Vol. 27, No. 5 | DOI: 10.26794/2587-5671 | ISSN 2587-5671 (Print) ISSN 2587-7089 (Online)

FINANCE: THEORY AND PRACTICE

Scientific and practical peer-reviewed journal
Published since 1997.
Former title: “Bulletin of the Financial University”

Registration certificate:
PI No. FS77-70021 of 31 May 2017

Founder: Financial University under the Government of the Russian Federation, Moscow, Russia

Publication frequency — 6 times a year

The Journal is focused on scientific discussion of topical problems in the sphere of financial economy.

Indexed in databases: Scopus, Russian Science Citation Index (RSCI), CrossRef, DOAJ, Ebsco, Dimensions, EconLit, EconBiz, RePec, eLibrary.ru, Russian Index of Science Citation (RINTs), etc.

A journal included in the first category of the List of VAC’s peer-reviewed scientific publications (K1) on specialties: 5.2.1. Economic theory, 5.2.4. Finance (Economic science).

Each article is assigned a digital object identifier (DOI).

The printed version of the journal is distributed by subscription.
Subscription to the Journal is carried out through the union catalogue “Pressa Rossii”, subscription index – 82140.

The electronic version of the journal in Russian and English is in open access on the website https://financetp.fa.ru/jour

Manuscripts are submitted via the electronic editorial board on the journal's website **https://financetp.fa.ru/jour**

Minimum volume of a manuscript to be submitted 4 ths words; optimal — 6 ths words.

The Editorial Board are assessment the peer-review manuscripts meticulously and executes scientific, literary and technical editing of the author's original in the journal.

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FINANCE: THEORY AND PRACTICE

Scientific and practical journal

Vol. 27, No. 5, 2023

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Signed for press on 19.10.2023
Format 60 x 84 1/8.
Size 27,25 printer sheets.
Order № 989.
Printed by Publishing House of the Financial University (Moscow, 51, Leningradsky prospekt)

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-6-17
UDC 336.14(045)
JEL H6, H7

Financial Interrelations of Scenario Indicators of Budget Forecasting with Indicators of the Federal Budget of Russia

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ABSTRACT

The realism of the scenario indicators used in the formation of the federal budget of the Russian Federation in the context of the special significance of the budgetary mechanism for the adaptation of the national economy to global challenges becomes of particular importance while maintaining internal and external sanctions risks. The **purpose** of this study is to assess the validity of the forecast values of scenario macroeconomic indicators that determine the key characteristics of the Russian federal budget in the current budget cycle, and to develop proposals for clarifying the composition and concretizing approaches to their forecasting for the medium term in conditions of increased uncertainty. The study is based on an abstract-logical **method**, including a critical analysis of the predictive values of macro-indicators adopted as the basis for the parameters of the federal budget of the Russian Federation in 2023 and the planned period of 2024 and 2025 (using the level of consumer prices and the exchange rate of the ruble as an example), establishing causal relationships between the reliability of projected budget parameters at the federal level and the state of the Russian economy, identifying possible directions for the development of approaches to forecasting initial indicators for the preparation of the federal budget. In particular, the article suggests that in the forecasting of basic scenario parameters to detail the accounting for the dynamics of world prices, the real effective exchange rate of the ruble, to optimize the selection of exchange rate factors, and to take into account the variability of exchange rate volatility. The author's developments presented in the article contribute to the efficiency of the execution of the federal budget in terms of the use of its resources, and therefore can be used in the activities of state authorities in the development of budget policy.
Keywords: federal budget; budget planning and forecasting; scenario macroeconomic indicators; inflation; exchange rate

For citation: **Kosov M.E., Voronkova E.K., Chalova A. Yu. Financial interrelations of scenario indicators of budget forecasting with indicators of the federal budget of Russia. *Finance: Theory and Practice*. 2023;27(5):6-17. DOI: 10.26794/2587-5671-2023-27-5-6-17**

INTRODUCTION

The role of state financial regulation, the effectiveness of which is determined by the quality of the processes of formation and execution of the federal budget of the Russian Federation (hereinafter — Federal budget) is substantially increasing in the changing conditions of the functioning of Russian economy [1]. Budget indicators influence not only the volume of financial distribution by spheres, industries and regions, but also represent a compass orienting market participants to public policy priorities. In turn, the fundamental indicators of economic development, which are commonly called scenario macroeconomic indicators, have a significant impact on budgetary parameters and the effectiveness of budgetary policy [2].

Given the increased volatility of macroeconomic indicators as a result of continued sanctions impact on the Russian economy, it becomes relevant and essential to analyze the validity of scenario conditions for the formulation of federal budget parameters in the medium term. The authors conduct such an assessment in connection to the values and methods of determining the level of consumer prices and the ruble exchange rate in order to achieve the objectives of this study. The selection of these macroeconomic indicators for further research and review is due to their uncertain impact on the various groups of

federal budget income and expenditure when their actual values diverge from the approved values during the budget cycle.

As a rule, the deviation of the level of consumer prices in a larger direction compared to the forecast value creates conditions for the nominal growth of the taxable base that determines the income of tax revenues of budgets. On the other hand, this deviation can negatively affect the level of business and purchasing activity, reducing budget revenues, causing the indexation of social obligations of the budget and increasing the cost of execution of government contracts.

Forecasting the level of consumer prices and the reverse multiplicative effect on it of budget expenditure planned in the reporting period [3], especially during periods of active fiscal anti-crisis or stimulus expansion, is not to be forgotten [4].

In turn, the effects of deviation from the predicted value of the ruble exchange rate can influence budgetary parameters in various ways, forming, for example, additional income from foreign economic activities of the state and business as a result of currency devaluation while decreasing income from organizations using imported technologies, raw materials etc. [5].

Furthermore, the present study focused on inflation and exchange rate because there is a close connection between the changes in consumer prices and the currency rate of the ruble: the exchange price follows the historical inflation trend, and prices react to currency volatility. Responsibly, if one of these indicators' changes, the federal budget will be under pressure from the other.

METHODOLOGY

Despite existing diverse studies of budgetary problems, including in the field of budget planning [6, 7], the authors proceed from the need to continuously improve the design processes and implementation of the parameters of the federal budget in order to preserve its resilience to various risks and expand on this basis budgetary capabilities to stimulate national economic development.

The *purpose* of the study — is to develop and substantiate proposals for the specification of approaches to the determination of the forecast values of individual scenario macroeconomic indicators used in the process of designing the parameters of the federal budget of Russia, in order to increase the degree of effectiveness of implementation of budget indicators in the context of anti-Russian sanctions.

To achieve the goal the following objectives are set:

- to analyze the forecast values of scenario macroeconomic indicators used in the planning and forecasting of the federal budget of Russia for 2023–2025 for their compatibility with the current situation;
- to identify and justify the connections between the reasonability of the scenario macroeconomic indicators of the federal budget and the possibilities of their parameters;
- to formulate proposals on the specification of approaches to the determination of forecast values of scenario macroeconomic indicators for the purpose of designing the parameters of the federal budget.

The methodological basis of the article is the general logical methods and methods of research, including comparison and comparative analysis of data, construction of trends on the basis of them, identification of causal relationships, etc., used to assess the validity and reliability of the forecast values of the basic scenario indicators of socio-economic development, taking into account the realized and planned geopolitical and economic risks of national development.

Scientific novelty of the study is that, based on the study of the causal relationships between important macro indicators of the federal budget and indicators of the scenario, the author has formulated proposals for specification of various methods for

determining the forecast values of these indicators and their composition in order to increase the reliability and realism of the characteristics of the federal budget.

ASSESSMENT OF THE REASONABLENESS OF THE MACROECONOMIC INDICATORS OF THE FEDERAL BUDGET OF RUSSIA ON THE EXAMPLE OF THE CURRENT BUDGET CYCLE

The federal budget as the main financial document of the state is the benchmark that sets a certain trajectory of the movement of the national economy, based on proven scenarios of developments in the medium-term period. The principle of reliability, which means the reliability of the forecasts of socio-economic development, on which the budget indicators are based, and the resulting realism of the calculation of the parameters of the federal budget itself, plays an essential role in its formation.[1] First of all, it affects the inflation rate and exchange rate.

With increasing market uncertainty in Russia, there are increasingly unfavorable variances between the actual levels of indicators used to calculate the parameters of the federal budget and their approved values (*Table 1*). In the authors view, this is due to insufficient scientific support for the forecast of these indicators.

