the same time, ignoring modern marketing tools is observed not only among small and medium-sized organizations, but also among fairly large companies that invest significant amounts of money in marketing activities. For them, making mistakes of this kind can result in significant losses due to fierce competition with other market participants.

Modern technologies have significantly facilitated the work of marketers, saving them from most of the routine work. At the same time, the development of information technology brings with it a large number of opportunities and threats for almost any company operating in the B2C sector. The main difference in terms of the requirements for the marketing department and its head, in our opinion, is a very significant increase in the requirements for the level of his competence. Both in the field of professional knowledge regarding the available marketing tools, and in terms of understanding all aspects of the market in which the company operates. Competencies in the field of information technology, database analysis and mathematical modeling are also of great importance.

Of course, it is not difficult to find a specialist in each of the above industries, but it does not always make sense, since the solution of many highly specialized tasks in isolation from the overall picture can be carried out with the help of a software and hardware complex. However, the correct formulation of the question and interpretation of the results obtained requires an understanding of the work of all processes. In this regard, highly specialized personnel are not able to effectively solve existing tasks. At the same time, the increasing level of automation in the field of marketing management leaves almost no room for a "mid-level" specialist, who has been in demand in the recent past.

In our opinion, the main directions for improving the use of client capital in the conditions described above are concentrated in the following areas:

1) It is necessary to review traditional approaches in the field of attracting and retaining customers.

2) Expanding cooperation with competitors in terms of marketing research is often beneficial.

3) Customer relationships should be built based not only on financial indicators, but also on the basis of what media resource the consumer has.

It is also worth noting that the growing popularity of online advertising, which provides even the smallest businesses with an equally wide range of tools for communicating with consumers.

Among the possible areas of future research in the field of improving customer capital management are: conducting research in the field of artificial intelligence for Big Data analysis and exploring the prospects for increasing the impact of reputational risks on companies' financial performance.

In practice, the process of increasing the efficiency of using customer capital can be facilitated by joining companies in associations in order to conduct a comprehensive analysis of various market segments and expand the information base of government statistics.

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Cost of Equity and Dividend Policy

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ABSTRACT

The economically justified amount of dividends is equal to the equity cost, assuming that investors use a dividend discounting model. The evaluation of the latter is an extremely difficult task. It is possible to do this within modern capital structure theory — Brusov-Filatova-Orekhova (BFO) — or within its perpetual limit — the Modigliani-Miller (MM) theory. After the recent generalization of both theories, taking into account the real conditions of the functioning of the companies, it becomes possible to estimate the cost of equity in these conditions. Dependence of the cost of equity on the level of leverage for different ages of the company, different values of k_0 (cost of equity at zero leverage level L) and debt costs, different frequencies of income tax payment, advance payments of income tax and payments at the end of periods, variable income of companies, etc. are being studied. Several very important innovative effects have been discovered, which significantly change the company's dividend policy. The developed methodology and results will help the company's management to develop an adequate and effective dividend policy. As well, the approach to dividend theory described here can be applied to business valuation and company value.

Keywords: dividend policy; equity cost; Brusov-Filatova-Orekhova theory; variable income; frequent payments of tax on income; WACC; Modigliani-Miller theory

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INTRODUCTION

As is well known, valuation of equity cost, which determines the amount of dividends, is an extremely complex task. It is possible to do this within one of the two main capital structure theories: either the Modigliani-Miller (MM) theory or the Brusov-Filatova-Orekhova (BFO) one. The first one is valid for perpetual companies only, while the second describes the companies of arbitrary ages. Until recently, both of these theories did not take into account some real conditions for the functioning of companies, such as the variable income of companies, the frequent payments of income tax, types of income tax payments (advance payments and payments at the end of reporting periods), etc. This was some gap in the study of the problem of the cost of equity. The challenge was to adapt both theories to these conditions and use the generalized Brusov-Filatova-Orekhova (BFO) and Modigliani-Miller (MM) theories in studying the problem of the cost of equity.

The correct dividend policy of the company, based on the correct assessment of the cost of equity, has both macroeconomic and microeconomic aspects.

From a macroeconomic point of view, it plays an important role in ensuring economic growth and economic efficiency, as well as the position in the financial and investment markets. At the macroeconomic level as well, an adequate dividend policy leads to increased investment and economic growth.

From a microeconomic point of view, the importance of a correct assessment of the cost of equity and the establishment of an adequate dividend policy of the company is determined by the following.

The rights of shareholders to receive adequate profit may be violated if the management of the company pursues an incorrect and inefficient dividend policy, due to the inability of management to correctly determine the amount of dividends (the economically justified amount of which is the cost of equity), or with a deliberate violation of the rights of shareholders in this sphere.

After the recent generalization of both theories, taking into account the real conditions of the functioning of the companies, it becomes possible to estimate the cost of equity in these conditions. Dependence of the cost of equity on the level of leverage for different ages of the company, different values of equity and debt costs, different frequencies of income tax payment, advance payments of income tax and payments at the end of periods, variable income of companies, etc. are being studied. The behavior and properties of the cost of equity are explored within the framework of the BFO theory. Several

very important innovative effects have been discovered, which significantly change the company's dividend policy. Among them are the abnormal dependence of equity cost on leverage level at different growth rates of variable income, at different ages of the company, at different frequencies of income tax payment, at different debt costs etc. The developed methodology and results will help the company's management to develop an adequate and effective dividend policy.

A comprehensive analysis was carried out of one of the most striking and significant phenomena in corporate finance in general and in the capital structure in particular — the anomalous dependence of the cost of equity on the leverage level, *L*. The first qualitative theory of the capital structure — Modigliani-Miller theory [1–3] had numerous limitations, the main ones being its perpetual nature and the absence of taxes: corporate and individual. Many scientists have tried to modify the Modigliani-Miller theory in different aspects [4–16].

In 2008 the main limitation of the Modigliani-Miller theory — the eternity of companies — was removed by Brusov et al. [16], and modern theories of the cost of capital and capital structure — Brusov-Filatova-Orekhova theory (BFO-theory) were created for companies of arbitrary age (BFO-1 theory) and for companies of arbitrary lifetime (BFO-2 theory) [17–20]. The well-known theory of the cost of capital and capital structure of Nobel laureates Modigliani and Miller has been replaced by Brusov-Filatova-Orekhova (BFO) theory. The authors departed from the Modigliani-Miller assumption about the eternity (infinity of life) of companies and developed a quantitative theory for estimating the main parameters of the financial activity of companies of arbitrary age. The results of the modern BFO theory turn out to be quite different from the results of the Modigliani-Miller theory. They show that the latter, due to its perpetuity, underestimates the cost of raising capital (WACC and equity) and significantly overestimates the company value. Such an incorrect assessment of key performance indicators of companies' financial activities led to an underestimation of the associated risks and the impossibility or serious difficulties in making adequate management decisions, which was one of the latent causes of the 2008 global financial crisis, which began with the crisis in the MBS (mortgage-backed securities) market.

In the Modigliani-Miller theory, there is no time factor (time is equal to infinity), which does not allow us to investigate the dependence of the company's financial performance on the time factor. But the theories of Brusov-Filatova-Orekhova (BFO-theories) are created for companies of arbitrary age and allow studying the dependence of a company's financial performance on the time factor.

Over the past couple of years, two main theories of the capital structure — Brusov-Filatova-Orekhova and Modigliani-Miller — have been adapted to the established financial practice of the functioning of companies, taking into account the real conditions of their work (see [19] and references there). This made it possible to investigate the impact of frequent income tax payments *p* with advance income tax payments and payments at the end of reporting periods, as well as the impact of the company's variable income on its main financial results. In paper [19], an analysis of all existing theories of the capital structure (with their advantages and disadvantages) was carried out in order to understand all aspects of the problem and make the right management decisions in practice. The role of the capital structure lies in the fact that the correct determination of the optimal capital structure allows the company's management to maximize the capitalization of the company and fulfill the long–term goal of the functioning of any company. In paper [19], the state of the theory of the structure of capital and the cost of capital is considered from the middle of the last century, when the first quantitative theory was created, to the present. The two main theories of Modigliani-Miller (MM) and Brusov-Filatova-Orekhova (BFO) are discussed and analyzed, as well as their numerous modifications and generalizations. The Brusov-Filatova-Orekhova (BFO) theory, its methodology, and results are widely known [19–31]. Many authors (see, for example, [26–28]) use the BFO theory in practice.

In addition to the approach of Modigliani and Miller, there are alternative approaches: Harris and Pringle [32], Miles and Ezzell [33].

Below we discuss them.

The following notation will be used in the text below.

k_d, $w_d = \dfrac{D}{D+S}$ — the debt capital cost and debt capital share, $k_e, w_e = \dfrac{S}{D+S}$ — the equity capital cost and the equity capital share, and $L = D/S$ — the value of financial leverage, D — the debt capital value, S — the equity capital value, k_0 — the equity capital cost at zero leverage level, g — income growth rate, p — frequency of tax on income payments, *WACC* — the weighted average cost of capital, t — tax on profit, n — company age.

Alternate WACC Formula

An alternate formula for the *WACC* has been suggested [8, 33–35]. It has the form below

$$WACC = k_0\left(1 - w_d t\right) - k_d t w_d + k_{TS} t w_d . \quad (1)$$

Here, k_0, k_d, and k_{TS} are the returns on the financially independent company, the debt, and the tax shield, respectively, t is the corporate tax rate, and w_d is the debt share.

Although Equation (1) is quite general, additional conditions are needed for practical applicability. When the *WACC* remains constant over time, the value of a leveraged company can be found by discounting the unleveraged free cash flows using the *WACC*. In this case, specific formulas can be found in textbook [11].

In the Modigliani-Miller theory [1–3], the debt value D is constant. V_0 is also constant, as the expected after-tax cash-flow of the financially independent company is fixed. By assumption, $k_{TS} = k_d$ and the tax shield value is $TS = tD$. Therefore, the company value V is a constant and the alternate *WACC* formula (1) simplifies the MM formula:

$$WACC = k_0\left(1 - w_d t\right). \quad (2)$$

The "classical" MM theory, suggesting that the returns on the debt k_d and the tax shield k_{TS} are equals (both these values have debt nature), is much more reasonable, so this is why we modify the "classical" MM theory, namely.

The Miles-Ezzell Model Versus the Modigliani-Miller Theory

Becker (2021) [12] discussed the differences between the Modigliani-Miller theory [1–3] and the Miles-Ezzell model [32], which deal with the stochasticity of free cash flows. The Modigliani-Miller theory considers a stationary process, while in the Miles-Ezzell model the process is stochastic. The author conducts a numerical experiment that allows you to determine the values and discount rates using a risk-neutral approach. He analyzes three formulas:

Modigliani-Miller theory [1–3]:

$$WACC = k_0\left(1 - w_d t\right); \quad (3)$$

Miles-Ezzell model [33]:

$$WACC = k_0 - w_d t k_f \frac{1 + k_0}{1 + k_f}; \quad (4)$$

Cooper and Nyborg (2006) [36]:

$$WACC = k_0 - w_d k_f t, \quad (5)$$

where k_f stands for the risk-free rate, which equals the required return of the debt holders.

The author shows that in the Miles-Ezzell model, all cash flows and the values depend on the path, in contrast to the Modigliani-Miller theory. Additionally, in the Miles-Ezzell model, all discount rates are time independent, with the exception of the discount rate used to discount tax shields, which depends on the duration of the cash flows. Conversely, in the Modigliani-Miller theory, all discount rates change over time except for the constant tax shield discount rate. This affects the applicability of the well-known formula for annuities and the development of models for estimating both finite and perpetual cash flows.

In this paper, Becker (2021) [12] raises the issue of paying the debt body together with the payment of interest on the debt. Regarding this issue, we would like to note that in both classical MM and BFO theories, the body of the debt is not paid. In the framework of the Modigliani-Miller theory, such an account is fundamentally impossible, while in the BFO theory it can be conducted and was conducted in the framework of the BFO-2 theory, where the amount of debt D decreases with time. This decrease in the value of debt D results in a decrease in the tax shield (see BFO-2 theory) [18, 37, 38–41].

Dividend Policy under Asymmetric Information

As we mentioned above, the economically justified amount of dividends is equal to the cost of equity. The task of calculating the cost of equity capital is one of the most difficult in financial management. Because of this problem, management decisions made by company managers are not always correct.

The rights of shareholders to receive adequate profits may be violated when the management of the company pursues an incorrect and ineffective dividend policy due to the inability of management to correctly determine the amount of dividends (the economically justified amount of which is the cost of equity capital), or with a deliberate violation of the rights of shareholders in this area.

The asymmetric information means that the company's managers know more than outside investors about the true state of the company's current earnings.

Miller and Rock [39] extended the standard financial model of dividend/investment/financing decisions of a company for conditions of asymmetric information. They showed that once stock trading along with asymmetric information is included in the model, Fisher's criterion for optimal investment becomes time–inconsistent: the market's belief that a company follows Fisher's rule creates incentives to violate the rule.

(Fisher's rule postulates that in the presence of efficient capital markets, a company's choice of investments is independent of the investment preferences of its owners, and therefore the company should be motivated only to maximize profits.)

Miller and Rock [39] showed that an informationally consistent signaling equilibrium exists under asymmetric information and stock trading, which restores the temporal consistency of investment policy but generally leads to lower

levels of investment than the optimal achievable under perfect information and/or no trading. Contractual provisions that modify information asymmetry or the ability to profit from it could eliminate both temporary inconsistency and inefficiency in investment policies, but these contractual provisions are also likely to incur sunk costs.

In this study we do not use an econometric model, but rather a first principles approach. Both theories (MM and BFO) use this approach. However, there are empirical studies where scientists have considered the influence of various factors on the cost of equity capital using simpler models. One of them is as follows.

The paper [42] examines the impact of environmental, social and governance (ESG) disclosures on the cost of equity capital in the food and beverage (F&B) sector.

This study analyses a sample of 171 internationally listed firms pertaining to the F&B sector and headquartered in North America, Western Europe and Asia Pacific (developed), forming an unbalanced panel of 1.316 observations, spanning the period 2010–2019. Authors run a fixed-effects panel regression model to test the relationship between ESG disclosure and the cost of equity capital. The authors' empirical outcomes suggest a significant negative relationship between ESG disclosure and the cost of equity capital. Authors find support for the notion that increased levels of ESG disclosure are linked to improved access to financial resources for firms.

The hypotheses of the current study are as follows [41]: (1) the actual operating conditions of companies affect the dependence of the cost of equity on debt financing and the company's dividend policy; (2) the abnormal dependence of the cost of equity on the company's debt financing can radically change the company's dividend policy. The presence and magnitude of the anomalous effect can be changed and controlled by changing such parameters as the cost of equity, k_e and debt capital, k_d, the frequency and method of paying income tax, the growth of the income rate, the age of the company, etc. The aims of this paper is to study the influence of the conditions of the real functioning of companies on the dependence of the cost of equity on debt financing, as well as on the anomalous effect: on its existence and management. The following research methods are used: the generalized Brusov-Filatova-Orekhova (BFO theory) and calculations by Microsoft Excel the equity cost depends on debt financing at different parameters, such as k_0 and k_d, the frequency and method of paying income tax, the growth of the income rate, the age of the company, etc. The anomalous effect affects the company's dividend policy and requires careful and detailed study. It's done here. The motivation of the study is to investigate one of the most striking effects in corporate finance — the anomalous dependence of the cost of equity on the company's debt financing. The significance of this study is determined by the importance of the anomalous effect that significantly affects the company's dividend policy. The limitation of the study is due to the fact that the case of a constant income growth rate is considered. In future publications, the case of a variable income growth rate will be considered. One more limitation of the consideration is related to the known limitations of the WACC approximation.

The structure of the paper is as follows:

We briefly discuss the literature review below. In 1 we will discuss the theoretical basis of our consideration and give the main formulas for *WACC* and k_d, which will be used to calculate *WACC* and k_e, and the influence of all considered factors on the dependence of equity cost k_e on the level of debt financing, *L*.

In 2 the influence of the following factors on the dependence of equity cost k_e on the level of debt financing, *L* is considered. In 2.1. Increase of tax on profit is considered; in 2.2. Variable income is considered; In 2.2.1. Influence of growth rate g is considered for tax on income payments at the ends of periods. In 2.2.2. Influence of growth rate *g* is considered with a comparison of results with advance income tax payments and payments at the end of periods. In 2.3. Frequent income tax payments is considered. In 2.3.1. Income tax payments at the ends of periods are considered. In 2.3.2. Frequent tax on income payments is considered with comparing the results for advance payments of tax on income and payments at the ends of periods. In 2.4. Simultaneous influence of the growth rate *g* and the frequency of income tax payment, p is considered. In 2.5. Influence of company age, *n* is considered. In 3 the explanations of the observed effects have been done. In 4 Conclusions are made.