When evaluating the realisticity of the inflation forecast values contained in the present federal budget law, it is possible to infer that the possibility of obtaining these indicators is low, because a number of components of inflation risk remained "beyond the frame" when setting their levels. First of all, this concerns the inadequate impact of global inflation. Indeed, the factors of modern economic development in Russia are unique, significantly different from the development factors of many countries. But the state of the world economy, at least, continues to influence the Russian economy. With significant volumes and the value of goods and services imported to Russia, global inflation trends can not but be reflected on the prices of the Russian market, because imports are taken into account, the price ratios for domestic analogues and related spheres are formed. If you look at the macroeconomic possibilities considered in the budget over the next three years, you can expect an increase in imported inflation due to planned import growth and devaluation rate dynamics.

Inflation in the federal budget for 2023–2025 differs from the forecasts for global inflation of the International Monetary Fund (IMF). The IMF forecasts that global inflation will be 7.0% in 2023 and 4.9% in 2024, with base inflation expected to decline at a slower rate. That is, the inflation rate, taken into account in the forecast characteristics of the federal budget, fell by 1.5 p.p. in 2023 and by 0.9 p.p. in 2024, below the IMF's global inflation forecasts. When the dynamics of global and Russian inflation are compared from 2000 to 2022, the Russian indicator consistently outperforms the global indicator, and this difference is especially obvious during crisis periods (*Fig. 1*).[2]

In the modeling of inflation in Russia, economic activity, costs of producers, sectoral production volumes, etc. are usually referred to as determinants [8]. But global inflation does not stand out among the factors taken into account in making inflation forecasts that are used in planning and forecasting the federal budget. It is necessary in the econometric and satellite models of forecasting CPI *to provide for the accounting of the dynamics of world prices in terms of its (index) of the main components*: subindices

[1] Budget Code of the Russian Federation. Chapter 5, art. 37. URL: https://www.consultant.ru/document/cons_doc_LAW_19702/73147d61f1183d32e517768da079cfdf28cca0a9/ (accessed on 28.07.2023).

[2] Trading Economics Platforms. Level of inflation by countries. URL: https://ru.tradingeconomics.com/country-list/inflation-rate; Official websites of Rosstat. URL: https://rosstat.gov.ru/statistics/price; Official website of the IMF. URL: https://www.imf.org/external/datamapper/PCPIPCH@WEO/WEOWORLD (accessed on 28.07.2023).

Table 1

Comparative Assessment of Forecast and Actual Values of Key Macroeconomic Indicators for 2013–2022

Year	Inflation rate, %		US dollar to Russian ruble exchange rate	
	Forecast	Actual	Forecast	Actual
2013	5–6	6.45	32.4	31.81
2014	5.0	11.36	33.4	37.5
2015	5.0	12.91	35.5	60.73
2016	6.4	5.4	63.3	66.9
2017	3.8	2.52	64.2	58.3
2018	4.0	4.3	64.7	62.5
2019	4.3	3	63.9	64.73
2020	3.0	3.9	57.0	71.9
2021	3.7	8.4	72.4	73.6
2022	4.0	11.9	72.1	68.35

Source: Compiled by the authors Forecasts of socio-economic development of the Russian Federation in 2013–2022.

of prices for food goods, non-food goods and services in accordance with the share of imports in each component. This is especially relevant when forecasting the dynamics of food prices, more than others affected by non-monetary factors of inflation.

Additionally, the forecast rate of change of GDP does not fully correspond to Russia's inflation scenarios for 2023–2025. Thus, it is expected that in 2023 the GDP will continue to decline, although with the negative dynamic slowing down.[3] However, given this context, a structural shortage of goods and services along with a total domestic supply reduction, the slowdown of Russian inflation appears to be an uncertain version.

"Over-planned" inflation increase relative to the federal budget may serve as the basis for tightening monetary policy, which will have a negative effect on consumer moods, related demand decisions, and production cost growth [9]. To stimulate business activity will require increased expenditure of the federal budget, the scale of extrabudgetary redistribution of resources. The consequences could be an increase in the imbalance of the federal budget and a return to the policy of fiscal consolidation, leading to the suspension of budgetary programmes and projects and a reduction in budgetary funds allocated to the financing of the national economy [10].

The exchange rate of the ruble is the second most important scenario indicator that has a direct and indirect impact on the state of the federal budget parameters, especially in the unstable conditions of anti-Russian sanctions.

The forecast of the federal budget indicators for 2023–2025 was made on the basis of a moderate weakening of the national currency rate during the specified period to 68.3–72.2 rubles per US dollar in accordance

[3] Forecast of the socio-economic development of the Russian Federation for 2023 and the planning period 2024–2025. URL: https://www.economy.gov.ru/material/file/ea2fd3ce38f2e28d51c312acf2be0917/prognoz_socialno_ekonom_razvitiya_rf_2023–2025.pdf (accessed on 28.07.2023).

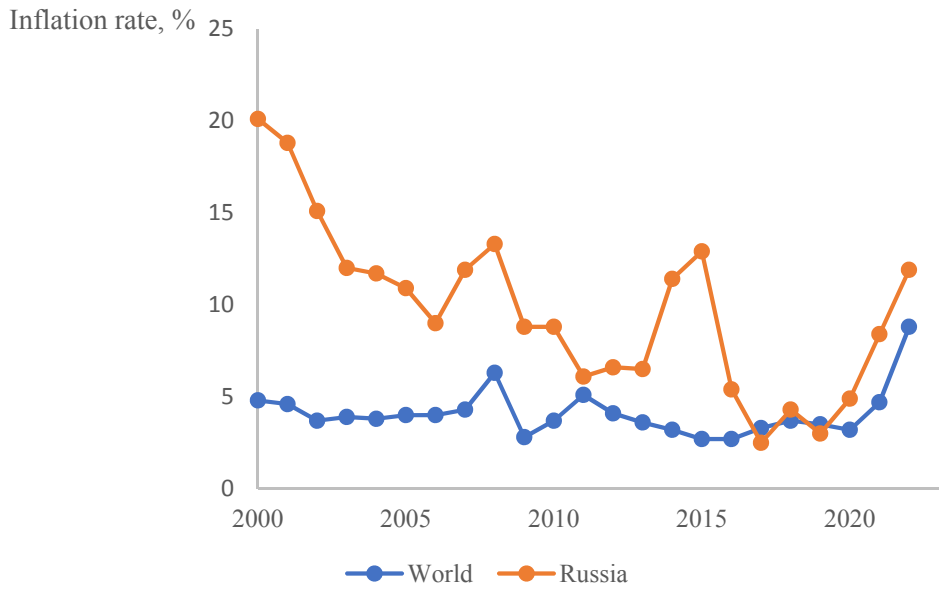

Fig. 1. **Dynamics of Inflation in the Russian Federation and in the World for 2000–2022, Annual Percent Change**

Source: Compiled by the authors.

with the current balance of payments account forecasts.[4] But it is the prospective state of the current account that gives reason to expect a greater weakening of the exchange rate of the ruble than is provided for by the federal budget law for 2023–2025.

According to the Monetary Policy Guidelines, exports are projected to decline by 31.7%, imports will increase by 11.4% between 2022 and 2025 and the current account balance will fall by more than 15 times.[5] Under such conditions, the net inflow of foreign currency into the domestic market will be significantly reduced in the forecast period, making it difficult to replenish the State's international assets and, as a result, the smooth devaluation of the national currency by the Bank of Russia through the mechanism of continuous foreign exchange interventions. Furthermore, in the current circumstances, cautious evaluation of state foreign exchange assets is required, because the growth of restrictive practices in interactions with the outside world can exacerbate the already tough situation with the Russian market's investment attractiveness. It should also be taken into account that the change in the configuration of the budget rule, affecting the volume indicators of the foreign exchange market depending on the sufficiency of oil and gas revenues, only increases uncertainty in the exchange rate dynamics of the ruble [11].

Given the above-mentioned variables, of which the most significant are the status of the current account and the number of international reserves, it is highly likely that the exchange rate of the Russian currency will be at least 90 rubles per US dollar on the horizon of the forecast of the federal budget.

The insufficient justification of the values of the exchange rate in the forecast of socio-economic development for 2023 is confirmed by its actual dynamics in the current reporting period. By mid-February 2023 the exchange rate of the ruble exceeded the maximum value of the rate range adopted for the federal budget for 2023–2025.

[4] Forecast of the socio-economic development of the Russian Federation for 2023 and the planning period 2024–2025 (further — forecast of SED).

[5] Official Website of Bank of Russia. URL: https://www.cbr.ru/about_br/publ/ondkp/on_2023_2025/; https://www.cbr.ru/statistics/macro_itm/svs/p_balance/ (accessed on 28.07.2023).