1. THEORETICAL BASIS

The Brusov-Filatova-Orekhova (BFO) theory and its perpetual limit — the Modigliani-Miller theory have recently been generalized to the established practice of the functioning of companies. This generalization took into account the real operating conditions of companies, such as variable income, frequent income tax payments, advance income tax payments, etc. This made it possible to investigate the impact of these conditions on its main financial performance [21]. In this paper we use the generalized Brusov-Filatova-Orekhova (BFO) theory as well as the generalized Modigliani-Miller theory to study the influence of the conditions of the real functioning of companies on the dependence of the cost of equity on debt financing, as well as on the anomalous effect: on its existence and management.

Below we give a summary of the WACC formulas for BFO-theory as well as for MM-theory [21].

The classical BFO equation for *WACC*

$$\frac{1-\left(1+WACC\right)^{-n}}{WACC}=\frac{1-\left(1+k_0\right)^{-n}}{k_0\cdot\left(1-w_d t\left[1-\left(1+k_d\right)^{-n}\right]\right)} \tag{6}$$

and its limit for perpetuity companies (MM limit)

$$WACC=k_0\cdot\left(1-w_d t\right). \tag{7}$$

The formula for the equity cost comes from the definition of *WACC*

$$WACC=k_e w_e+k_d w_d\left(1-t\right), \tag{8}$$

accounting that

$$w_e=\frac{1}{1+L};\ \ w_d==\frac{L}{1+L} \tag{9}$$

and is as following

$$k_e=WACC\left(1+L\right)-Lk_d\left(1-t\right). \tag{10}$$

The *WACC* formulas for BFO-theory and for MM-theory under the conditions of the real functioning of companies are presented below [21].

1.1. Variable Income Case

1.1.1. Income Tax Payments at the Ends of Periods

$$\text{BFO: }\frac{1-\left(\frac{1+g}{1+WACC}\right)^n}{WACC-g}=\frac{1-\left(\frac{1+g}{1+k_0}\right)^n}{\left(k_0-g\right)\cdot\left(1-w_d t\left[1-\left(1+k_d\right)^{-n}\right]\right)}, \tag{11}$$

$$\text{MM: }WACC=\left(k_0-g\right)\cdot\left(1-w_d t\right)+g. \tag{12}$$

1.1.2. Advance Income Tax Payments

$$\text{BFO: }\frac{1-\left(\frac{1+g}{1+WACC}\right)^n}{WACC-g}=\frac{1-\left(\frac{1+g}{1+k_0}\right)^n}{\left(k_0-g\right)\cdot\left(1-w_d t\left[1-\left(1+k_d\right)^{-n}\right]\cdot\left(1+k_d\right)\right)}. \tag{13}$$

$$\text{MM: }WACC=\left(k_0-g\right)\cdot\left(1-w_d t\cdot\left(1+k_d\right)\right)+g. \tag{14}$$

1.2. Frequent Income Tax Payments

1.2.1. Income Tax Payments at the Ends of Periods

$$\text{BFO: }\frac{1-\left(1+WACC\right)^{-n}}{WACC}=\frac{1-\left(1+k_0\right)^{-n}}{k_0\cdot\left(1-\frac{k_d w_d t}{p}\frac{\left[1-\left(1+k_d\right)^{-n}\right]}{\left(1+k_d\right)^{1/p}-1}\right)}, \tag{15}$$

$$\text{MM: } WACC = k_0 \cdot \left(1 - \frac{k_d w_d t}{p \cdot \left[\left(1+k_d\right)^{1/p} - 1\right]}\right). \tag{16}$$

1.2.2. Advance Income Tax Payments

$$\text{BFO: } \frac{1-\left(1+WACC\right)^{-n}}{WACC} = \frac{1-\left(1+k_0\right)^{-n}}{k_0 \cdot \left(1 - \frac{k_d w_d t}{p} \frac{\left[1-\left(1+k_d\right)^{-n}\right] \cdot \left(1+k_d\right)^{1/p}}{\left(1+k_d\right)^{1/p} - 1}\right)}, \tag{17}$$

$$\text{MM: } WACC = k_0 \cdot \left(1 - \frac{k_d w_d t \cdot \left(1+k_d\right)^{1/p}}{p \cdot \left[\left(1+k_d\right)^{1/p} - 1\right]}\right). \tag{18}$$

1.3. Simultaneous Accounting of Variable Income in Case of Frequent Income Tax Payments

1.3.1. Income Tax Payments at the Ends of Periods

$$\text{BFO: } \frac{1-\left(\frac{1+g}{1+WACC}\right)^n}{WACC - g} = \frac{1-\left(\frac{1+g}{1+k_0}\right)^n}{\left(k_0 - g\right) \cdot \left(1 - \frac{k_d w_d t}{p} \frac{\left[1-\left(1+k_d\right)^{-n}\right]}{\left(1+k_d\right)^{1/p} - 1}\right)}, \tag{19}$$

$$\text{MM: } WACC - g = \left(k_0 - g\right) \cdot \left(1 - \frac{k_d w_d t}{p \cdot \left(1+k_d\right)^{1/p} - 1}\right). \tag{20}$$

1.3.2. Advance Income Tax Payments

$$\text{BFO: } \frac{1-\left(\frac{1+g}{1+WACC}\right)^n}{WACC - g} = \frac{1-\left(\frac{1+g}{1+k_0}\right)^n}{\left(k_0 - g\right) \cdot \left(1 - \frac{k_d w_d t}{p} \frac{\left[1-\left(1+k_d\right)^{-n}\right] \cdot \left(1+k_d\right)^{1/p}}{\left[\left(1+k_d\right)^{1/p} - 1\right]}\right)}, \tag{21}$$

$$\text{MM: } WACC - g = \left(k_0 - g\right) \cdot \left(1 - \frac{k_d w_d t \cdot \left(1+k_d\right)^{1/p}}{p \cdot \left(1+k_d\right)^{1/p} - 1}\right). \tag{22}$$

The general formula for equity cost, k_e, is as following

$$k_e = WACC\left(1+L\right) - Lk_d\left(1-t\right). \tag{23}$$

To study the dependence of the cost of equity capital, k_e, on various variables, it is first necessary to find the value of WACC and substitute it into formula (23).

2. RESULTS AND DISCUSSIONS

Below we study the influence of the conditions of the real functioning of companies on the dependence of the cost of equity on debt financing, as well as the conditions for the existence of the "anomalous effect" and the possibility of controlling it in accordance with the program stated above.

Our consideration combines theoretical and numerical results: the latter are based on calculations in Microsoft Excel using some typical data on the cost of equity and debt capital of companies, as well as on the actual data of a particular company (see clause 3.5 and *Figs. 30–35*, where calculations were made for PJSC GAZP). The data are taken from company reports: profitability, leverage level, cost of debt, etc. Then the data is processed to obtain the necessary calculation parameters, the most important of which is k_0, the cost of equity at zero leverage level *L*.

2.1. Increase of Tax on Profit

Within the Modigliani — Miller theory formula for equity cost, k_e, has a view

$$k_e = k_0 + L(k_0 - k_d)(1-t). \qquad (24)$$

Using formula (19) we calculate the dependence of cost of equity, k_e, on leverage level, *L* at different tax on profit rates *t*.

It could be seen from *Fig. 1*, where the dependence of cost of equity, k_e, on leverage level, *L* at different tax on profit rates *t* is shown for the case $k_0 = 10\%;\ k_d = 8\%$ (line 1 corresponds to tax on profit rates $t = 0$; line 2 corresponds to tax on profit rates $t = 0.1$; line 3 corresponds to tax on profit rates $t = 0.2$; line 4 corresponds to tax on profit rates $t = 0.3$; line 5 corresponds to tax on profit rates $t = 0.4$; line 6 corresponds to tax on profit rates $t = 0.5$; line 7 corresponds to tax on profit rates $t = 0.6$; line 8 corresponds to tax on profit rates $t = 0.7$; line 9 corresponds to tax on profit rates line 10 corresponds to tax on profit rates $t = 0.9$; line 11 corresponds to tax on profit rates $t = 1$), that the slope k_e (*L*) decreases with t and becomes zero at *t* = 1. In this case (at *t* = 1) the line k_e (*L*) is horizontal. This behavior can be explained by the presence of a multiplier (1 — *T*) (tax corrector).

The situation for the finite age company, described by the Brusov-Filatova- Orekhova (BFO) theory is completely different: there is an anomalous dependence of the cost of equity, k_e, on the level of leverage *L*: the cost of equity k_e decreases with the level of leverage *L*. This effect radically changes the principles of the company's dividend policy: shareholders receive smaller dividends with an increase in debt financing (which leads to financial difficulties and the risk of bankruptcy). In *Fig. 2* the dependence of cost of equity k_e on leverage level *L* at different tax on profit rate *t* ($n = 5, k_0 = 10\%, k_d = 8\%$) (1 — $t = 0$; 2 — $t = 0.2$; 3 — $t = 0.4$; 4 — $t = 0.6$; 5 — $T = 0.8$; 6 — $t = 1$) is shown.

From *Fig. 2* it can be seen that starting from certain values of the income tax rate (in this case, from $t^* = 40\%$), the cost of equity of a company with leverage does not increase, but decreases. Note, that *t** value (as well as the presence or the absence of such an abnormal effect) depends on particular values of parameters n, k_0, k_d, and at other values of parameters n, k_0, k_d critical values of tax on profit rate t^* could be lower.

The anomalous effect could only take place for a finite-age company and is not observed in the eternal Modigliani-Miller limit.

This effect exists within the framework of the BFO theory NOT at all parameters values: below we give an example of the usual behavior similar to the Modigliani-Miller limit one (see *Table 1* and *Fig. 3*).

Let us calculate the dependence of the critical value of the income tax rate, *t**, on the age of the company, *n*. To do this, we must first calculate the *WACC* value over a set of parameters, including the age of the company, *n*, by solving the classical BFO equation (1). Then obtained value of *WACC* at a fixed n should be substituted into equation (18) and the right side should be equated to k_0.

$$k_0 = WACC(1+L) - Lk_d(1-t). \qquad (25)$$

By solving this equation, one can obtain the critical value of the income tax rate *t** for a fixed *n*. At *Fig. 4* the results of such calculations are shown: the dependence of the critical value of tax on profit rate t^* on the age of the company, *n*, under variation of the difference between k_0 and k_d ($\Delta k = k_0 - k_d = 2\%; 4\%; 6\%; 8\%$) (1 — k_d = 6%, k_0 = 8%; 2 — k_d = 6%, k_0 = 10%; 3 — k_d = 6%, k_0 = 12%; 4 — k_d = 6%, k_0 = 14%).

From the *Fig. 4* it follows, that:

1. The critical value of tax on profit rate t^* increases with the difference $\Delta k = k_0 - k_d$, therefore a small difference between the value of cost of equity (at *L* = 0) k_0 of the company and the credit rate k_d favor to existence of a new effect.

2. The critical value of tax on profit rate t^* decreases monotonically with the age of the company (only for 10 — years

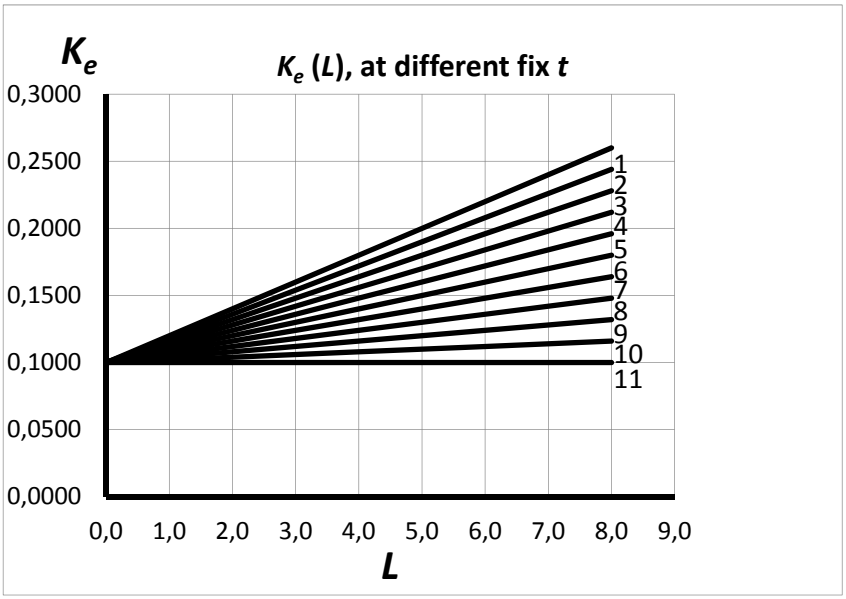

Fig. 1. **Dependence of Cost of Equity on Leverage Level *L* at Different Tax on Profit Rates *t***

Source: Compiled by the authors.

in case of $\Delta k = k_0 - k_d = 2\%$ it has a minimum). Therefore the probability of the anomaly effect is higher for "adult" companies.

3. Recapitulating 1 and 2, one can note, that a small difference between the value of cost of equity (at $L = 0$) k_0 of the company and the credit rate k_d as well as old enough age of the company favor to existence of a new effect.

Below (*Table 2*) the dependence of the critical value of tax on profit rate t^* on the company age, *n*, under different values of k_0 and k_d at constant difference between them $\Delta k = k_0 - k_d = 2\%$ is studied.

In *Fig. 5* the dependence of the critical value of tax on profit rate, t^*, on the company age, *n*, is shown at different values of k_0 and k_d at constant difference between them $\Delta k = k_0 - k_d = 2\%$ (1 – $k_0 = 8\%$; 2 – $k_0 = 10\%$; 3 – $k_0 = 12\%$; 4 – $k_0 = 14\%$; 5 – $k_0 = 16\%$; 6 – $k_0 = 20\%$; 7 – $k_0 = 24\%$).

The following conclusions could be made:

1. All curves are convex and the critical value of tax on profit rate t* reaches minimum, which value decreases with k_0.

Min t^* = 22.2% at $k_0 = 24\%$, min t^* = 24.35% at $k_0 = 20\%$, min t^* = 28.1% at $k_0 = 16\%$, min t^* = 30.43% at $k_0 = 14\%$, min t^* = 33.92% at $k_0 = 12\%$, min t^* = 38.92% at $k_0 = 10\%$, min t^* = 46.4% at $k_0 = 8\%$. Therefore the higher value of k_0 and the higher value of k_d at constant difference between them $\Delta k = k_0 - k_d = const$ favor for existence of a new effect.

2. The critical value of tax on profit rate t^* reach minimum at company age, decreasing with k_0: $n = 4{,}5$ years at $k_0 = 24\%$, $n = 5{,}5$ years at $k_0 = 16\%$, $n = 6{,}5$ years at $k_0 = 12\%$ and $n = 10{,}5$ years at $k_0 = 8\%$.

3. Thus, a parallel shift up of rates k_0 and k_d favor a for new effect, while company age, favorable a new effect, decreases with k_0.

The dependence of the critical value of tax on profit rate t^* on k_0 (equity cost at zero leverage level, *L*) at constant difference between them $\Delta k = k_0 - k_d = 2\%$ is shown at *Fig. 6*, where (1 – $n = 2$; 2 – $n = 3$; 3 – $n = 5$; 4 – $n = 7$; 5 – $n = 10$; 6 — $n = 15$; 7 – $n = 20$; 8 – $n = 25$).

What is the practical value of the effect? Does it exist in real life, or is its discovery of purely theoretical interest? Since the new effect takes place at an income tax rate that is greater than a certain value of t^*, it is necessary to compare this value with the real income tax rates established in different countries. The biggest tax on profits of corporation rates is in USA — 39.2%. In Japan it exceeds a little bit 38%. In France tax on profits of corporations varies from 33.3% for small and medium — sized companies, up to 36% for the major ones. In England tax on profits of corporations is in the range of 21% to 28%. In the Russian Federation tax on profits of corporations is installed in the amount of 20%.

In considered by us examples the value t^* strongly depends on the ratio between k_0, k_d, n and reaches a minimal value of 22.2%, and it is quite likely even lower values of t^* with other ratios between k_0, k_d, n.

In this way, we come to the conclusion that at some ratios between equity cost, debt cost and company age k_0, k_d, n

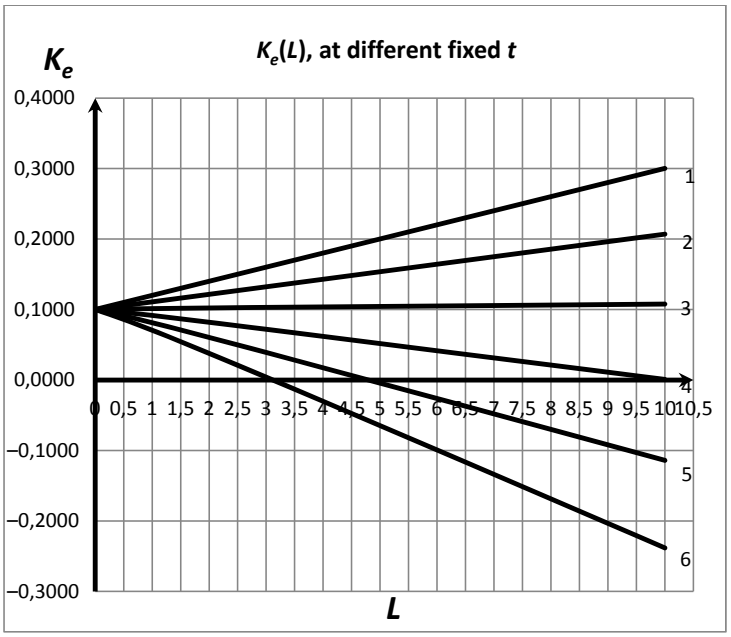

Fig. 2. **Dependence of Cost of Equity k_e on Leverage Level *L* at Different Tax on Profit Rate *T***

Source: Compiled by the authors.

Table 1

Dependence of Cost of Equity k_e on Leverage Level L at Different Fix Tax on Profit Rates *T* for the Case $n = 7, k_0 = 20\%, k_d = 10\%$

T/L	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10
0	0.2000	0.3000	0.4000	0.5000	0.6000	0.7000	0.8000	0.9000	1.0000	1.1000	1.2000
0.2	0.2000	0.2842	0.3682	0.4522	0.5362	0.6202	0.7042	0.7874	0.8713	0.9551	1.0389
0.4	0.2000	0.2677	0.3344	0.4008	0.4672	0.5335	0.5998	0.6661	0.7323	0.7986	0.8649
0.6	0.2000	0.2504	0.2984	0.3457	0.3928	0.4397	0.4865	0.5334	0.5802	0.6265	0.6731
0.8	0.2000	0.2323	0.2601	0.2861	0.3117	0.3369	0.3619	0.3867	0.4116	0.4364	0.4612
1	0.2000	0.2132	0.2185	0.2210	0.2223	0.2229	0.2231	0.2233	0.2231	0.2228	0.2224

Source: Compiled by the authors.

discovered by us effect takes place at tax on profits of corporation rate established in most developed countries, that provides the practical value of the effect.

Its account is important in improving tax legislation and may change dividend policies of the company.

Opening the effect expands our view of the rules of the game in the economy.

If prior to that it was widely known that, with the rising of leverage, the cost of equity is always growing, that is associated with the decrease in financial sustainability of the companies, with an increase in the share of borrowing, when the shareholders require a higher rate of return on the share.

But now it becomes clear that this is not always the case, and the dependence of cost of equity on leverage depends on the ratio between the parameters k_0, k_d, n , and, ultimately, on the tax on profit rate.

This effect has never been known, therefore, it was not taken into account by controls tax legislation, but possibilities here are opening tremendously.

The effect is also important for the development of the dividend policy of the company.

It turns out that the rule adopted by shareholders since time immemorial to demand a higher rate of return per share when increasing the share of debt capital does not always work now.

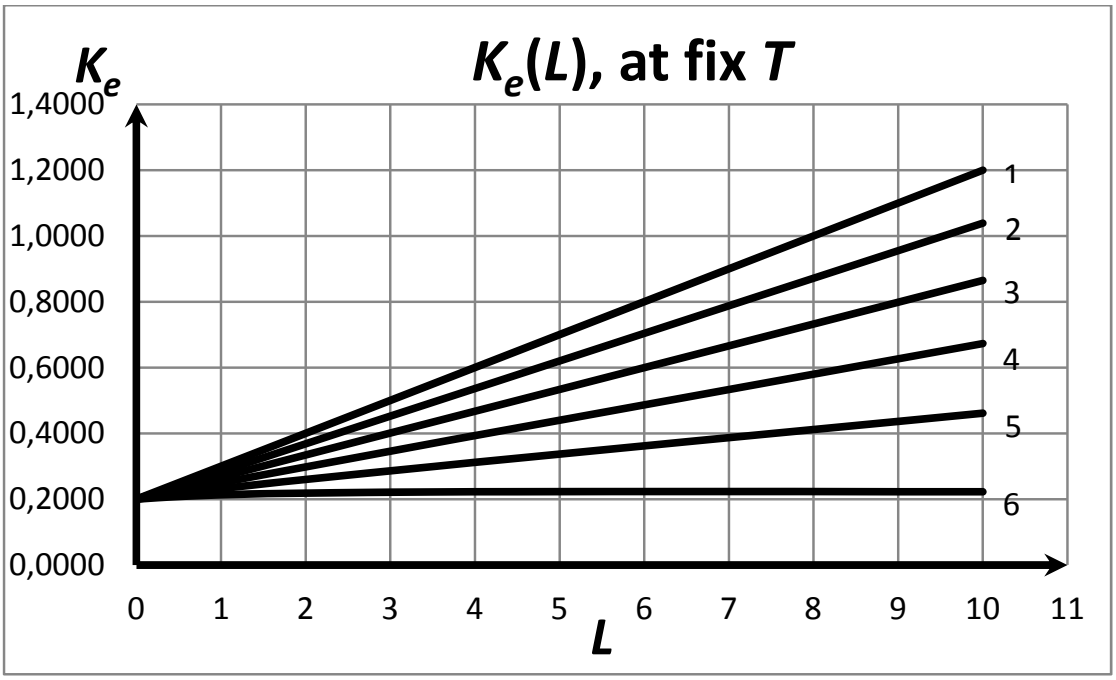

Fig. 3. **Dependence of Cost of Equity k_e on Leverage Level *L* at Different Tax on Profit Rate *T* ($n = 7, k_0 = 20\%, k_d = 10\%$) (1 – $T = 0$; 2 – $T = 0.2$; 3 – $T = 0.4$; 4 – $T = 0.6$; 5 – $T = 0.8$; 6 – $T = 1$)**

Source: Compiled by the authors.

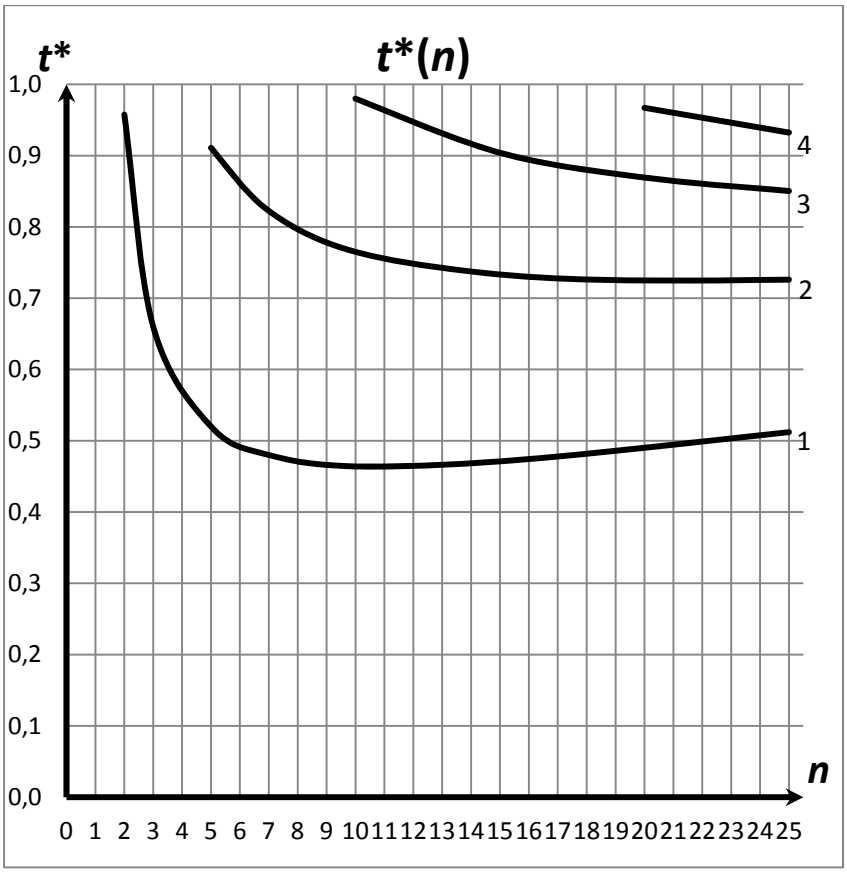

Fig. 4. **The Dependence of the Critical Value of Tax on Profit Rate t^* on the Age of the Company**

Source: Compiled by the authors.

Table 2

The Dependence of the Critical Value of Tax on Profit Rate t^* on the Age of the Company Under Different Values of k_0 and k_d at Constant Difference Between them $\Delta k = k_0 - k_d = 2\%$

ke(t)\n	2	3	5	7	10	15	20	25
k_d = 6%. k_0 = 8%	0.9575	0.6600	0.5200	0.4800	0.4640	0.4710	0.4903	0.5121
k_d = 8%. k_0 = 10%	0.7313	0.5125	0.4140	0.3905	0.3892	0.4138	0.4453	0.4803
k_d = 10%. k_0 = 12%	0.6000	0.4280	0.3510	0.3392	0.3467	0.3840	0.4285	0.4733
k_d = 12%. k_0 = 14%	0.5125	0.3687	0.3110	0.3043	0.3218	0.3697	0.4239	0.4788
k_d = 14%. k_0 = 16%	0.4437	0.3266	0.2810	0.2821	0.3043	0.3636	0.4277	0.4904
k_d = 18%. k_0 = 20%	0.3625	0.2710	0.2435	0.2549	0.2895	0.3677	0.4468	0.5221
k_d = 22%. k_0 = 24%	0.3100	0.2370	0.2220	0.2400	0.2875	0.3818	0.4759	0.5588

Source: Compiled by the authors.

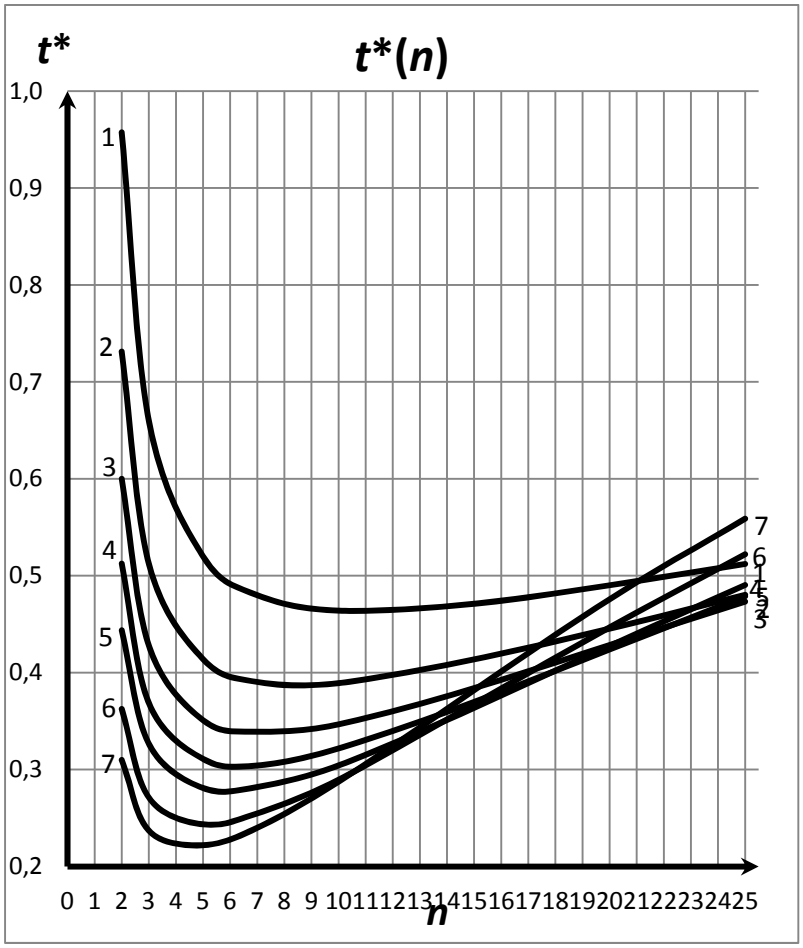

Fig. 5. **The Dependence of the Critical Value of Tax on Profit Rate t^* on the Company Age, *n***

Source: Compiled by the authors.

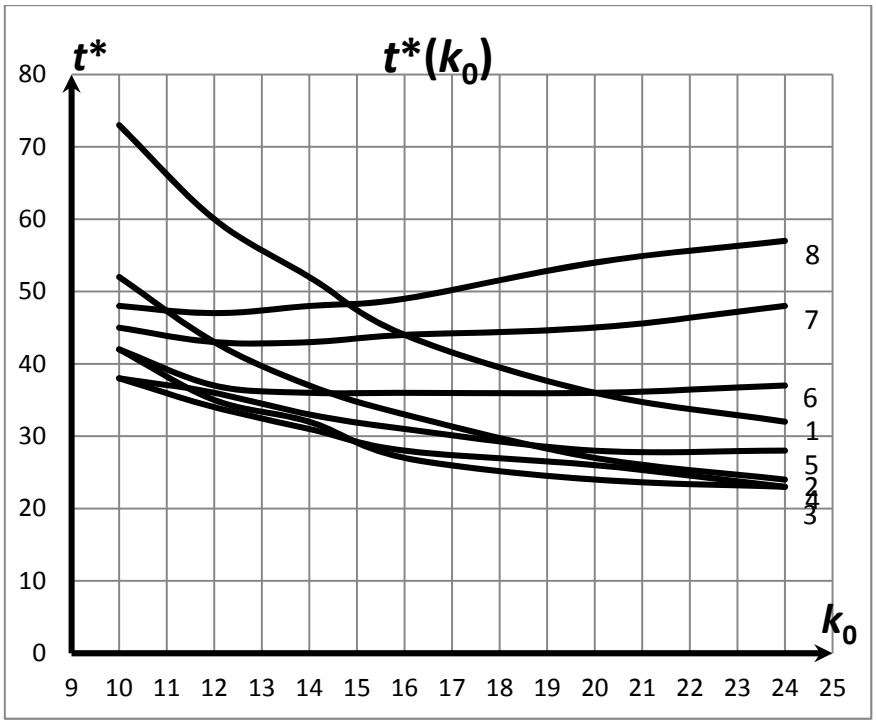

Fig. 6. **The Dependence of the Critical Value of Tax on Profit Rate t^* on k_0 at Constant Difference Between them $\Delta k = k_0 - k_d = 2\%$**

Source: Compiled by the authors.

This will allow the company's management to pursue a more realistic dividend policy, limiting shareholders' appetites to an economically justified amount of dividends.

As we mentioned in 2, the Brusov-Filatova-Orekhova (BFO) theory and its eternal limit — the Modigliani-Miller theory have recently been generalized to the established practice of the functioning of companies, such as variable income, frequent income tax payments, advance payments on income tax, etc. Below, we use the generalized theory of Brusov-Filatova-Orekhova (BFO) to study the existence and behavior of an anomalous effect in a wide range of the financial parameters of the company. We start from the case of variable income.

2.2. Variable Income

2.2.1. Influence of Growth Rate G: Tax on Income Payments at the Ends of Periods

Below we study the influence of growth rate of income g in case of tax on income payments at the ends of periods.

2.2.1.1. Six Year Company

Figure 7 shows the dependence of equity cost, k_e, on leverage level, L, for six year company at $p = 1$; $k_0 = 0.16$; $k_d = 0.14$; $t = 0.2$; at different $g = -0.2; -0.15; -0.1; -0.05; 0; 0.05; 0.1; 0.15; 0.2$ with payments of tax on income at the end of periods.

From *Fig. 7* it is seen, that with an increase in the rate of income growth g, the slope of the curve $k_e(L)$ increases. The anomalous effect for six year company at $k_0 = 0.16$; $k_d = 0.14$ takes place at $g < -1$: the slope of the curve $k_e(L)$ is negative.