The forecast value of the exchange rate of the ruble, stated in the developed scenario conditions of socio-economic development by the Ministry of Economic Development of Russia for 2024–2026 (hereinafter — forecast for the period 2024–2026) seems unrealistic.[6] The forecast for 2024–2026 suggests that in 2024 the rate of the ruble will decrease by 0.4% with a growth of the trade balance to GDP of 6.9%, not compensating for its fall in 2023, and practically the same change in the indicators of exports and imports. It is doubtful that the declared growth rate of the Russian GDP as a factor of the ruble will be achieved due to such a small increase in investment in fixed assets at the current high level of depreciation of fixed assets and only on the internal possibilities of their renewal. Without additional external stimulus to economic growth, GDP growth above 2–3% per year can occur with a time lag of 1.5–2 years after the implementation of a sustained positive investment in fixed capital. The growth of the real disposable income of the Russian population, as indicated in the forecast for 2024–2026, after their decline in previous years is unlikely to turn demand into the main driver of the development of Russian economy.

To maintain the rate of the ruble in the framework set by the forecast for 2024–2026 is possible only at the expense of the active intervention policy of the mega regulator, on the problematic of which in the conditions of adaptation of the Russian economy to the sanctions regime was indicated earlier.

If, in fact, the exchange rate of the ruble weakens significantly above the value approved for the federal budget, it may partially compensate for the loss of federal budget revenues due to the fall in exports. Simultaneously, there will be a pro-inflationary effect of exchange rate change. According to the latest data of the Bank of Russia, the effect of transferring the change of the exchange rate to annual inflation in Russia was estimated as follows: with a decrease in the nominal effective currency rate of the ruble by 10% the yearly inflation increases by 1 p.p.[7]

Despite the fact that the shocks of the anti-Russian sanctions 2022 affected the effect of the exchange rate shift, increasing the sensitivity to inflation, even taking advantage of the indicated ratio, characteristic of not as complicated as at the current moment of the situation, we get that with our forecasts of the nominal rate of the ruble, which are given above (at least 90 rubles per 1 dollar), and extrapolation of the differences in the dynamics between nominal and nominal effective rate of ruble in the Q1 of 2023, inflation only under the influence of the devaluation of national currency in 2024 can increase almost 1.5% compared to its forecast value.

The indicated pro-inflation effect is likely to affect the decline in key non-oil-gas revenues of the federal budget against the background of higher imports and rising inflation expectations [12]. As a result, its execution in terms of expense will deteriorate, exacerbated by the financial problems of national security with all the consequences.

Obviously, it is not easy to the maximum reliability of forecasting scenario indicators in budgetary planning in conditions of high uncertainty [13]. But it is in this situation that the requirements for the scientific justification of forecasting the values of macroeconomic parameters are increasing. In this regard, the authors identify several potentially

[6] The official website of the Ministry of Economic Development. Development scenarios of the economy of the Russian Federation and the main parameters of the forecast of the socio-economic development of Russia for 2024 and for the planning period 2025–2026. URL: https://www.economy.gov.ru/material/directions/makroec/prognozy_socialno_ekonomicheskogo_razvitiya/scenarnye_usloviya_funkcionirovaniya_ekonomiki_rossiyskoy_federacii_i_osnovnye_parametry_prognoza_socialno_ekonomicheskogo_razvitiya_rossiyskoy_federacii_na_2024_god_i_na_planovyy_period_2025_i_2026_godov.html (accessed on 28.07.2023).

[7] Official Website of Bank of Russia. URL: http://www.cbr.ru/Collection/Collection/File/7822/2018_03_ddcp.pdf (accessed on 28.07.2023).

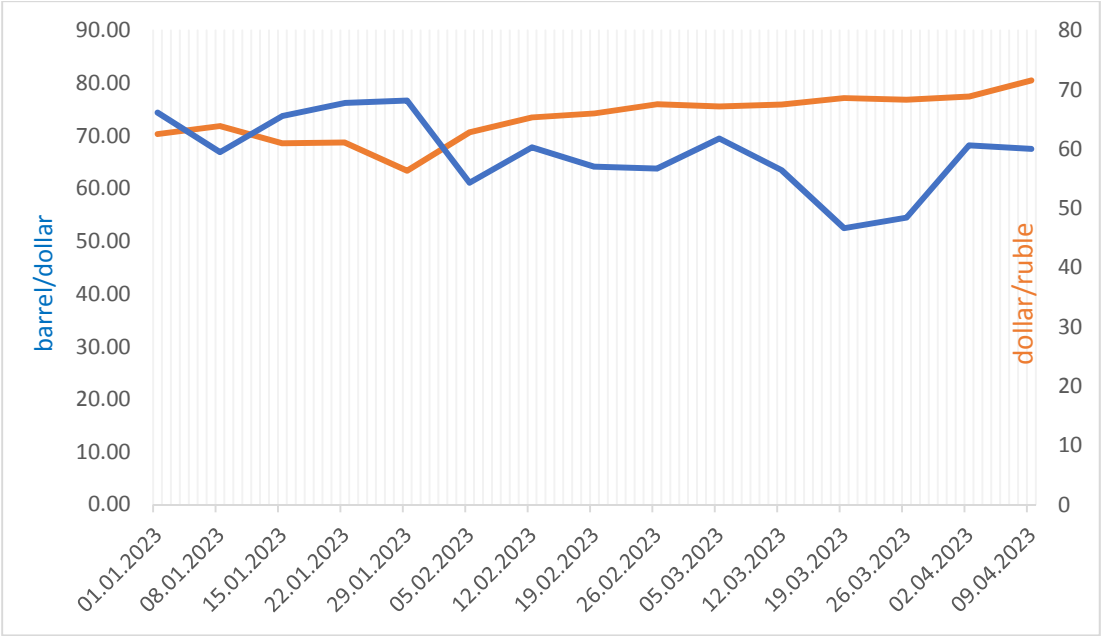

Fig. 2. **Dynamics of World Oil Prices and the US Dollar Exchange Rate in Rubles for the Period from 01.01.2023 to 04.30.2023**

Source: Compiled by the authors.

important directions of transformation of the course formation process for the purposes of forecasting the federal budget of the Russian Federation in the conditions of the economy of resistance.

The shift of priorities among the exchange rate factors is very important in budgetary forecasting. Importance in contemporary conditions should acquire such factors of exchange rate dynamics of the Russian currency, as risk of investments in Russian assets, geopolitics, uncertainty of global development, from which substantially depends the volume of dollar liquidity in the Russian foreign exchange market. The statistics confirm the need for such a transformation. The exchange rate of the ruble, for example, is less and less dependent on such a traditional factor as the dynamics of world prices (*Fig. 2*), but is more and more responsive to economic developments: the volume of foreign currency sales by exporters, the amount of cross-border transfers, the sale of business in Russia by foreign companies, the introduction of external governance of foreign firms, the rise of political tensions, etc.

The determination of the planned size of the federal budget indicators requires a review and evaluation of any factors impacting the dynamics of the ruble exchange rate that may develop during the implementation of the budget law. The authors consider that to optimize the process of selection of price-forming factors in planning and forecasting the characteristics of the federal budget will help the preparation of the EFE matrix (External Factor Evaluation matrix), which will reflect the complex of factors, relevant to the situation and ranked by significance on the basis of expert assessments for the state strategy implemented in the relevant reporting period. Comprehensive accounting in the matrix of the most significant exchange rate factors, with the focus of the state's financial policy on the implementation of priority strategies, will allow for a more objective assessment of the forecast values of the national currency in accordance with the national development guidelines during the modeling process. An example of such a matrix is given in *Table 4, 5*.

Table 2

Exchange Rate Matrix (Pattern)

Exchange rate factors	National economic development strategies		
	Import substitution	Structural transformation of the economy	Total for each factor
Endogenous factors			
Inflation	3		
Economic growth rate	3		
Consumer demand	4		
Investment activity	4		
Public expenditure	2		
……			
Exogenous factors			
International reserves	1		
World prices of basic exports goods	1		
World prices of basic imports goods	2		
Balance of payments	2		
……			

Source: Compiled by the authors.

Note: The number of strategies included in the forecast is not limited.

At the same time, in order to improve the adaptation of the federal budget to conditions of uncertainty under external sanctioning pressure, it is advisable to calculate scenario macroeconomic indicators on the basis of variability of exchange rate volatility in reasonable exchange rates corridors.