Figure 8 shows the dependence of equity cost, k_e, on leverage level, L, for six year company at $p = 1$; $k_0 = 0.16$; $k_d = 0.12$; $t = 0.2$; at different $g = -0.2; -0.15; -0.1; -0.05; 0; 0.05; 0.1; 0.15; 0.2$ with payments of tax on income at the end of periods.

From *Fig. 8* it is seen, that, like previous case, with an increase in the rate of income growth g, the slope of the curve $k_e(L)$ increases. The anomalous effect for six year company at $k_0 = 0.16$; $k_d = 0.12$ is absent at all g values: the slope of the curve $k_e(L)$ is positive.

2.2.1.2. Three Year Company

Let us consider three year company.

From *Fig. 9* it is seen, that, like previous case, with an increase in the rate of income growth g, the slope of the curve $k_e(L)$ increases. The anomalous effect for three year company at $k_0 = 0.16$; $k_d = 0.14$ is absent at all g values: the slope of the curve $k_e(L)$ is positive.

From *Fig. 10* it is seen, that, like previous case, with an increase in the rate of income growth g, the slope of the curve $k_e(L)$ increases. The anomalous effect for three year company at $k_0 = 0.16$; $k_d = 0.12$ is absent at all g values: the slope of the

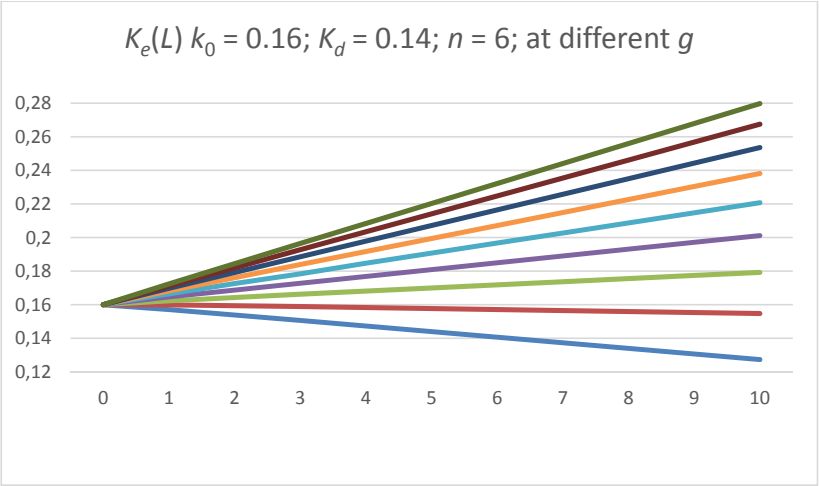

Fig. 7. **The Dependence of Equity Cost, K_e, on Leverage Level, L, at p = 1; k_0 = 0.16; k_d = 0.14; t = 0.2; n = 6 at different g = –0.2; –0.15; –0.1; –0.05; 0; 0.05; 0.1; 0.15; 0.2 (from the Bottom to the Top) with Payments of Tax on Income at the End of Periods**

Source: Compiled by the authors.

curve $k_e(L)$ is positive. The width of the bundle of straight lines $k_e(L)$ narrows with decreasing k_d.

From *Figs. 7–11* we could conclude the following:

1. With an increase in the rate of income growth g, the slope of the curve $k_e(L)$ increases, since in this case shareholders can count on larger dividends.

2. The anomalous effect exists for a small difference between k_0 and k_d ($k_0 - k_d$) and is absent for a larger value of this difference.

2.2.2. Influence of Growth Rate g: Comparison of Results with Advance Income Tax Payments and Payments at the End of Periods

Below we continue study the influence of growth rate g. We consider the case of advance income tax payments for six year and three year companies. The results for advance income tax payments are shown at *Figs. 12–16*.

Six Year Company

From *Fig. 12* it is seen, that with an increase in the rate of income growth g, the slope of the curve $k_e(L)$ increases. The anomalous effect for six year company with advance payments of tax on income at k_0 = 0.16; k_d = 0.14 takes place at g < 0: the slope of the curve $k_e(L)$ is negative for all negative g.

From *Fig. 13* it is seen, that with an increase in the rate of income growth g, the slope of the curve $k_e(L)$ increases. The anomalous effect for six year company with advance payments of tax on income at k_0 = 0.16; k_d = = 0.12 is absent: the slope of the curve $k_e(L)$ is positive for all g values.

Three Year Company

Let us make calculation for three year company.

From *Fig. 14* it is seen, that with an increase in the rate of income growth g, the slope of the curve $k_e(L)$ increases. The anomalous effect for three year company with advance payments of tax on income at k_0 = 0.16; k_d = 0.14 takes place at g < –0.1: the slope of the curve $k_e(L)$ is negative for g < –0.1. Note, that for six year company with advance payments of tax on income at k_0 = 0.16; k_d = 0.14 the anomalous effect takes place at bigger g < 0. From *Figs. 15* and *16* it is seen, that with an increase in the rate of income growth g, the slope of the curve $k_e(L)$ increases. The anomalous effect for three year company with advance payments of tax on income at k_0 = 0.16; k_d = 0.12 is absent: the slope of the curve $k_e(L)$ is positive for all g values. The width of the bundle of straight lines k_e narrows with decreasing k_d.

From *Figs. 12–16* the following conclusions follows:

1. With an increase in the rate of income growth g, the slope of the curve $k_e(L)$ increases, since in this case shareholders can count on larger dividends.

2. The anomalous effect exists for a small difference between k_0 and k_d $\Delta k = k_0 - k_d$ and is absent for a larger value of this difference.

3. The width of the bundle of straight lines k_e narrows with decreasing k_d.

4. Advance income tax payments are favorable for the existence of the anomalous effect.

The dependence of the existence of anomalous effect the $\Delta k = k_0 - k_d$, company age, n, and value of g^*, below which (g < g^*) this effect exists is shown in *Table 1*.

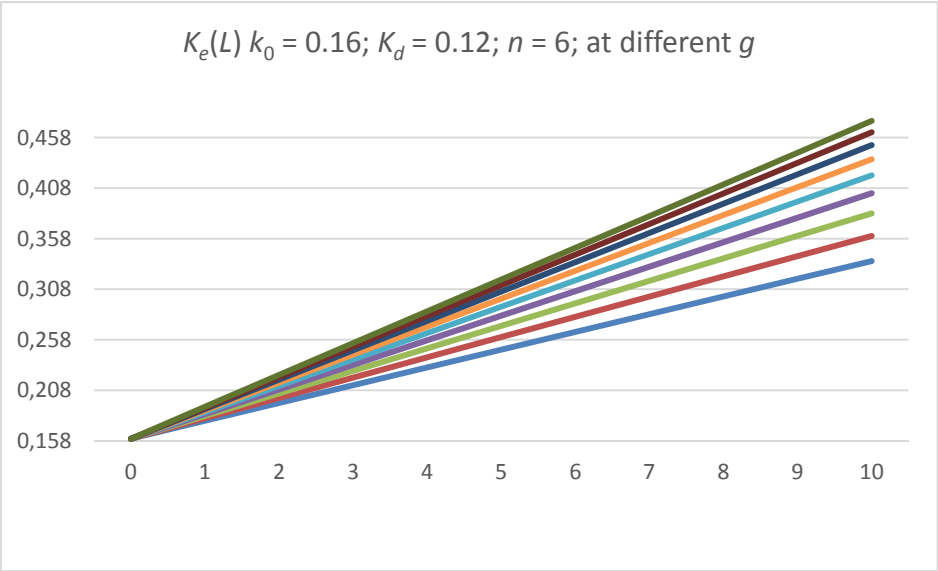

Fig. 8. **The dependence of equity cost, k_e, on leverage level, L, at p = 1; k_0 = 0.16; k_d = 0.12; t = 0.2; n = 6 at different g = –0.2; –0.15; –0.1; –0.05; 0; 0.05; 0.1; 0.15; 0.2 (from the Bottom to the Top) with Payments of Tax on Income at the End of Periods**

Source: Compiled by the authors.

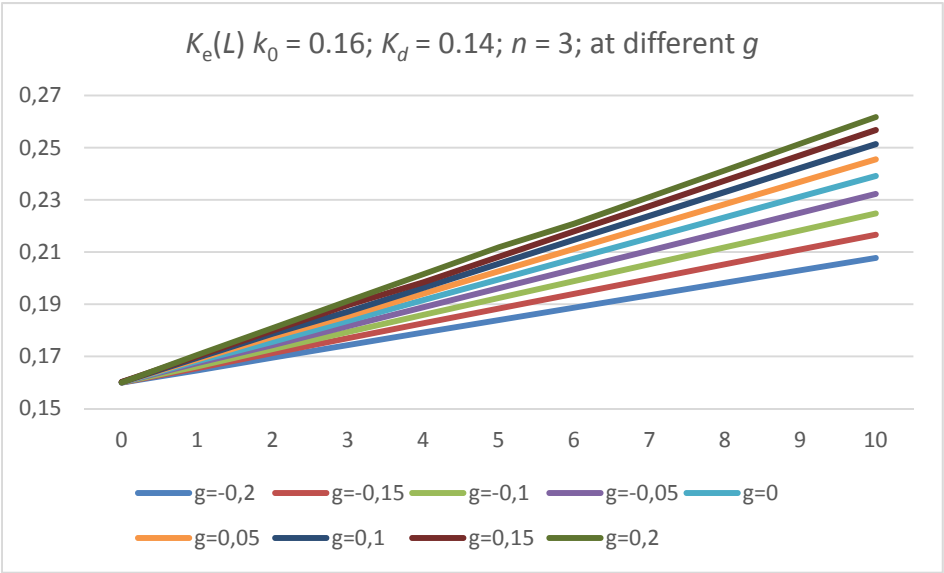

Fig. 9. **The Dependence of Equity Cost, k_e, on leverage level, L, at p = 1; k_0 = 0.16; k_d = 0.14; t = 0.2; n = 3 at different g = –0.2; –0.15; –0.1; –0.05; 0; 0.05; 0.1; 0.15; 0.2 (from the Bottom to the Top) with Payments of Tax on Income at the End of Periods**

Source: Compiled by the authors.

From the *Table 3* it is seen that at company age n = 6 the effect exists at Δk = 2% only in both cases [for payments of tax on income at the ends (1) of periods as well as for advance payments of tax on income (2)] at that the g^*value increases under transition from (1) type of payments to (2) from –0.125 to zero. At company age n = 3 the effect exists at Δk = 2% only in the case of advance payments of tax on income at the g^* = –0.125.

Small value of Δk favorable to existence of effect, as well as bigger age of company and advance payments of tax on income.

2.2.3. Influence of Debt Cost k_d

Below, we examine the impact of the cost of debt k_d on the existence of an anomalous effect for advance income tax

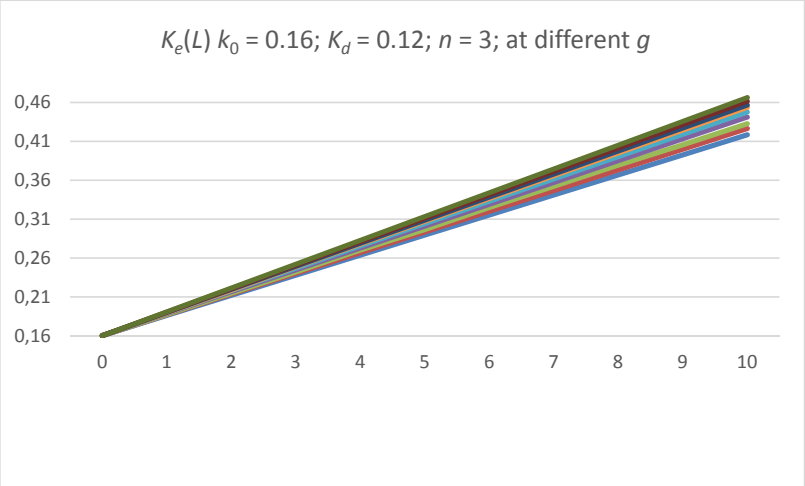

Fig. 10. **The Dependence of Equity Cost, k_e, on Leverage Level, L, at p = 1; k_0 = 0.16; k_d = 0.12; t = 0.2; n = 3 at Different g = –0.2; –0.15; –0.1; –0.05; 0; 0.05; 0.1; 0.15; 0.2 (from the Bottom to the Top) with Payments of Tax on Income at the End of Periods**

Source: Compiled by the authors.

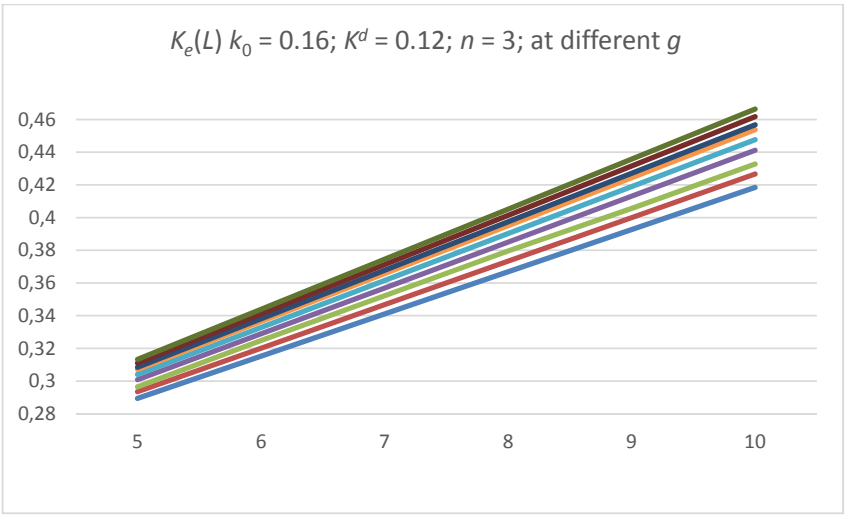

Fig. 11. **The Dependence of Equity Cost, k_e, on leverage level, L, at p = 1; k_0 = 0.16; k_d = 0.12; t = 0.2; n = 3 at Different g = –0.2; –0.15; –0.1; –0.05; 0; 0.05; 0.1; 0.15; 0.2 (from the Bottom to the Top) with Payments of Tax on Income at the End of Periods (Lager Scale)**

Source: Compiled by the authors.

payments and income tax payments at the end of periods, both in the case of falling and rising profits.

It can be seen from *Fig. 17* that the slope of the curve $k_e(L)$ decreases with the value of k_d for both cases of income tax payment (for payments at the end of periods (1) and also for advance payments (2)). In this case, all curves (except curve at k_d = 0.05) related to case (1) have a greater slope compared to the curves related to case (2). It can be seen *Fig. 18* that the slope of the curve $k_e(L)$ decreases with the value of k_d for both cases of income tax payment [for payments at the end of periods (1) and also for advance payments (2)]. In this case, all curves (except curve at k_d = 0.05) related to case (1) have a greater slope compared to the curves related to case (2).

2.3. Frequent Income Tax Payments

2.3.1. Frequent Tax on Income Payments: Compare the Results for Advance Payments of Tax on Income and Payments at the Ends of Periods

Below we investigate the impact of frequent income tax payments on the existence and behavior of the anomalous effect for advance payments of tax on income and payments at the ends of periods for three- and six-year companies. For

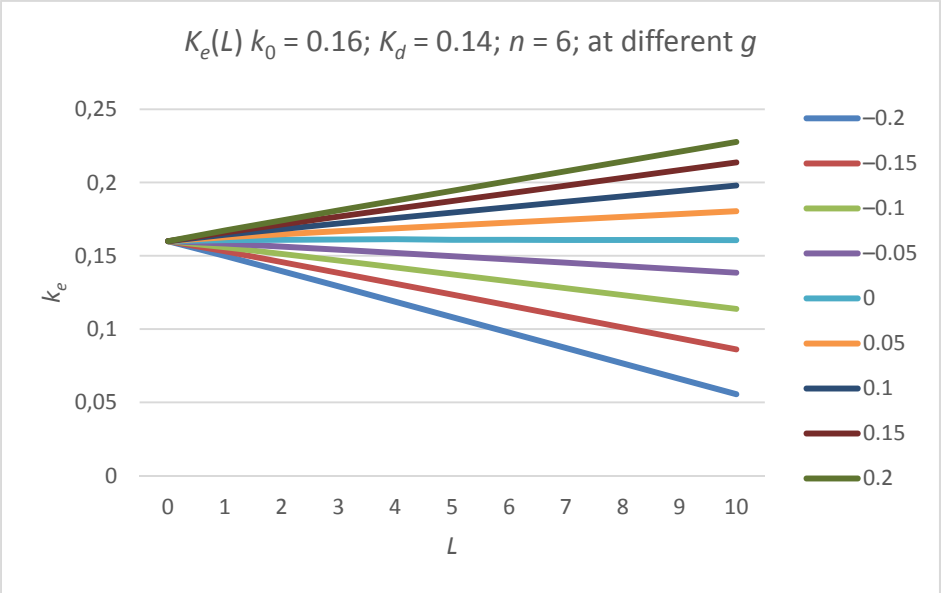

Fig. 12. **The Dependence of Equity Cost, k_e, on leverage level, L, at p = 1; k_0 = 0.16; k_d = 0.14; t = 0.2; n = 6 at different g = –0.2; –0.15; –0.1; –0.05; 0; 0.05; 0.1; 0.15; 0.2 (from the Bottom to the Top) with Advance Payments of Tax on Income**

Source: Compiled by the authors.

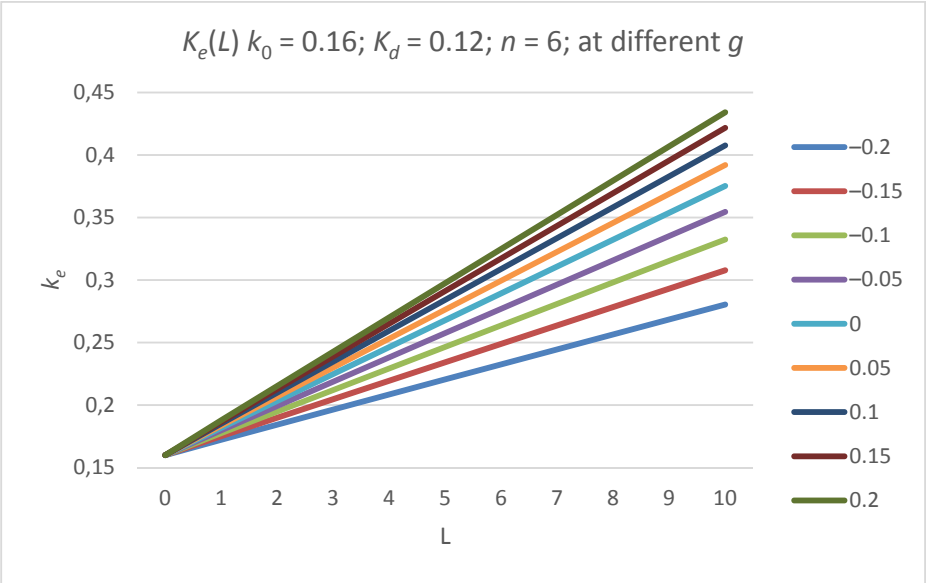

Fig. 13. **The Dependence of Equity Cost, k_e, on Leverage Level, L, at p = 1; k_0 = 0.16; k_d = 0.12; t = 0.2; n = 6 at Different g = –0.2; –0.15; –0.1; –0.05; 0; 0.05; 0.1; 0.15; 0.2 (from the Bottom to the Top) with Advance Payments of Tax on Income**

Source: Compiled by the authors.

this, we calculate the dependence of equity cost, k_e, on leverage level, L, at different p = 1; 2; 4; 6; 12; k_0 = 0.22; at k_d = 0.2; t = 0.2; n = 3 with advance payments of tax on income (p') and payments of tax on income at the ends of periods (p). Results for three year company are shown in *Table 4* and *Fig. 19* and for six year company are shown in *Table 5* and *Fig. 20*.

The slope $k_e(L)$ decreases with p when income tax is paid at the end of periods and becomes negative at $p > 4$ and higher for n = 3 and at $p > 2$ and higher for n = 6 (*Fig. 20*). For advance income tax payments, the slope $k_e(L)$, which is negative for any income tax frequency payments, increases (decreases modulo) with a frequency p, but never intersects with the curves $k_e(L)$

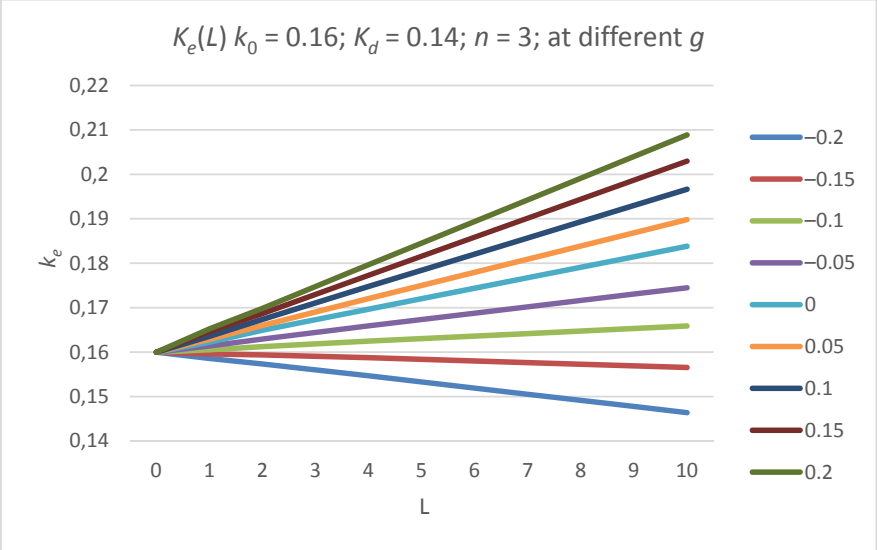

Fig. 14. **The Dependence of Equity Cost, k_e, on Leverage Level, L, at p = 1; k_0 = 0.16; k_d = 0.14; t = 0.2; n = 3 at Different g = –0.2; –0.15; –0.1; –0.05; 0; 0.05; 0.1; 0.15; 0.2 (from the Bottom to the Top) with Advance Payments of Tax on Income**

Source: Compiled by the authors.

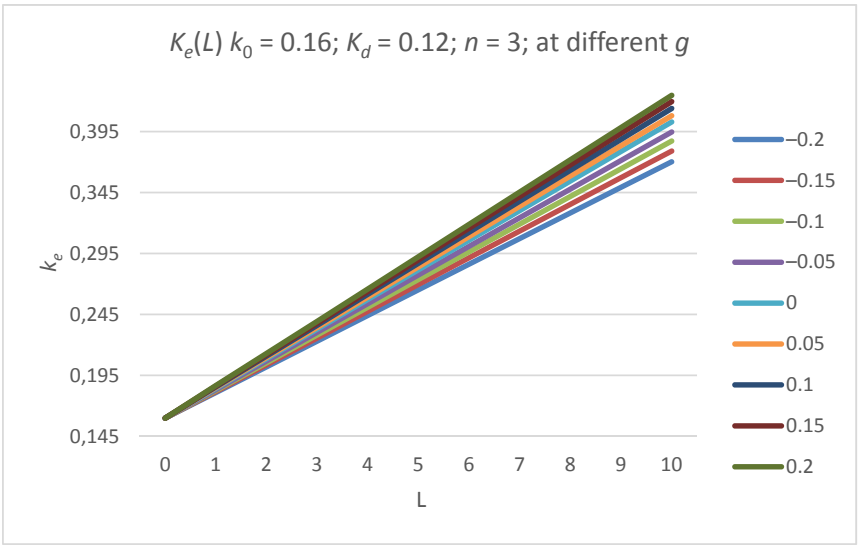

Fig. 15. **The Dependence of Equity Cost, k_e, on Leverage Level, L, at p = 1; k_0 = 0.16; k_d = 0.12; t = 0.2; n = 3 at Different g = –0.2; –0.15; –0.1; –0.05; 0; 0.05; 0.1; 0.15; 0.2 (from the Bottom to the Top) with Advance Payments of Tax on Income**

Source: Compiled by the authors.

in case of income tax payment at the end of the periods. The anomalous effect disappears at Δk = 4% and above (see *Fig. 21*).

The slope of $k_e(L)$ is positive for all p and both payment methods: this means that there is no anomalous effect. The slope $k_e(L)$ decreases with p when income tax is paid at the end of the period and increases when income tax advances are paid. The order of the curves $k_e(L)$ corresponding to these two methods of payment turns out to be mixed. This can lead to very interesting effects, providing new opportunities and the ability to manage the payment of income tax in accordance with tax laws (*Fig. 21*).

2.4. Simultaneous Influence of the Growth Rate g and the Frequency of Income Tax Payment, p

2.4.1. Tax Payments at the End of Periods

Below (see *Fig. 22, 23*), we examine the impact of growth rate g and income tax frequency payments, p on the existence of

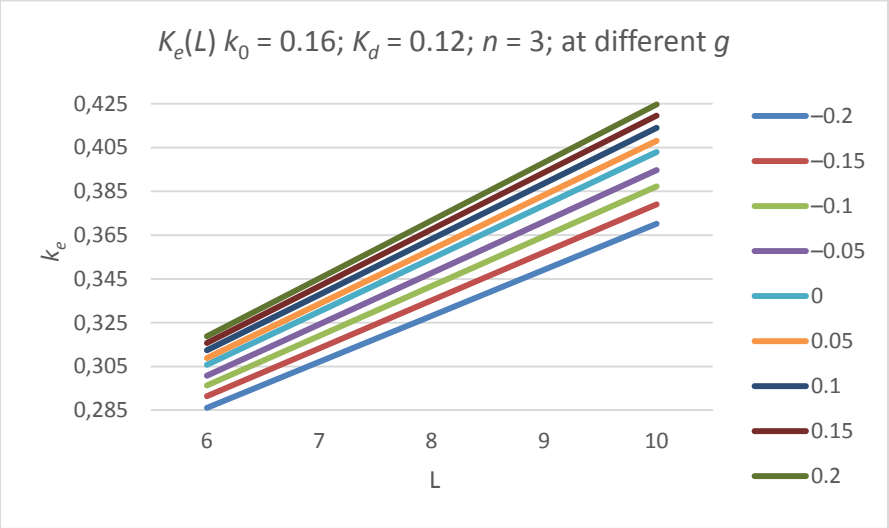

Fig. 16. **The Dependence of Equity Cost, k_e, on Leverage Level, L, at p = 1; k_0 = 0.16; k_d = 0.12; t = 0.2; n = 3 at Different g = –0.2; –0.15; –0.1; –0.05; 0; 0.05; 0.1; 0.15; 0.2 (from the Bottom to the Top) with Advance Payments of Tax on Income**

Source: Compiled by the authors.

Table 3

The Dependence of the Existence of Anomalous Effect on the Δk, Company Age, n, and Value of g^*, Below Which ($g < g^*$) this Effect Exists

Company age	Δk	Payments of tax on income at the ends of periods		Advance payments of tax on income	
		Existence of effect	g^* value	Existence of effect	g^* value
n = 6	2%	+	–0.125	+	0
	4%	–		–	
	6%	–		–	
n = 3	2%	–		+	–0.125
	4%	–		–	
	6%	–		–	

Source: Compiled by the authors.

an anomalous effect for income tax payments at the end of periods, both in the case of falling and rising profits.

The slope $k_e(L)$ decreases with p and becomes negative at $p > 2$ (p = 4; 6; 12).

The slope $k_e(L)$ decreases with p and remains positive at all p.

The slope $k_e(L)$ decreases with p and remains positive at all p. Comparing to the case g = 0 the slope $k_e(L)$ is higher, this means, that the slope $k_e(L)$ growths with g (*Fig. 24*).

2.4.2. Advance Tax Payments

Below, we examine the impact of the frequency of income tax payments on the existence of an anomalous effect for advance income tax payments, both in the case of falling and rising profits.

At negative growth rate g the slope $k_e(L)$ increases with frequency of payments of tax on profit, p, being negative at p = 1 and about zero.

At p = 1 the slope $k_e(L)$ increases with growth rate g, being negative at g = –0.2.

At p = 2 the slope $k_e(L)$ increases with growth rate g, being positive at all g.

At p = 6 the slope $k_e(L)$ increases with growth rate g, being positive at all g.

At p = 12 the slope $k_e(L)$ increases with growth rate g, being positive at all g. From *Figs. 25–29* it follows, that the slope of all curves $k_e(L)$ increase with frequency of advance payments of tax on income.

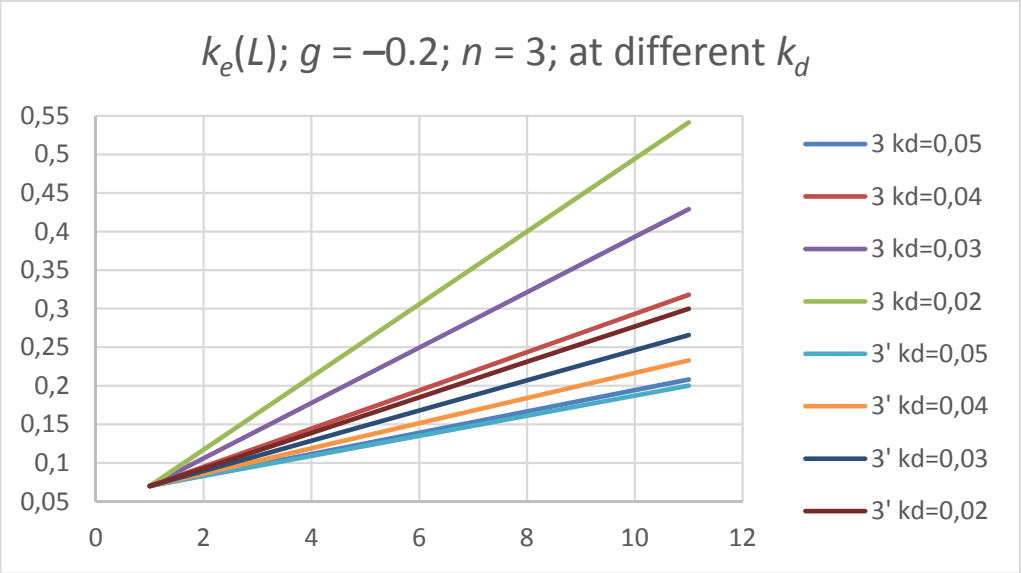

Fig. 17. **The Comparison of the Dependences of Equity Cost, k_e, on Leverage Level, L, at p = 1; k_0 = 0.07; at Different k_d = 0.02; 0.03; 0.04; 0.05; t = 0.2; n = 3 at negative g = –0.2 with Advance Payments of Tax on Income (3') and Payments of Tax on Income at the Ends of Periods (3)**

Source: Compiled by the authors.

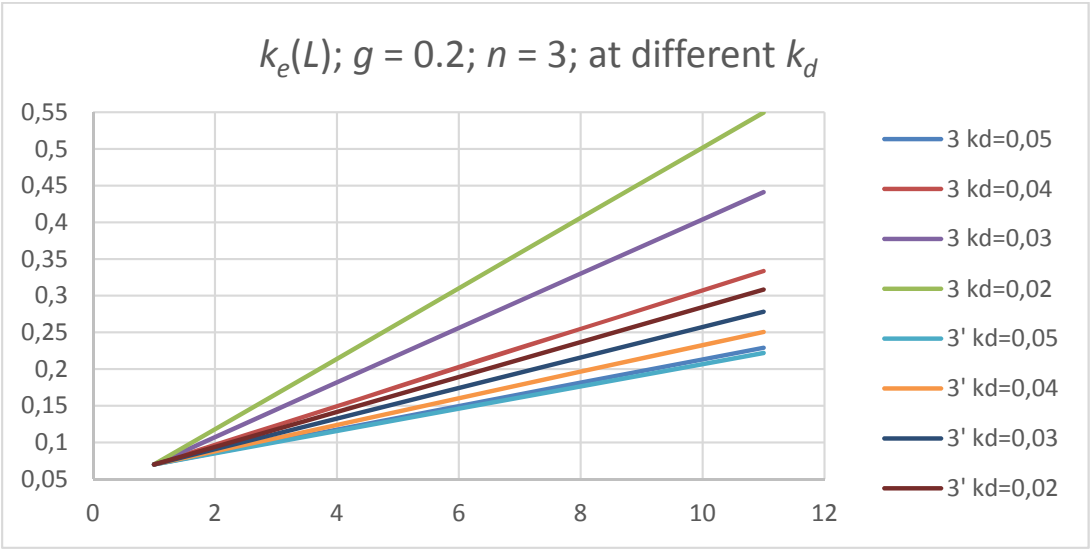

Fig. 18. **The Comparison of the Dependences of Equity Cost, k_e, on Leverage Level, L, at p = 1; k_0 = 0.07; at Different k_d = 0.02; 0.03; 0.04; 0.05; t = 0.2; n = 3 at Positive g = 0.2 with Advance Payments of Tax on Income (3') and Payments of Tax on Income at the Ends of Periods (3)**

Source: Compiled by the authors.