The aspect of the problem of correctness of forecasting the parameters of the federal budget is the type of exchange rate of the ruble, which should be taken as a macroeconomic indicator. The parameters of the federal budget are formed based on the average annual nominal rate of the national currency, but are very sensitive to the price dynamics of traded goods and the currency structure of international settlements. These dependencies can be summarized if the real effective exchange rate (REER) of the ruble is used to predict the average annual nominal exchange rate of national currency in the budget cycle.

The undoubted advantages of using REER in planning and forecasting the parameters of the federal budget are that this indicator allows to detail the "contribution" of inflation dynamics in different countries to the index of consumer prices in Russia and

Table 3

Accounting Methods for Results of Assessing Exchange Rate Factors

Exchange rate factors assessment	Degree of influence of exchange rate factors
4	Very strong influence
3	Strong influence
2	Average influence
1	Weak influence
0	No influence

Source: Compiled by the authors.

Note: The forecast takes into account factors whose share is 50% of the total estimate.

to take into account the structure of foreign trade turnover of Russia with other states, which is extremely relevant in the current conditions of transformation of foreign economic relations. Furthermore, the use of the REER in macroeconomic forecasts will ensure consistency of the values of the other indicators it affects for all subsequent periods of the budget cycle [14].

Given the probability of diversified dynamics of the real effective exchange price of the ruble for different commodity groups and, consequently, the different impact of this indicator on the parameters of the federal budget, it is proposed to include the real effective exchange rate of the Ruble for the three-year period in the list of the main macroeconomic indicators forecast by the Ministry of Economic Development of Russia and used for the formation of the draft Federal budget. According to the authors, adding the indicators proposed to the scenario conditions for the creation of the federal budget will allow more objectively to consider the effects of inflation and the changes in the structure of foreign trade turnover at the nominal exchange rate of the ruble. Authors also consider that this will increase the accuracy of the forecast of the budgetary designs themselves.

The determination of the real effective exchange rate of the ruble is necessary not only in determining the parameters of the federal budget, but also in the development of budgetary policy tools. For example, the reason for the state support of market operators using imports as intermediate goods at the expense of the federal budget may be a loss of their competitiveness due to a decrease in the real effective rate of the ruble, designed specifically for imports.

Other effects of using this indicator as part of macro indicators will include improved predictability of the scenarios of the conditions of activities of various economic actors. And with the positive dynamics of the real effective exchange rate, determined by the targeted economic policy of the state, this will serve as a motivation for the growth of business activity in the medium- and long-term periods.

CONCLUSION

To solve the strategic task of adapting the Russian Federation's economy to the conditions of strong anti-Russian sanctions, which have resulted in major financial and non-financial resource limits, funds given to the economy from the federal budget are important. Budgetary capabilities for regulating economic development, depending on the volume of budget revenues from different sources, are largely determined at

the stage of planning and forecasting of the federal budget.

Analysis of the indicators of the federal budget of Russia for 2023–2025 showed that the forecast values used in their planning of key macroeconomic indicators do not fully correspond to the developing trends and risks of the medium-term period. In part, this was expressed either in the undervaluation or revaluation of individual input basic indicators of macroeconomic development.

During the study carried out by the authors proved the need to change individual approaches in forecasting such scenario macro indicators, behind the federal budget, as the level of consumer prices and the exchange rate of the ruble. The authors developed and substantiated proposals on optimization of the procedure of selection of price factors in the planning and forecasting of the characteristics of the federal budget on the basis of a matrix approach. In forecasting the annual nominal exchange rate of the national currency for the medium-term period, it is proposed to use the real effective rate of ruble with the inclusion of the latter in the compulsory scenario conditions for the formation of budgetary projections at the federal level.

In preparing the Forecast of socio-economic development of the Russian Federation for the three-year period, objective coherence should be ensured between the rate of growth of GDP and the level of inflation, taking into account the impact on them of the forecasted parameters of expenditure of the federal budget and the new mechanism of their financing through the change of the budget rule for the introduction of the practice of variable scenario modeling, especially in the context of sanctions.

Since the current conditions of development of the Russian economy are characterized by their unpredictable volatility, we consider it advisable when forecasting the values of key macroeconomic indicators, on which the budgetary characteristics are based, to lay a certain "pillow" in the form of an interval range of such values, taking into account endogenous and exogeneous factors, which minimizes the risks of execution of the federal budget. In addition, in the situation of possible long-term preservation of external sanctions pressure on the Russian economy in the design of the parameters of the federal budget, it is advisable to use a variable approach more productively, which would allow to launch algorithms for the realization of budgetary objectives, adequate to the specific circumstances, reduce the likelihood of failures and negative consequences of crisis situations, increase the probability of balanced high-technology development of Russian economy.

The authors consider that the ideas have applied importance because they affect the reliability and credibility of major features of the federal budget, and thus increase the effectiveness of its the implementation to ensure balanced development of the Russian economy.

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A. Yu. Chalova — the formulation of goals and objectives, analysis and systematization of the results of the study of macroeconomic indicators adopted for the preparation of the federal budget, the formation of conclusions and proposals.

Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 13.02.2023; revised on 16.04.2023 and accepted for publication on 26.04.2023.
The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-18-29
UDC 365(045)
JEL G380

Methodological Support of the Estimated Efficiency of Public Procurement on a Contractual Basis

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ABSTRACT

The **subject** of the study is the problems of institutional and methodological-legal regulation of the contract system of public procurement. The **relevance** of the problem is due to the fact that there have been changes in the structure and composition of forms of contract activity as a result of the 2017 adoption of amendments to Law No. 44 in the dynamics of the distribution of order placement procedures. The **purpose** of the study is to develop a scientific methodology for calculating the effectiveness of procurement activities on the basis of a comprehensive assessment of the effectiveness of public procurement on a contractual basis, plan-fact analysis, and the implementation of the principles of compliance control in public procurement management. The paper uses **methods** of statistical and comparative analysis, generalization, classification and valuation. The paper shows that the present disadvantages of institutional regulation of procurement processes have a negative effect on their effectiveness, requiring improved oversight of public procurements as well as analytical and methodological support. The authors suggested that the principles of compliance-control of public procurement management be applied on a contractual basis in order to increase the level of credibility and legality of activities conducted in procurement. The author's vision of the content of the methods of calculating the performance of procurement activities on the basis of a comprehensive evaluation of the effectiveness of public procurements on a contract basis is presented. For the collection of data for plan-fact analysis, their systematization for further calculation of performance indicators of public procurement on a contractual basis, a specialized form "Data Summary for Plan-Fact Analysis of Procurement" is proposed. If the procurement proposals presented in the study are implemented, they will increase the efficiency of the Russian public procurement contract system, the responsibility of participants in it, and the professional competence of officials.

Keywords: institute of procurement; procurement; contract; state patronage; corruption; institutional trap; principles of compliance control

For citation: **Rogulenko T.M., Bodyako A.V., Ponomareva S.V., Pashkov P.A. Methodological support of the estimated efficiency of public procurement on a contractual basis.** ***Finance: Theory and Practice.*** **2023;27(5):18-29. DOI: 10.26794/2587-5671-2023-27-5-18-29**

INTRODUCTION

The relevance of the problem

The current institutional structure of the contract system in the field of procurement for state and municipal needs has not yet been formed. There are several reasons for this: the conceptual apparatus of the theory of procurement management has not been developed, which confuses the practice of purchasing; the principles of fair competition in the sphere of public purchases have not been established; the normative, legal and methodological basis of the procurement process is imperfect [1–3]. Significantly influenced by the processes of digitization of communications of procurement participants, which "breaks" customary traditions and procedures.

Researchers focus on procurement — it is first and foremost a set of methods that, to some extent, are able to satisfy the interests of the customer to the maximum extent.

In terms of market relations, the public procurement institute performs functions to satisfy state needs in a qualitative and timely manner, with the most efficient use of budgetary appropriations allocated for the establishment of public order; establishment of control; and ensuring transparency of state resource expenditure.[1]

However, the requirement of substantial temporary costs of contract managers for conducting transactions is predetermined by the text of the Federal Law from 05.04.2013 No. 44 "On the contract system in the sphere of procurement of goods, works, services for the provision of state and municipal needs" (further — Law No. 44), because it is extremely voluminous and difficult to perceive. Understanding the norms takes a long time. It is required to understand not only the text of Law No. 44, but also the comments to it, as well as rules and numerous classifiers, in order to carry out a single procurement. It is impossible to build the skills of rapid search and effective application of essential information without such knowledge. In the recent history of Russia, the issue of the working hours of the employee of the contract service for procurement activities has been an open problem. Thus, in practice, questions often arise about the possibility of applying other methods of labor normalization by specialists to procurement activities in budget organizations. In their work, N. V. Yurchenko and E. A. Bykova discuss these issues and emphasize the following factors:

- difficulty of recording employment transactions when performed jointly or simultaneously by several employees;
- difficulty assessing the results of individual work due to the lack of standard time limits for individual work;
- the need to collect preliminary data on the types of operations and their duration in order to establish the number of staff according to time norms.