2.5. Impact of Company Age

The dependence of the cost of equity, k_e, on the level of leverage, L, at different ages of the company, n, was studied. It was shown that there are two kind of dependences of slope $k_e(L)$ on company age, n: monotonic decrease of tilt angle $k_e(L)$ with n (see *Fig. 30*) and seems random addiction of tilt angle $k_e(L)$ with n (see *Fig. 31*).

At *Fig. 30* at negative g = –0.05 the following ordering of curves $k_e(L)$ takes place: n = 1; n = 3; n = 5; n = 7; n = 10; n = 15; n =20; n = 25; n = 30. This ordering is monotonic.

At *Fig. 31*, at positive g = 0.05 the following ordering of curves $k_e(L)$ takes place n = 1; n = 30; n = 25; n = 20; n = 15; n = 3; n = 10; n = 5; n = 7. This ordering is not monotonous, but seemingly random. The reason for the existence of two types

Table 4

The Comparison of the Dependences of Equity Cost, k_e, on Leverage Level, L, at Different p = 1; 2; 4; 6; 12; k_0 = 0.22; at k_d = 0.02; t = 0.2; n = 3 with Advance Payments of Tax on Income (p') and Payments of Tax on Income at the Ends of Periods (p)

L	0	1	2	3	4	5	6	7	8	9	10
*P*1	0.2202527	0.224593	0.228886	0.23312	0.237315	0.241494	0.245665	0.249829	0.25399	0.258148	0.262305
*P*2	0.2202527	0.221983	0.223697	0.225345	0.226963	0.228565	0.230162	0.231751	0.233333	0.234894	0.236496
*P*4	0.2202527	0.221029	0.220729	0.221286	0.221551	0.221801	0.222043	0.22228	0.222513	0.222744	0.222974
*P*6	0.2202527	0.220172	0.220075	0.219908	0.220674	0.220139	0.219594	0.219043	0.218488	0.217931	0.217371
*P*12	0.2202527	0.219711	0.219149	0.218517	0.217855	0.217179	0.216495	0.215805	0.215112	0.214416	0.213718
P'1	0.2199314	0.213774	0.207216	0.20056	0.193864	0.187147	0.180416	0.173609	0.166787	0.159962	0.153135
P'2	0.2199314	0.216589	0.212896	0.209117	0.205303	0.201472	0.19763	0.193783	0.189931	0.186075	0.182212
P'4	0.2199314	0.217965	0.21567	0.213294	0.210886	0.208461	0.206028	0.203588	0.201144	0.198697	0.196249
P'6	0.2199314	0.218419	0.216585	0.214672	0.212727	0.210766	0.208796	0.20682	0.204841	0.202858	0.200874
P'12	0.2199314	0.218871	0.217495	0.216041	0.214558	0.213058	0.211549	0.210035	0.208517	0.206996	0.205473

Source: Compiled by the authors.

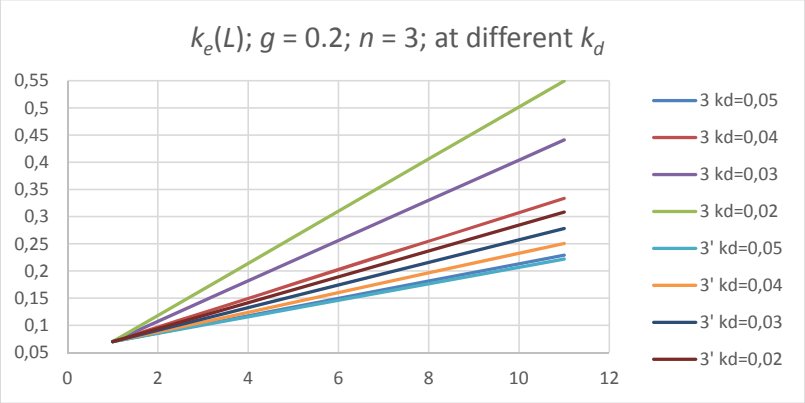

Fig. 19. **The Comparison of the Dependences of Equity Cost, k_e, on Leverage Level, L, at Different p = 1; 2; 4; 6; 12; k_0 = 0.22; at k_d = 0.2; t = 0.2; n = 3 with Advance Payments of Tax on Income (p') and Payments of Tax on Income at the Ends of Periods (p)**

Source: Compiled by the authors.

of dependences of the slope $k_e(L)$ on the age of the enterprise, n: a monotonous decrease in the slope angle $k_e(L)$ with n and a seemingly random dependence of the slope angle $k_e(L)$ with n, is the absence or presence of the so-called "golden age" company effect [21].

The so-called "golden age" of the company effect is the situation, when the cost of capital raised (*WACC*) is below the perpetuity limit, and the company's value is higher. The absence or presence of the "golden age" company effect could explain the ordering of curves $k_e(L)$ (of slopes of curves $k_e(L)$) (see *Figs. 32–34*):

- in case of the absence of the "golden age" company effect, the ordering of curves $k_e(L)$ is monotonic (*Fig. 32*).
- in case of the presence of the "golden age" company effect, the ordering of curves $k_e(L)$ is not monotonous (*Fig. 33*).

From *Fig. 34* it is seen, that the main factor affecting the slope $k_e(L)$ (between the cost of debt k_d and the growth rate g) is the cost of debt k_d. From *Fig. 34* it can be seen that the slope $k_e(L)$ decreases as the cost of debt k_d increases. We deliberately choose a leverage level, L = 10, where the difference between the cost of equity values is the largest, in order to make this difference more noticeable. Of the doublet of curves corresponding to the fixed cost of debt k_d, the upper curve refers to the larger growth rate g. Note, that the shape of the $k_e(n)$ curve is similar to the shape of the *WACC*(n) curve.

2.6. Simultaneously Impact of Company Age, n, and Growth Rate, g

The conclusions from *Fig. 35* are as following:

- The slope of curves, $k_e(L)$, decreases with company age, n, and increases with growth rate, g.
- The curves corresponding to different company ages mix at different growth rates g. This can lead to interesting

Table 5

The Comparison of the Dependences of Equity Cost, k_e, on Leverage Level, L, at Different p = 1; 2; 4; 6; 12; k_0 = 0.22; at k_d = 0.2; t = 0.2; n = 6 with Advance Payments of Tax on Income (p') and Payments of Tax on Income at the Ends of Periods (p)

P / L	0	1	2	3	4	5	6	7	8	9	10
P1	0.220001	0.223948	0.227332	0.230598	0.234363	0.237707	0.241035	0.244354	0.247667	0.250975	0.25428
P2	0.220001	0.221308	0.222079	0.222713	0.223284	0.223825	0.224352	0.224865	0.225367	0.225839	0.226362
P4	0.220001	0.219931	0.219315	0.218552	0.217729	0.216874	0.216737	0.215709	0.214677	0.213643	0.212606
P6	0.220001	0.219464	0.218373	0.217133	0.215831	0.214498	0.213147	0.211785	0.210415	0.209039	0.20766
P12	0.220001	0.218774	0.217249	0.215655	0.214025	0.21238	0.210725	0.209065	0.2074	0.205734	0.202836
P'1	0.219896	0.212774	0.20494	0.196401	0.188102	0.179762	0.1714	0.163023	0.154636	0.146243	0.137844
P'2	0.219896	0.215592	0.210457	0.205549	0.200371	0.195157	0.189921	0.184673	0.179415	0.174151	0.168883
P'4	0.219896	0.21697	0.213446	0.209762	0.20601	0.202225	0.19842	0.194603	0.190777	0.186946	0.18311
P'6	0.219896	0.217424	0.214366	0.21115	0.207869	0.204555	0.201221	0.197875	0.194521	0.191161	0.187798
P'12	0.219896	0.217876	0.215281	0.212531	0.209717	0.206871	0.204006	0.201128	0.198243	0.195353	0.192458

Source: Compiled by the authors.

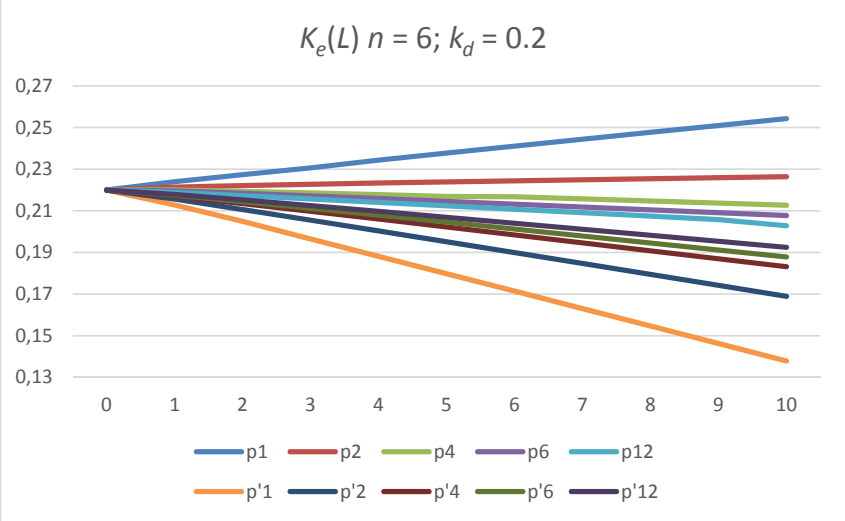

Fig. 20. **The Comparison of the Dependences of Equity Cost, k_e, on Leverage Level, L, at Different p = 1; 2; 4; 6; 12; k_0 = 0.22; at k_d = 0.2; t = 0.2; n = 6 with Advance Payments of Tax on Income (p') and Payments of Tax on Income at the Ends of Periods (p)**

Source: Compiled by the authors.

effects and create new options for the company's dividend policy.

3. THE EXPLANATIONS OF THE OBSERVED EFFECTS

3.1. Increase of ke with *L*

$k_e(L)$ rises with L, because as L increases, financial distress and the risk of bankruptcy increase, shareholders demand higher returns per share.

3.2. Tax Rate Increases

As taxes increase, the slope $k_e(L)$ decreases via tax corrector, which decreases with tax on profit rate.

3.3. Influence of the Rate of Income Growth *g*

With an increase in the rate of income growth g, the slope of the curve $k_e(L)$ increases, since in this case shareholders can count on larger dividends.

At $g < 0$ earnings per share decreases.

3.4. Influence of the Frequency of Income Tax Payments

For income tax payments at the ends of periods slope $k_e(L)$ decreases with p, thus earnings per share decreases (properties of ordinary annuity). The increase in PV and FV of cash flows with the growth of p follows from their behavior in the

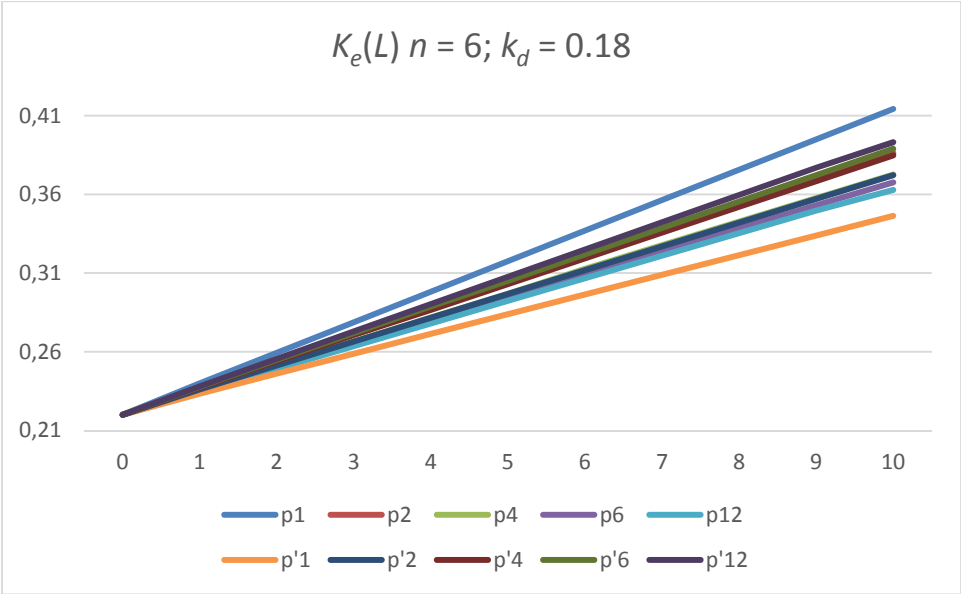

Fig. 21. **The Comparison of the Dependences of Equity Cost, k_e, on Leverage Level, L, at Different p = 1; 2; 4; 6; 12; k_0 = 0.22; at k_d = 0.18; t = 0.2; n = 6 with Advance Payments of Tax on Income (p') and Payments of Tax on Income at the Ends of Periods (p)**

Source: Compiled by the authors.

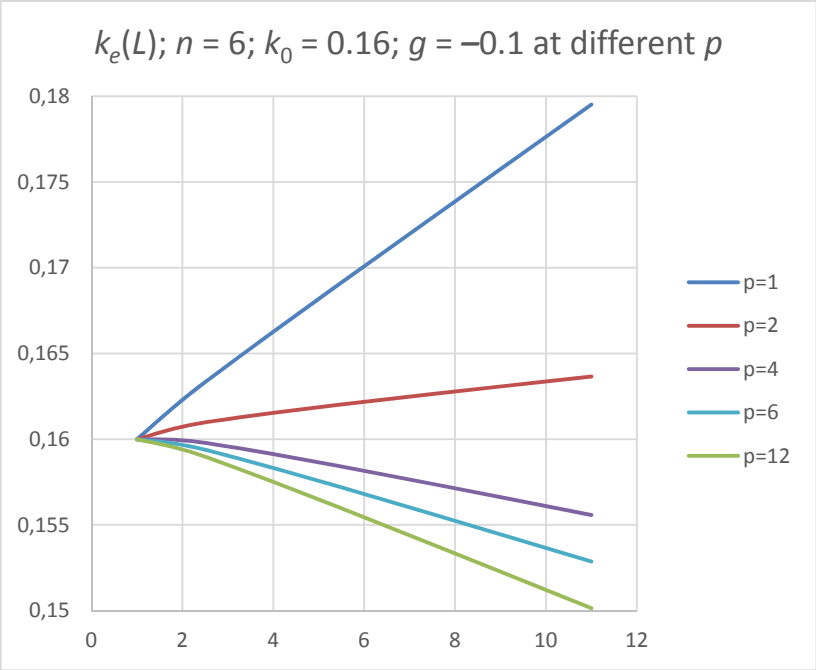

Fig. 22. **The Dependences of Equity Cost, k_e, on Leverage Level, L, at Different p = 1; 2; 4; 6; 12; k_0 = 0.16; at k_d = 0.14; t = 0.2; n = 6, g = –0.1 with Payments of Tax on Income at the Ends of Periods**

Source: Compiled by the authors.

ordinary p-term annuity with the growth of p. Both of them increase because an increase in p gives a percentage gain: their earlier accrual. **For advance income tax payments** the slope $k_e(L)$ increases with p, thus earnings per share increases (properties of annuity due). Advance income tax payments correspond to the case of p-term annuity due: the decrease in PV and FV of cash flows with increasing p follows from their behavior in the p-term annuity due with increasing p. They

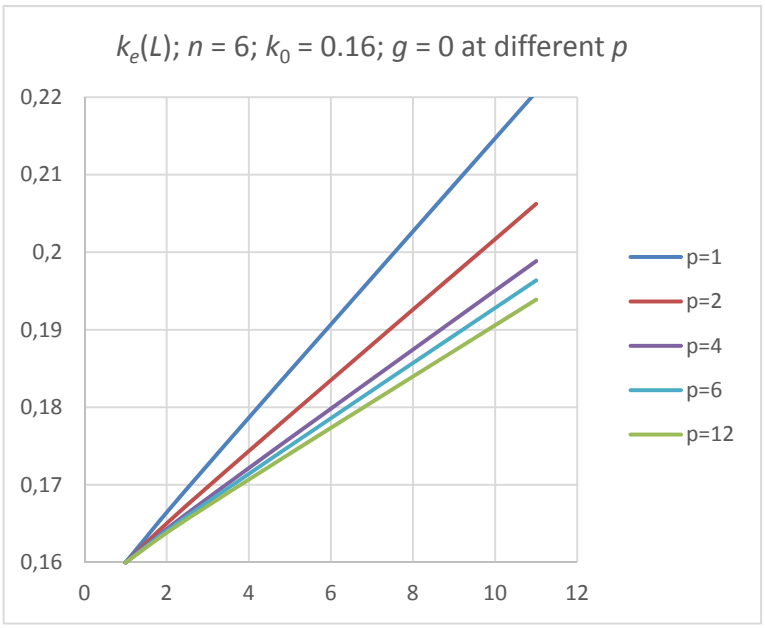

Fig. 23. **The Dependences of Equity Cost, k_e, on Leverage Level, L, at Different p = 1; 2; 4; 6; 12; k_0 = 0.16; at k_d = 0.14; t = 0.2; n = 6, g = 0 with Payments of Tax on Income at the Ends of Periods**

Source: Compiled by the authors.