The subject of this study is the organizational and economic relations arising in the formation of the contract system in accordance with the existing legislative and regulatory legal acts between regulatory bodies and educational organizations — customers of goods, works, services through the system of public procurement.

The article discusses the problems of institutional, methodological and legal regulation of the contract system of public procurement.

The purpose of the study is to develop scientifically substantiated and practical proposals on the methodology of calculating the effectiveness of procurement activities.

MAIN PART

According to experts, the procurement institute with the adoption of the new version of Law No. 44 was in an institutional trap [4].

[1] Federal Law from 05.04.2013 No. 44 "On the contract system in the sphere of procurement of goods, works, services for the provision of state and municipal needs" (ed. from 02.07.2021).

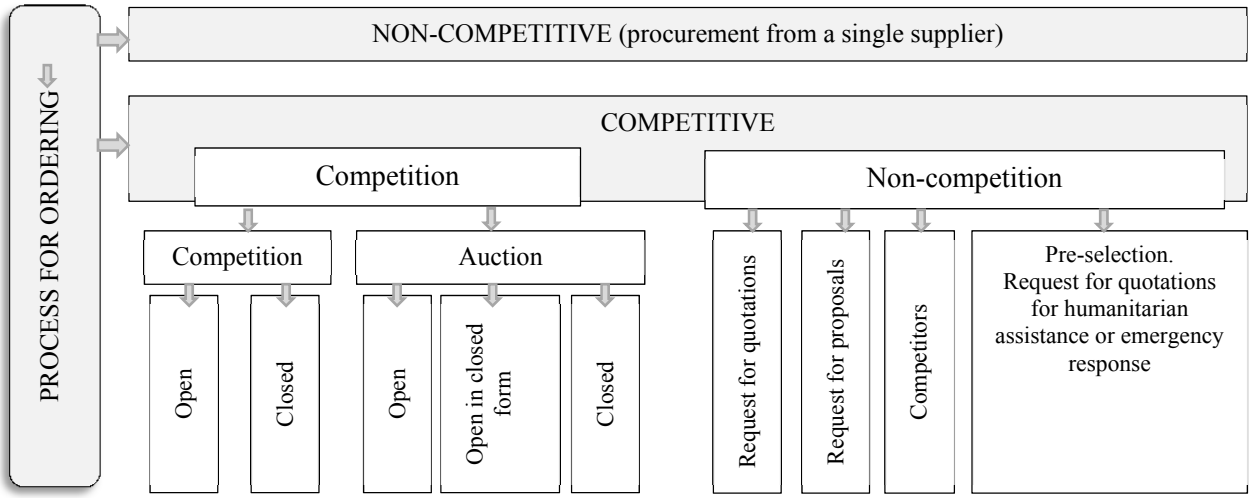

Fig. 1. **Types and Subspecies of Procurement Methods in the Contract System**

Source: Compiled by the authors.

The fundamental difficulty inherited by the Russian Institute of Public Procurement from its "predecessor" was the corruption of contractual procedures. [3]. Due to the shortcomings of institutional regulation of contract-based public procurement and the corruption of quote requests, the Russian Federation's FAS has taken the initiative to ban it from the available methods of placing state and local orders.

Being under the patronage of the State, procurement participants are obliged to comply with all requirements of Law No. 44 (small business entities (further — SBE), socially-oriented non-profit organizations (further — SONPO) and Federal Law from 18.07.2011 No. 223 "On Procurement of Goods, Works, Services by Certain Types of Legal Entities" (ed. from 04.08.2023) (commercial legal entities). Control over the implementation of the legislation is entrusted to such regulators as the Bank of Russia, the Ministry of Finance of Russian Federation, the Ministries of Economic Development of Russia, FAS of Russia, Rosfinmonitoring and others.

Adoption in 2017 of amendments to Law No. 44 substantially changed the structure and composition of forms of contractual activity (*Fig. 1*).

Dynamics of distribution of ordering procedures for the period 2010–2020 presented in *Fig. 2*.

State procurement is a special national entity whose aim is to supply the needs of economic actors in the form of goods, works, and services on contract conditions at the expense of budgetary funding. However, the existing shortcomings in the institutional regulation of procurement procedures have adversely affected their effectiveness [5]. To solve this problem, it is necessary to improve the management of public procurement and its analytical and methodological support.

Many contemporary analysts: V.V. Volchik, V.V. Gorlov, R.A. Grigoriev, O.V., Kiseleva, K. Yu. Kotova, T. V, Kramin, E.L. Kumundzhieva, A. E. Lapin, A. V. Lukinyh, O. V. Michalev, K. O. Muthylina, A. A. Nalbandyan, P.A., Pashin, E. Yu. Podosinnikov, K. V. Razuvaev, I.L. Surat and others are attempting to shape an idea about the content of the concept of "effectiveness of public procurement" and on this basis to develop a methodology for its assessment.

The Law No. 44 and the regulatory acts refer to the effectiveness of procurement, but they do not have a clear definition of the concept of "efficiency of purchasing". In our view, the term "efficiency" is not quite suitable for

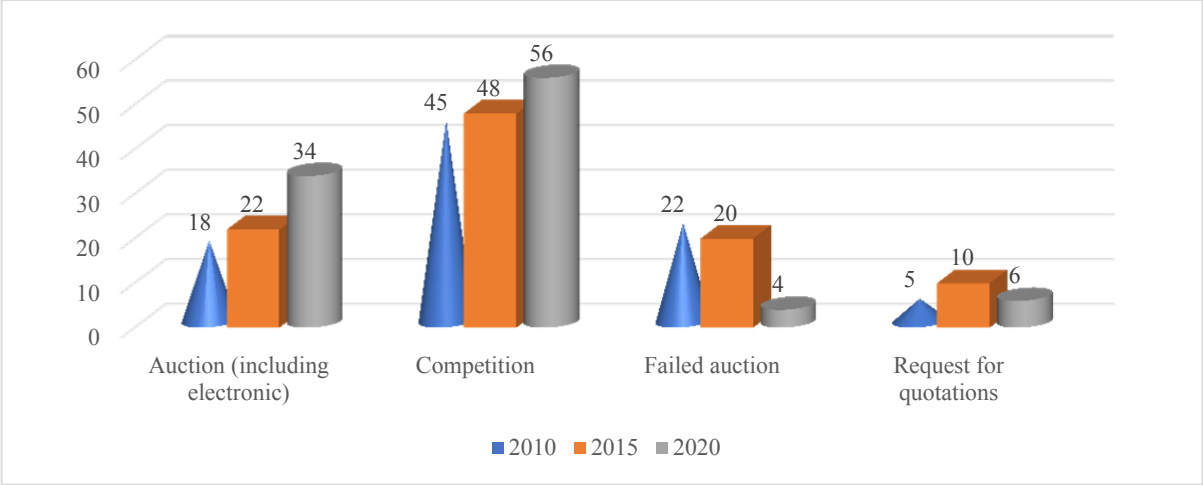

Fig. 2. **Distribution of Order Placement Procedures (by Number of Procedures, %)**

Source: Author's calculations.

evaluating the activities of the participants in the procurement process. The term "effectiveness" is more appropriate because it can reflect not only cost but other valuation indicators, such as qualitative valuations, the level of competitiveness of contracts, the duration of execution of orders, savings in time for forming an application, etc.

A study of the practice of Law No. 44 implementation revealed that not all regulatory difficulties had been handled, and as a result, SBE and SONPO are facing problems with order development, supplier selection, and price conditions of execution of the contract for the provision of products, works, and services. However, from the results of 2022, it can be concluded that the overall state of SONPO procurement is satisfactory (*Fig. 3*).

The methodical orientation of the recommendations for assessing the effectiveness of competitions for the placement of orders for the supply of goods for state needs (further — Recommendations) exclusively on price indicators puts state organizations before the need to stop their choice on cheaper, but less quality goods.

In addition to price indicators, the Recommendations include: share of tenders in total procurement, share of procurements from a single supplier, etc.

REFLECTION OF A PROBLEM

Russian researchers on the evaluation of the effectiveness of public procurement on a contract basis are proposing their own developments. The study of these techniques shows that none of them can be considered imperfect. In the methodology of the team of authors of the Volgograd Institute of Business [6], the effectiveness of procurement is proposed to be characterized by such indicators as "the amount of savings, as well as an integral indicator of efficiency of the implementation of purchases (implementation of plans, reasonability of the initial price of contracts, proportion of competitive purchases, compliance with the legislation, discipline of contract execution)". It should be noted that this methodology, despite its comprehensive nature, has disadvantages related to the fact that it does not take into account the specifics of the budgetary system and the institution of regulation of the public procurement system. The authors' views on the quantitative expression of certain positions, in particular, such as compliance with contractual discipline in accordance with legal acts, procurement legislation, raise doubts. An important feature of the methodology developed by M.K. Aristarkhova, O.C. Zueva and A. Yu. Perevezentseva, "the simultaneous use of a dual system of

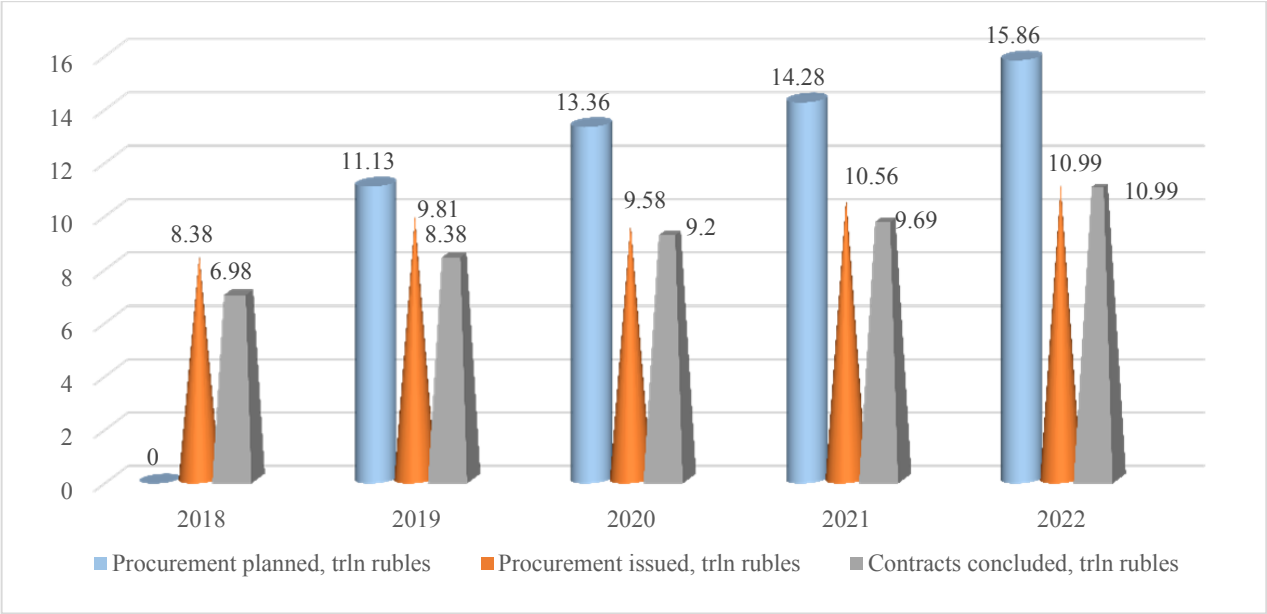

Fig. 3. **Dynamics of the Contract System of Public Procurement**

Source: Author's calculations based on: Statistics of implementation of procurement (Rosstat information); Report of the Ministry of Finance of Russia. Procurement monitoring. URL: https://rosstat.gov.ru/folder/12979; URL: https://minfin.gov.ru/ru/perfomance/contracts/purchases. (accessed on 20.01.2023).

assessments — by the executor of the public order and by the customer; this methodology is also based on the assessment of the performance of the state order at the time of its completion and after a certain time, when the quality of the works (services) performed or delivered goods begins to manifest" [7].

The expert's justification [4–5, 7] of the need for an integrated valuation indicator appears to be correct due to the participation in procurement by both commercial and non-profit organizations. The methods of these authors focus on finding an integral indicator of procurement efficiency.

This article implemented the principle of comprehensive evaluation of the effectiveness of public procurement on a contractual basis, but on a different methodological basis, since such participants in public purchases as budget educational organizations were evaluated. The set of indicators includes savings in budgetary appropriations for the procurement of values and time savings of labor costs for the maintenance of a single contract. Rationalization of the functional load of specialists, improvement of labor normalization, redistribution of functions of procurement participants — all of this generally gives time savings, and each saved hour on contract service brings, respectively, and savings of financial resources.

The methodical implementation of the principle of integrated assessment of the effectiveness of public procurement on a contractual basis in respect of specific space and time was implemented using rational items in the aforementioned methodologies.

RESULTS

The methods of T. G. Sheshukova and A. A. Mal'tseva seem to us to be the most adequate to the current state of the economy and the market. These authors have divided the calculation of indicators of the effectiveness of public procurement into the following stages: preparatory (search of suppliers, choice of method of delivery, preparation of documentation, registration of applications, etc.) and the stage of delivery of values to the customer.

The methodology considered by these authors includes systems of calculations

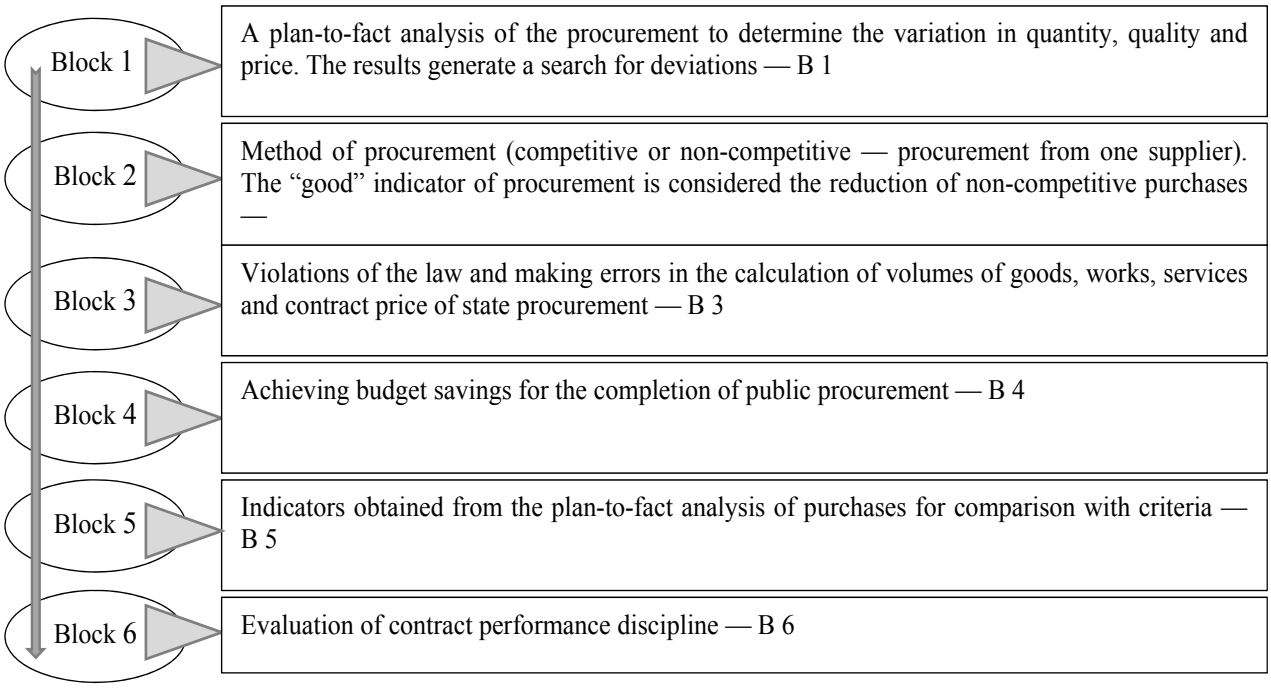

Fig. 4. **The Content of the Blocks of the Methodology for Evaluating the Effectiveness of Public Procurement**

Source: Author's calculations.

of indicators grouped into six blocks. The developers of this methodology believe that it "is intended directly for budgetary institutions and allows for the assessment of the effectiveness of procurement performed on each contract. The analysis was conducted from the point of view of the rationality of the expenditure of budgetary funds, the correctness of the implementation of the procurement procedure. Furthermore, the methodology is based on information that is posted on the official website of UIS in the procurement sphere and, accordingly, does not require additional information from other sources" [8]. The study of the methodology of T. G. Sheshukova and A. A. Mal'tseva allowed us to determine and clarify the general logic of its retention, as presented in *Fig. 4*.