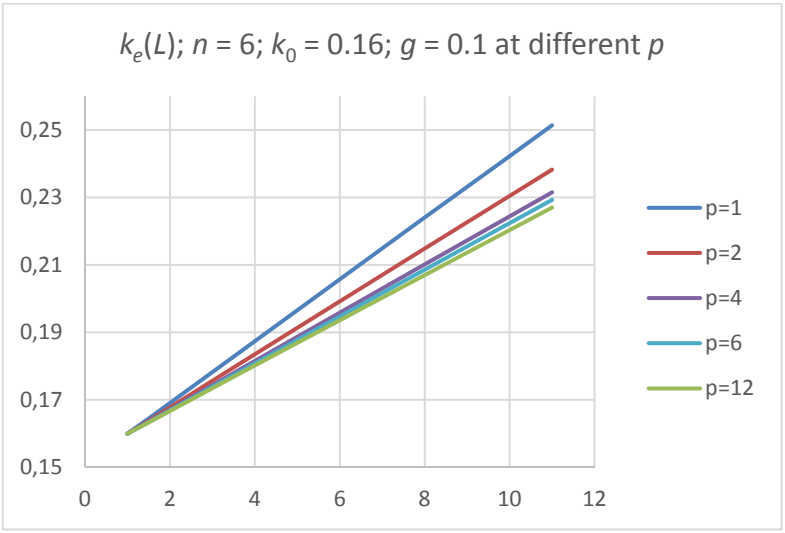

Fig. 24. **The Dependences of Equity Cost, k_e, on Leverage Level, L, at Different p = 1; 2; 4; 6; 12; k_0 = 0.16; at k_d = 0.14; t = 0.2; n = 6, g = 0.1 with Payments of Tax on Income at the Ends of Periods**

Source: Compiled by the authors.

both decrease because an increase in p gives an interests decrease via charging interest on the smaller value of the annuity payment R/p instead of R.

CONCLUSIONS

The contribution of the current results to the theory is related to the use of generalized theories of capital structure (both BFO and MM) to estimate the cost of equity capital in real-life operating conditions of companies. A study was conducted of the dependence of the cost of equity on the level of leverage for different ages of the company, different values of the leverage level, of the cost of debt capital for different frequencies of payment of income tax, advance payments of income tax and payments at the end of periods, the company's variable income, etc. As a result, it becomes possible to estimate the cost of equity in these conditions. The behavior and properties of the cost of equity are explored within the framework of the BFO theory. Several very important innovative effects have

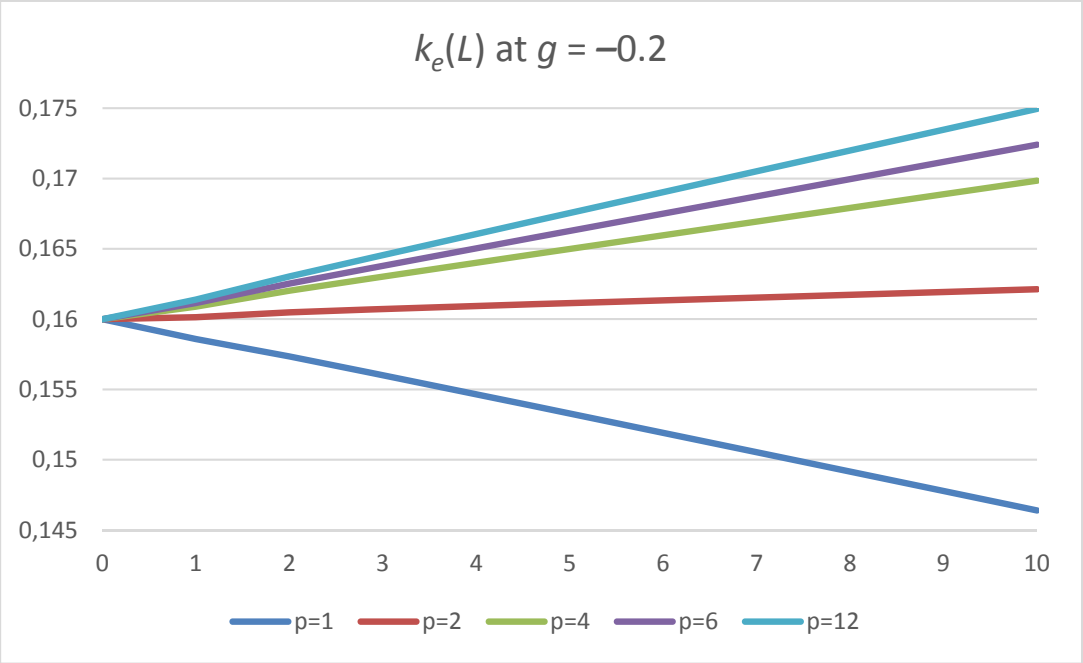

Fig. 25. **The Dependences of Equity Cost, k_e, on Leverage Level, L, at Different p = 1; 2; 4; 6; 12; k_0 = 0.16; at k_d = 0.14; t = 0.2; n = 6, g = –0.2 with Advance Payments of Tax on Income**

Source: Compiled by the authors.

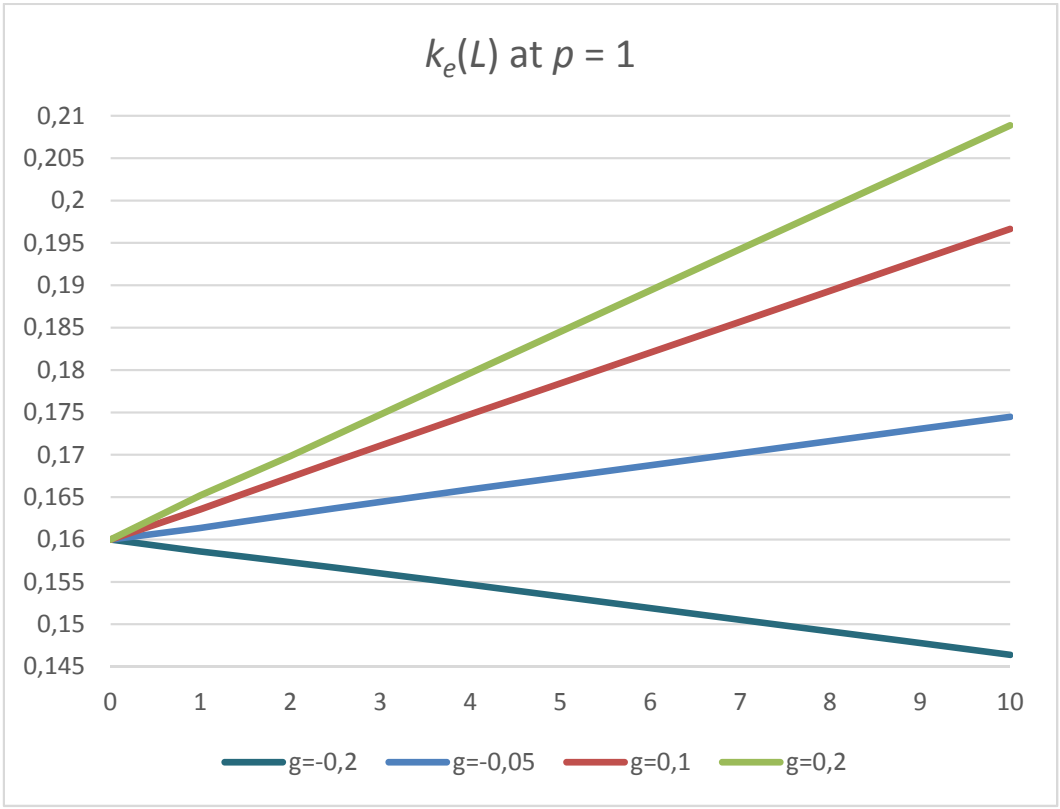

Fig. 26. **The Dependences of Equity Cost, k_e, on Leverage Level, L, at p = 1; k_0 = 0.16; at k_d = 0.14; t = 0.2; n = 6, at different g = –0.2; –0.05; 0.1; 0.2 with Advance Payments of Tax on Income**

Source: Compiled by the authors.

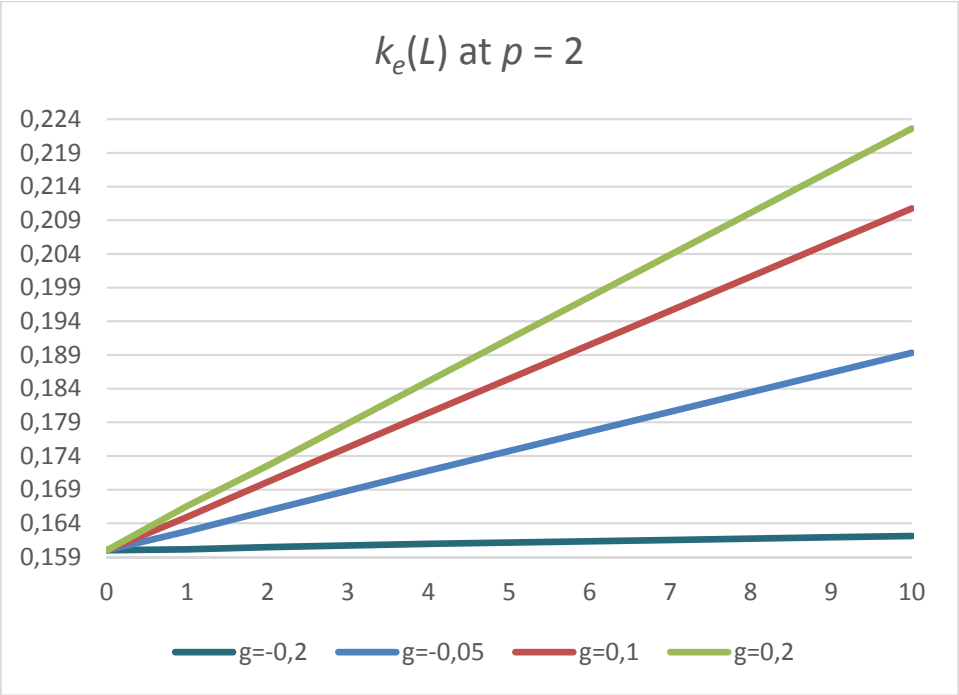

Fig. 27. **The Dependences of Equity Cost, k_e, on Leverage Level, L, at p = 2; k_0 = 0.16; at k_d = 0.14; t = 0.2; n = 6, at different g = –0.2;–0.05; 0.1; 0.2 with Advance Payments of Tax on Income**

Source: Compiled by the authors.

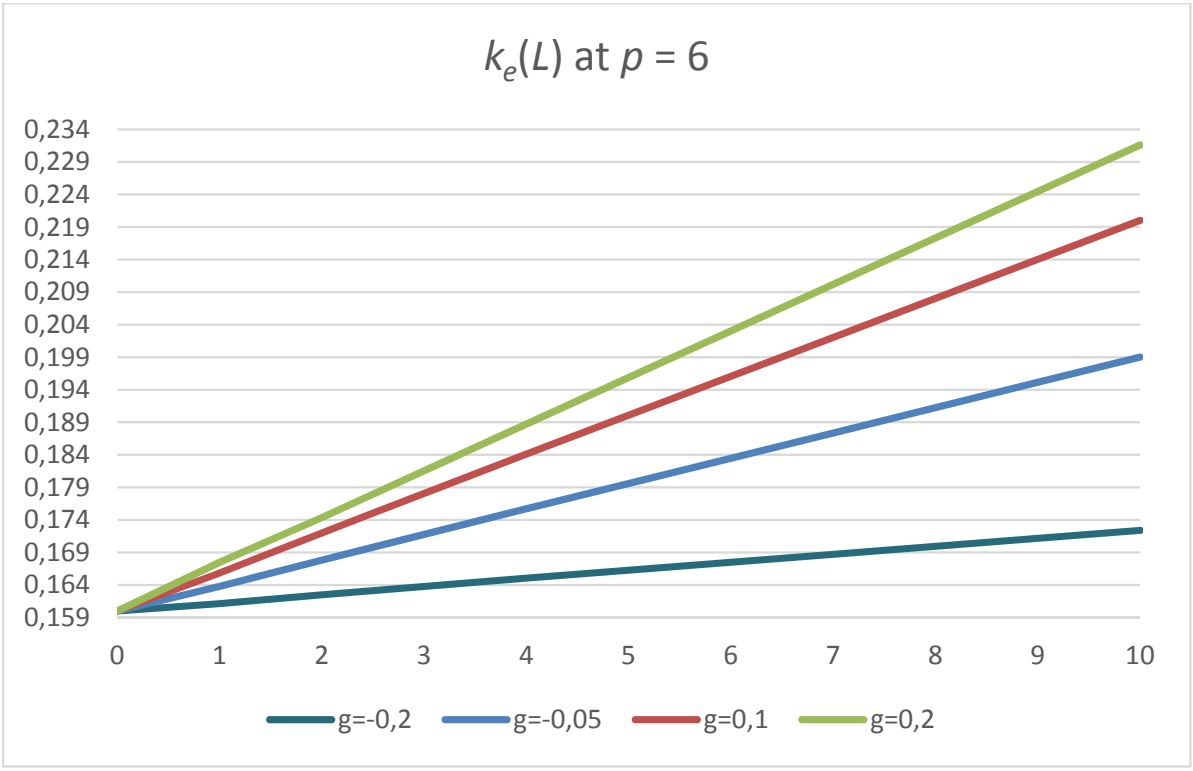

Fig. 28. **The Dependences of Equity Cost, k_e, on Leverage Level, L, at p = 6; k_0 = 0.16; at k_d = 0.14; t = 0.2; n = 6, at different g = –0.2;–0.05; 0.1; 0.2 with Advance Payments of Tax on Income**

Source: Compiled by the authors.

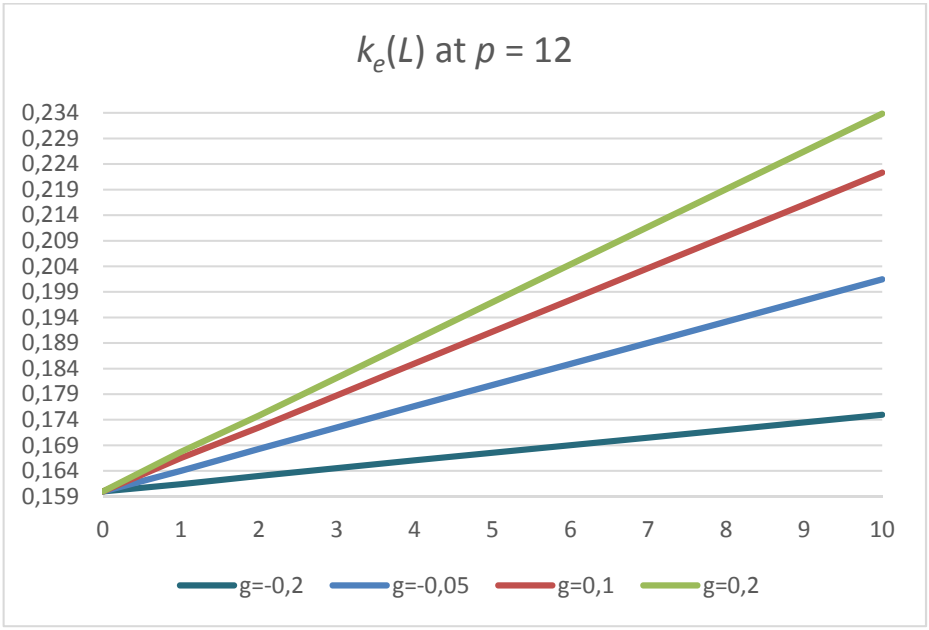

Fig. 29. **The Dependences of Equity Cost, k_e, on Leverage Level, L, at p = 2; k_0 = 0.16; at k_d = 0.14; t = 0.2; n = 6, at different g = –0.2;–0.05; 0.1; 0.2 with Advance Payments of Tax on Income**

Source: Compiled by the authors.