Analysis of the first block involves not only the comparison of planned and actual (reporting) indicators, but also an estimate of the causes of deviations, which is not always quantifiable. Experts are involved in the first phase. All plan-fact changes are assessed by experts on a situation-specific basis:

- "cancellation of procurement (0.2 points);
- change in planned acquisition dates (0.4 points);
- decrease in the volume of procurement, decrease or increase in the price of the purchased goods, works, services (0.6 points);
- adjustments to the original version of the schedule (0.8 points);
- increase or decrease in the volume of purchases or the price of purchased values within 10% of the parameters of the original plan-fact (1 point)".

For the same reason, the experts assigned the following estimate values to the indicator positions:

- "conclusion of a contract with a single supplier as a result of unsuccessful competitive procedures in the presence of only one participant (0.3 points);
- procurement from a single supplier (0.5 points);

- conclusion of the contract on the results of competitions, auctions, quotation requests with the number of participants of competitive procurement less than three (0.7 points);
- conclusion of a contract on the results of competitions, auctions, quotation requests with a number of participants of competitive procurement of not less than three (1 point)".

The analysis of the content filling of calculations in block 3 is based on the same principle as in blocks 1 and 2. Experts attribute three values to situations:

- "controlled violations (0.4 points);
- the same violations and errors that do not lead to the cancellation of procurement (0.6 points);
- in full compliance with the legislative norms (1 point)".

The indicator of the fourth block of the plan-fact analysis is determined by the ratio between the initial price published in the notice and the price of the contract concluded. Variations in the rate of savings of budgetary appropriations for procurement in the methodology under consideration appear to be economically reasonable and applicable to all participants in public procurements. With a savings indicator of $0 < S < 0,5$ it is concluded that the customer has very accurately determined the initial price of the contract. If the savings rate is $0.1 < S < 0.5$, this indicates that the customer's actions are optimal. At the indicator of $0.1 < S < 0.25$ the customer achieves high efficiency of work, which in this case causes fear of the possibility of fulfillment of its obligations by the supplier. Effectiveness should be checked for $S > 0.25$. In particular, it is necessary to ensure that excessive efficiency is not the result of miscalculations or deliberately unfair conduct.

In our view, the criteria proposed in the fifth block are not quite correct: "the indicator's maximum value is the sum of the following values: 0.3 points for delivering goods, performing work, and providing services; 0.4 points for accepting the product, performing work, or providing services with the signing of a bilateral acceptance act or concluding the conducted examination; and 0.3 points for delivery without claims to the supplier, the contractual executor. 0.3 point when delivery with claims, but eliminated within a defined contract period of delivery of the good, performance of the works, and provision of services, the index receives the value". As you notice, the criteria's content does not reveal the features of the purchased goods, works, or services.

Not quite successfully, the authors of the methodology named the sixth block of analytics. The publications examined on the problem under consideration do not contain a clear definition of the concept of "contractual discipline".

The final indicator of the comprehensive evaluation of the performance of procurement is calculated as the sum of values and weighting factors for each of the above indicators, which is a traditional method of expert evaluation.

To identify deviations in quantitative, qualitative, and price dimensions and to initiate the search for causes of deviations (B 1), it is advisable to systematize the study proposed in *Table 1*.

RECOMMENDATIONS

A specialized form will be required for the collection of data for plan-fact analysis, their systematization for further calculation of performance indicators of public procurement on a contractual basis. This form is called "a data summary for the plan-fact analysis of acquisitions" by the authors of the current article. Based on the name of this analytical form, it records data from the procurement schedules and associated reporting forms for each stage of the purchase's implementation. All information is published on the unified information system (UIS) in the procurement sector. A visual representation of the document "Data summary for procurement plan-fact analysis" is presented in *Table 1*.

Table 1
Form No.

Data Summary for Plan-fact Analysis of Purchases

Organization _____

For Three Quarters of the Year

	I quarter			II quarter			III quarter		
Position	**Schedule**	**Fact**	**Deviation**	**Schedule**	**Fact**	**Deviation**	**Schedule**	**Fact**	**Deviation**
1	2	3	4	5	6	7	8	9	10
Suppliers									
Single supplier									
Amount of the contract									
Monitoring									
Saving									
Values in the contract list									
of which:									
– goods									
– works									
– services									
Claims – total of:									
Paid fines									

Source: Developed by the authors based on research.

At the end of the reporting period (year), the data in the specified form is specified, and a similar form is prepared with the data for the year.

In order to increase the level of credibility and legality of procurement activities, the system of internal and external financial control should be strengthened on the basis of

Table 2

Principles of Compliance Control of Public Procurement Management on a Contractual Basis

No.	The name of the principle	The content of the principles of compliance control of state procurement management on a contractual basis
General principles of compliance — standards for monitoring activities		
1	Ethical principles	When conducting inspections and compliance-control activities, the basis of the inspection activities and their implementation should be the requirements of the codes of professional ethics of internal controllers, auditors of the Russian Federation, professional ethic of the organization
2	Principles of independence	Subjects of compliance-control must be administrative, functional and financially independent of the control objects, neither in family nor in property relations with them
3	Objectivity	When conducting audits, compliance audits should use only objective information, documented and financially validated, without prejudice and bias
4	Professional competence	High professional qualities, knowledge of legislation and methods of forming objective information about the objects of compliance-control verification
5	Determination	The work of the controllers is constructed in accordance with the purposes and objectives of the event carried out, according to the labour legislation and the laws on procurement
6	Reliability	Compliance-control results are based on the study of documents on procurement legislation, their compliance with regulations
7	Professional scepticism	The results of the monitoring activities are not credible on the basis of the words of the performers, re-checking is carried out without the application of generalization, evaluated on actual studies
Principles of professional activity — standards of control activity for audit of public procurement management on a contractual basis		
8	Efficiency	Monitoring measures should ensure that procurement results are achieved to meet state and municipal needs, in accordance with the tasks faced by the management of procurements, taking into account risks and optimality.
9	Risk orientation	Risk-oriented compliance control involves identifying the riskiest areas that should be given more attention when checking procurement activities, which may cause damage to the economic operator, inefficient use of funds, appropriation and fraud
10	Automation	Subjects of compliance-control of procurement should have access to the data of automation of accounting, management processes with the underlying function of monitoring of the standard positions of work on purchases, the application of control measures on centers of financial responsibility, the functional separation of admission to information and personal responsibility of executors for the prevention of corruption and other abuses in the sphere of such purchases
11	Informatization	The construction of information systems should be formed with the fullest support of the compliance control body for the controlled procurement management segment
12	Methodological consistency	The organization should develop internal standards for the compliance control body, using them for verification, planning, conducting verification activities, generalization of findings, drafting of results, reports
13	Interaction	Interaction between internal and external controls must be carried out, coordination of the activities of the management bodies of the organization, internal and foreign controls, audits, law enforcement bodies must be ensured
14	Information transparency	The results of the control activities are both to the heads of structural units, employees, and are put to the control for the elimination of shortcomings, the adoption of measures to normalize the management of procurement

Source: Developed by the authors on the basis of the Decree of the Government of the Russian Federation of 06.02.2020 No. 95.

the principles set out in the Federal Standard of Internal State (Municipal) Financial Control "Principles of compliance control of public procurement management on a contractual basis" (*Table 2*).[2]

The purpose of compliance-control of procurement management — is to verify the legality and fixing of shortcomings aimed at meeting state and municipal needs in order to improve the efficiency, effectiveness of the implementation of the procurements of goods, works, services, ensuring transparency and transparency, prevention of corruption and other abuses in the part concerning the planning of the purchases of goods, works, services; identification of suppliers (contractors); conclusion and execution of contracts; monitoring of the procurement of products, works and services (Law No. 44).

CONCLUSION

Because of the immense flexibility of any economic system and the inflexibility of the subjects of institutional and legal control, no method of assessing the effectiveness of public procurement on a contractual basis can satisfy the demands of customers, contractors, and analysts. For this reason, the methodological and legal assessments of the regulations of the procurement institution must be continuously audited and improved.

Based on the analysis of changes in the structure and composition of forms of contractual activity as a result of the adoption in 2017 of amendments to Law No. 44 on the dynamics of distribution of order placement procedures, the authors state that public procurement is a special institution of national importance, the mission of which is to meet the needs of economic actors in goods, works, services on contractual terms at the expense of budgetary funding.