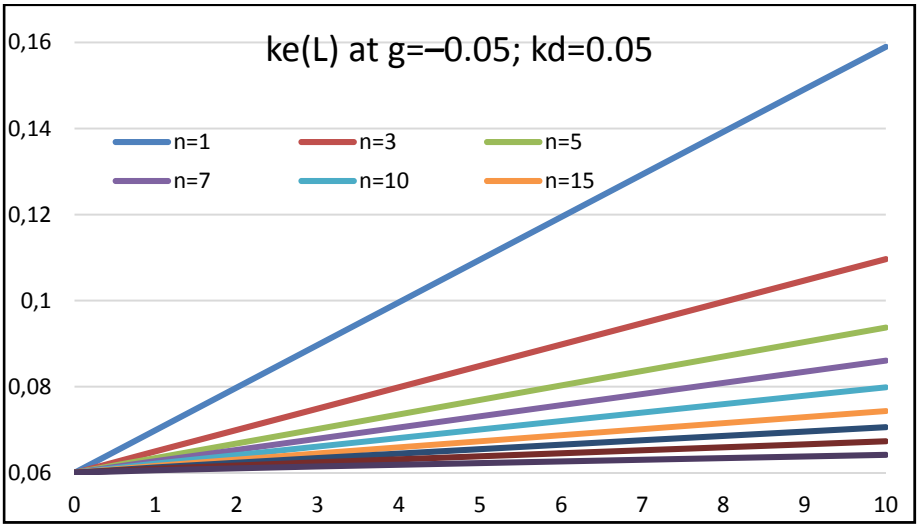

Fig. 30. **The Dependences of Equity Cost, k_e, on Leverage Level, L, at p = 1; k_0 = 0.06; at k_d = 0.05; t = 0.2; at Negative g = –0.5 and at Different Company Age n with Payments of Tax on Income at the End of Periods**

Source: Compiled by the authors.

been discovered, which significantly change the company's dividend policy. Among them are the abnormal dependence of equity cost on leverage level at different growth rates of variable income, at different ages of the company, at different frequencies of income tax payment, at different debt costs etc.

The developed approach can be applied to any country, you just need to use the tax rate for a specific company in a specific country. And the methods of paying income tax: advance payments or at the end of periods and with what frequency: annually, semi–annually, quarterly or monthly.

The following results have been obtained:

1. $k_e(L)$ rises with L, because as L increases, financial distress and the risk of bankruptcy increase, shareholders demand higher returns per share.

2. As taxes increase, the slope $k_e(L)$ decreases via tax corrector, which decreases with tax on profit rate.

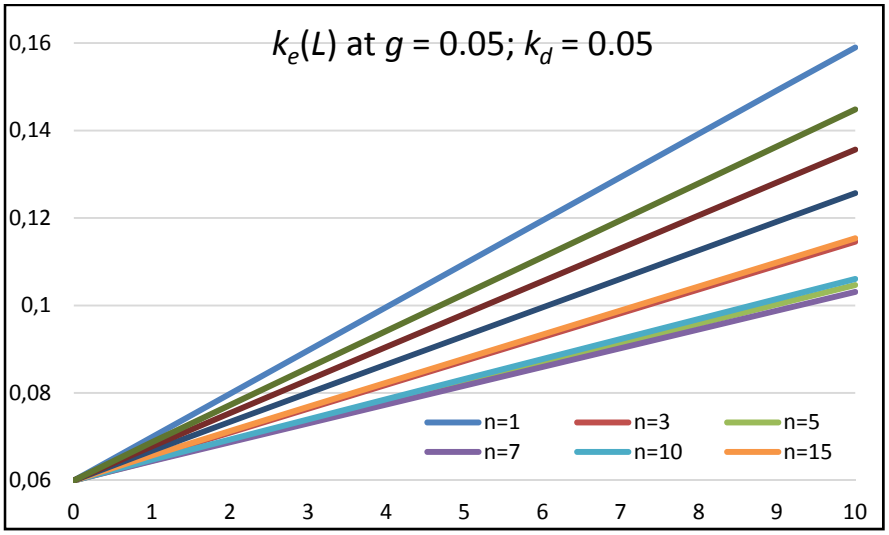

Fig. 31. **The Dependences of Equity Cost, k_e, on Leverage Level, L, at $p = 1$; $k_0 = 0.06$; $k_d = 0.05$; $t = 0.2$; at Positive $g = 0.5$ and at Different Company Age n with Payments of Tax on Income at the End of Periods**

Source: Compiled by the authors.

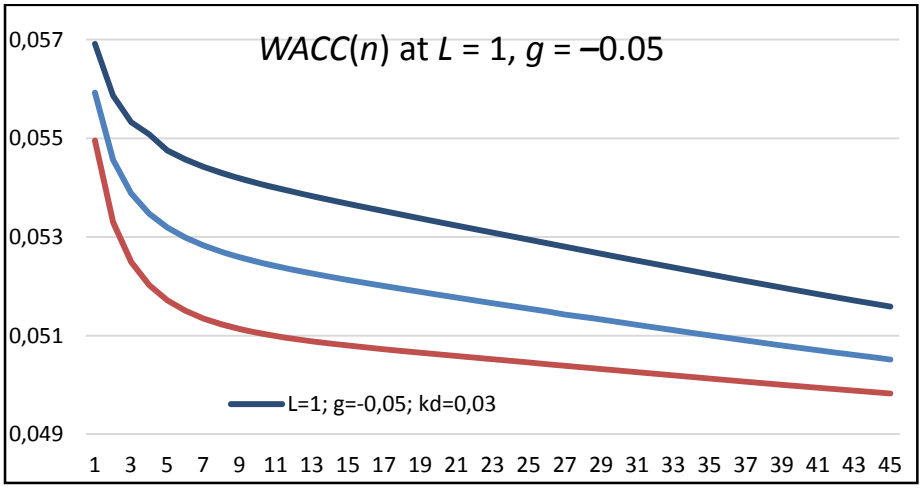

Fig. 32. **The Absence of the "Golden Age" Company Effect. The Dependences of Equity Cost, k_e, on Leverage Level, L, at $p = 1$; $k_0 = 0.06$; $k_d = 0.03$; 0.04; 0.05; $t = 0.2$; at Negative $g = -0.5$ and at Different Company Age n with Payments of Tax on Income at the End of Periods**

Source: Compiled by the authors.

3. With an increase in the rate of income growth g, the slope of the curve $k_e(L)$ increases, since in this case shareholders can count on larger dividends. At $g < 0$ earnings per share decreases.

4. For income tax payments at the ends of periods slope $k_e(L)$ decreases with the frequency of income tax payments p, thus earnings per share decreases (properties of ordinary annuity). The increase in PV and FV of cash flows with the growth of p follows from their behavior in the ordinary p-term annuity with the growth of p. Both of them increase because an increase in p gives a percentage gain: their earlier accrual.

For advance income tax payments the slope $k_e(L)$ increases with p, thus earnings per share increases (properties of annuity due).

5. It was found two types of dependences of the slope $k_e(L)$ on the age of the enterprise, n: a monotonous decrease in the slope angle $k_e(L)$ with n and a seemingly random dependence of the slope angle $k_e(L)$ with n. The reason for the existence of is the absence or presence of the so-called "golden age" company effect [21].

The so-called "golden age" of the company effect is the situation, when the cost of capital raised (WACC) is below the

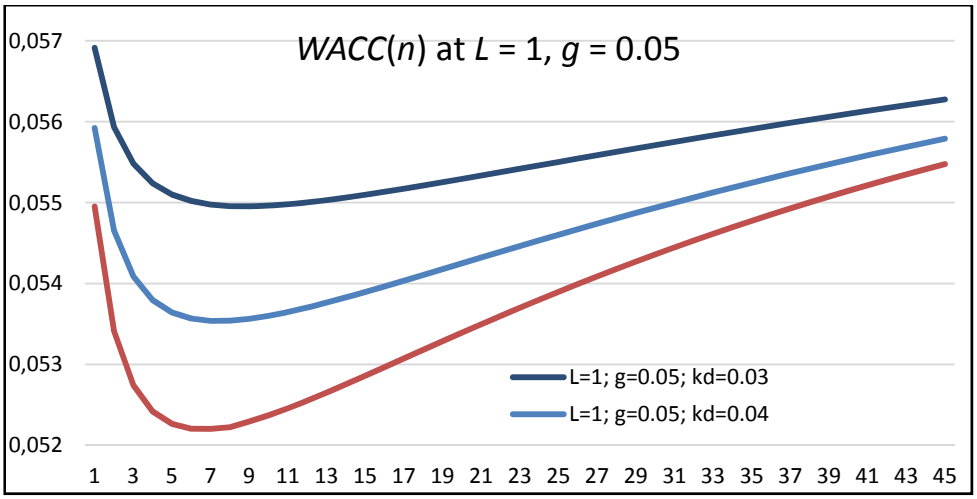

Fig. 33. **The presence of the "golden age" company effect. The Dependences of Equity Cost, k_e, on Leverage Level, L, at $p = 1$; $k_0 = 0.06$; $k_d = 0.03$; 0.04; 0.05; $t = 0.2$; at Positive $g = 0.05$ and at Different Company Age n with Payments of Tax on Income at the End of Periods**

Source: Compiled by the authors.

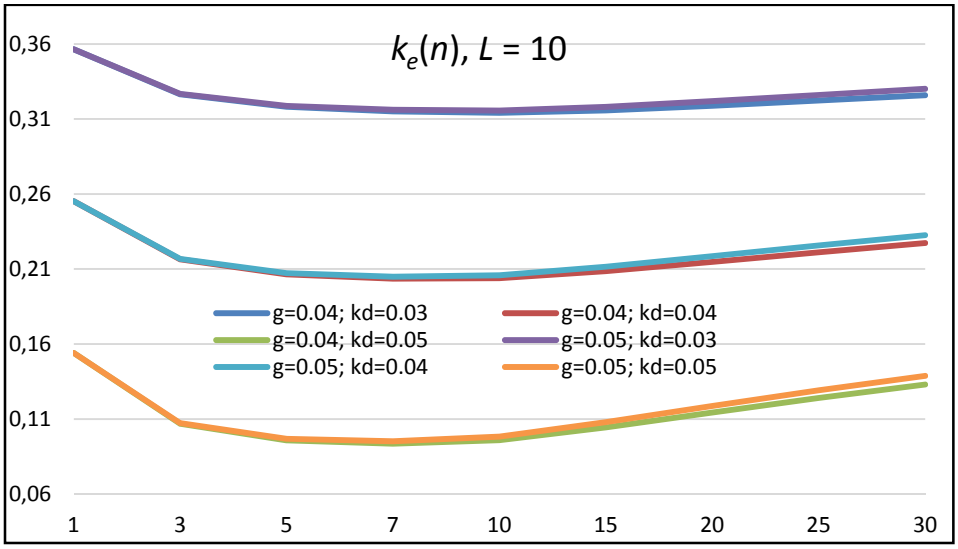

Fig. 34. **The Dependence of the Cost of Equity, k_e, on Company Age at Different Cost of Debt k_d and Growth Rate g at Leverage Level $L = 10$ for Advance Payments of Tax on Income**

Source: Compiled by the authors.

perpetuity limit, and the company's value is higher. The absence or presence of the "golden age" company effect could explain the ordering of curves $k_e(L)$ (of slopes of curves $k_e(L)$) (see *Figs. 32–34*):

- in case of the absence of the "golden age" company effect the ordering of curves $k_e(L)$ is monotonic (*Fig. 32*);
- in case of the presence of the "golden age" company effect the ordering of curves $k_e(L)$ is not monotonous (*Fig. 33*).

The developed methodology and results will help the company's management to develop an adequate and effective dividend policy, taking into account the real conditions for the functioning of companies, such as variable income of companies, frequent income tax payments, types of income tax payments. (Advance payments and payments at the end of reporting periods), etc. This allows, when developing a dividend policy, the use of qualitatively new effects that we have discovered, such as the anomalous dependence of the cost of equity on the level of leverage at different growth rates of variable income, at different company ages (the "golden age" effect), at different frequencies of income tax payments, at different costs of debt, etc.

The limitation of the study is due to the fact that the case of a constant income growth rate is considered. In future publications, the case of a variable income growth rate will be considered. One

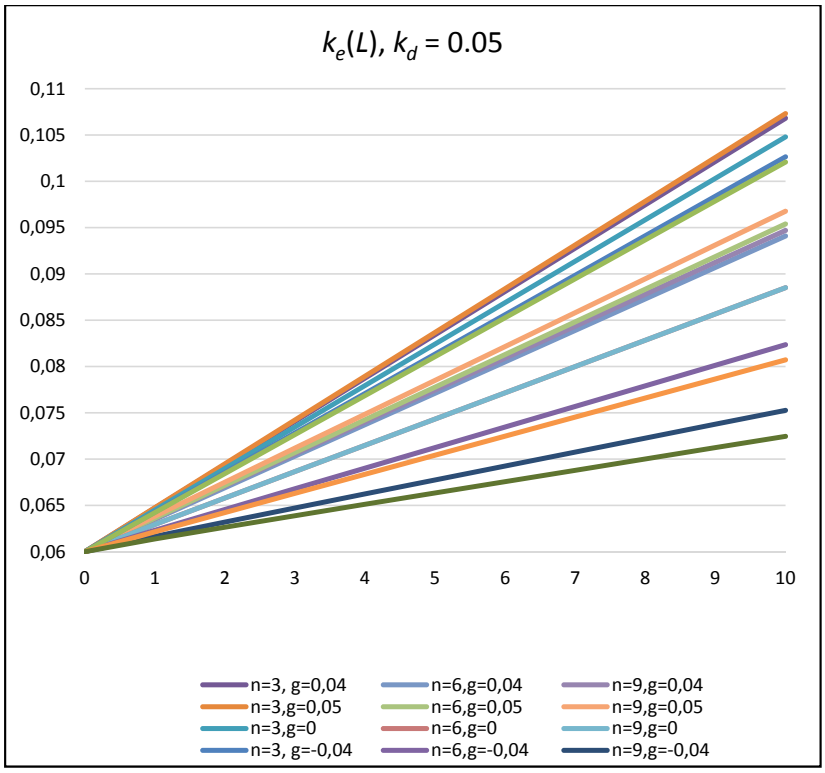

Fig. 35. **The Dependence of Equity Cost, k_e, on leverage level, L, at p = 1; k_0 = 0.06; k_d = 0.05; t = 0.2; at g = –0.05; –0.04; 0; 0.04; 0.05 and at Different Company Age n = 3; 6; 9 with Advance Payments of Tax on Income**

Source: Compiled by the authors.

more limitation of the consideration is related to the known limitations of the *WACC* approximation.

Concerning the direction of further research: the authors plan to take into account both business and financial risks when assessing the financial performance of companies, including the cost of equity.

Direction for Further Research

When studying the cost of equity capital within the framework of BFO and MM theory, we take into account only the financial risks associated with the use of debt financing. There is the Capital Asset Pricing Model (CAPM) that also looks at return on equity, but only considers business risks that relate to the investment in the portfolio rather than in the risk-free assets. In practice, companies use debt financing and operate at non-zero levels of leverage. This means that it is necessary to take into account the financial risk associated with the use of debt financing along with business. A new approach to CAPM has been developed recently [35] that takes into account both business and financial risk. The authors combine the theory of CAPM and the Modigliani-Miller (MM) theory. The first is based on portfolio analysis and accounting for business risks in relation to the market (or industry). The second one (the Modigliani-Miller (MM) theory) describes a specific company and takes into account the financial risks associated with the use of debt financing. The combination of these two different approaches makes it possible to take into account both types of risks: business and financial ones. The authors [37, 38] combine these two approaches analytically, while Hamada [4, 40] did it phenomenologically. Using the Modigliani-Miller (MM) theory [1–3, 43], it is shown that the Hamada's model, the first model, used for this purpose half a century ago, is incorrect. In addition to the renormalization of the beta-coefficient, obtained in the Hamada model, two additional terms are found: the renormalized risk-free return and the term dependent on the cost of debt k_d. A critical analysis of the Hamada model was carried out in [37, 38]. The vast majority of listing companies use debt financing and are leveraged, and the Hamada model is not applicable to them in contrast to a new approach applicable to leveraged companies. Two versions of CAPM (market or industry) have been considered. A recent application of the dividend theory to business valuation is described in [44–45], where a new approach to business valuation was developed, including the monograph [45].

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