The current shortcomings in the institutional regulation of procurement procedures, in particular the methodological recommendations for evaluating the effectiveness of competitions for the placement of orders for the supply of goods for state needs, have a negative impact on their efficiency, which requires an improvement in the management of public procurements and its analytical and methodological support. The author's vision of the content of the methods of calculating the performance of procurement activities is proposed on the basis of a comprehensive evaluation of the effectiveness of public procurements on a contract basis. For the collection of data for plan-fact analysis, their systematization for further calculation of indicators of efficiency of public procurement on a contractual basis, a specialized form called "Data summary for plan-fact analysis of procurement" has been proposed.

In order to increase the level of credibility and legality of procurement activities, the authors proposed to apply the principles of compliance-control of government procurement management on a contractual basis in order to improve the degree of reliability and legitimacy of activities conducted in the sphere of purchasing and strengthen the system of internal and external financial control.

Implementation of the procurement proposals presented in the study will improve the effectiveness of the Russian contract system of public procurements and contribute to increasing the level of responsibility of its participants and the professional literacy of officials.

Several requirements contribute to the improved effectiveness of the Russian public procurement contract system: the high level of responsibility of its participants, the professional literacy of officials, and the expansion of the number of universities offering purchasing manager training programs. It is recommended that future research focus on the issues of institutional, methodological, and legal regulation of the public procurement contract system.

[2] Order of the Government of the Russian Federation from 06.02.2020 No. 95 "On approval of the federal standard of internal state (municipal) financial control "Principles of the control activity of bodies of internal State (municipal) fiscal control" (accessed on 20.01.2023).

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 11.03.2023; revised on 11.04.2023 and accepted for publication on 26.04.2023.
The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-30-42
UDC 339.91(045)
JEL G18

Financial Policy of Government Support for Semiconductors Industry Globally and in Russia under Sanctions

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ABSTRACT

The **relevance** of this study is determined by the need to develop the domestic semiconductors industry in Russia, taking into account the negative effects both internal and external. The **purpose** of this paper is to test the hypothesis of the positive impact of the methods used by the state of financial support of domestic companies to acquire advanced technologies in a specific area in the context of a lack of funding and the significant lag of the national semiconductor industry in the world's leading countries. The **target** of this study is the analysis of possible tools of state support, including subsidies and grants, and methods of their application for the creation of competitive industry of domestic semiconductor production. The key **methods** used in this study include the collection and processing of statistical data, their comparative analysis, as well as the elaboration of the regulatory framework on tax regulation in this sector of the economy. The main **methods** applied in this study are data collection and processing, comparative analysis, and the development of a regulatory framework for tax regulation in this sector of the economy. The authors analyzed the semiconductors industry in the world, including the production of microprocessors and other semiconductor components. The situation in countries such as China, USA, Japan, Europe, Taiwan, India and Russia is discussed in more detail. The main problems with semiconductor industry development in Russia have been revealed. Additionally, researchers have evaluated and outlined fields of federal budget spendings in the industry in the period of years 2022 and 2025. The **scientific novelty** of this paper is to identify the relationship between the measures of state tax incentives provided to the radio-electronic industry and macroeconomic indicators. Based on that authors have developed evaluation criteria of the relevance and efficiency of fiscal preferences for the analyzed industry which is considered as **the result** of research. It **concluded** that the state's initiatives to promote the radio-electronics industry might provide Russia a chance to catch up to the world's leading countries in this industry.

Keywords: import substitution; semiconductors; government support; subsidies; federal budget spendings; tax support; investments; competitiveness; sanctions; national economy

For citation: **Cherednichenko L.G., Novikova E.S., Golubtsova E.V. Financial policy of government support for semiconductors industry globally and in Russia under sanctions.** ***Finance: Theory and Practice*****. 2023;27(5):30-42. DOI: 10.26794/2587-5671-2023-27-5-30-42**

INTRODICTION

At the present time, the development of the microelectronics market in both the global and individual economies has been a top priority in the competition for countries to achieve a competitive advantage. China continues to develop domestic microelectronics production; India is trying to surpass China as the world's biggest producer; and the US and China are trying to divide their areas of influence in Taiwan.

Given the fact that the microelectronics market is growing by an average of 26% annually (compared with the annual growth of the energy market, which is twice as low),[1] the world's leading economies are interested in developing full-cycle manufacturing, including semiconductors, in their territory or in countries that are more controlled by these economies. In this regard, the US provides financial incentives to manufacturers who are prepared to close their manufacturing facilities in China and Russia and relocate them to other countries.

[1] Global reorganization of the semiconductor industry. URL: https://www.it-world.ru/it-news/market/186649.html (accessed on 20.11.2022).

Over the last 30 years, the semiconductor market has changed considerably. About 50% of the world's export market for microprocessors is controlled by the largest Asian manufacturers, namely China, South Korea and Taiwan. Previously, almost 40% of the world's semiconductors were manufactured in the US and the other 40% — in Europe. Western markets are growing to depend on Asian countries for the supply of these types of products, which increases Asian countries' position on the global map.

Russia, with the smallest share of the world's market in microprocessor production (0.7% of the total market) [1], was in a difficult situation due to the sanctions imposed, given the high dependence of the market on supplies of any kind of component from other countries. However, Russia has an opportunity to obtain a competitive advantage in the microprocessor production cycle, including cheap natural resources such as oil and gas, as well as rare metals such as silicon, which are essential in such manufacture [2].

The task of this study is to analyse possible tools of government support, including subsidies and grants, as well as methods of their use in order to create a competitive industry for domestic microelectronics production.

The object of this study is the semiconductor sector, including the production of microprocessors, and the subject is the methods of government support for its development.

As a hypothesis, an argument has been provided for the positive impact of state support for domestic companies to acquire breakthrough technologies in the context of a lack of funding and a significant lag in the national semiconductor industry in comparison to the world's leading countries.

LITERATURE REVIEW

Microprocessor development and production can be identified as so-called "subversive innovations", which were first analyzed by American scientists C. Christensen and others in terms of changing the market's value ratio, in connection with which old products gradually lose their competitiveness, thereby contributing to the substitution and replacement of some leaders with others [3]. These same issues are relevant in terms of emerging innovations within the framework of digitization and explosive use of big data systems [4].

Research in the semiconductor industry, particularly microprocessors, demonstrates the need for analyzing the competitiveness of existing production cycles by country. Chinese scientists H. Li et al. [5] analysed the microprocessor industry in terms of the effectiveness of innovative approaches to organizing the production cycle of the final product at the lowest possible cost. The DEA (Data Envelopment Analysis) three-factor mathematical model is used for this purpose to compare all internal and external factors affecting product production. This model was also used by Taiwanese scientists [6] to analyze the competitiveness of microprocessor production in Taiwan compared to the leading competitive markets in the world. American scientist C.P. Bown [7] examined the semiconductor industry in the US compared to the Chinese market in the context of the trade war. In many ways, he used the methodology and results presented by S. Goodman et al. [8], who studied the impact of the trade war between South Korea and Japan on the future development of the two nations' semiconductor industries.

A special effort should be made to study the influence of government support on the growth of certain industries in order to bring them up to international competitiveness. Thus, scientists D. Soogwan and B. Kim [9] showed that the state funding of small and medium-sized enterprises in the field of various technologies in South Korea contributed to the even development of the regions of the country, which directly positively affected the economic situation in

the country. Taiwanese economists [10] also noted that state subsidies under Taiwan's industrial and technical complex upgrading program allowed the region to become a leader in semiconductors.

As regards the Russian experience of government support of the domestic industry and the prospects of its development, it should be emphasized the national projects implemented in Russia, which are aimed at the implementation of technical initiatives in the field of semiconductors. Research on state financing of various sectors of the economy, including semiconductors, was conducted by L. G. Sokolova, A. Gnidchenko, O. A. Romanova and others [11–13]. The state and possibilities of development of the Russian semiconductor industry under the conditions of state support were studied by D. Sirotin [14].

In regard to this, the issue of point-of-contact government support for existing domestic enterprises for breakthrough technologies in order to ensure Russia's long-term economic development is important.

INTERNATIONAL MARKET OF MICROPROCESSORS

To date, the microprocessor market is one of the key markets in terms of the country's further technological breakthrough. By the end of 2022, the annual market volume of microprocessors is estimated at approximately 400–500 bln US dollars.

The global market for microprocessors is growing rapidly in terms of revenue (*Fig. 1*). The main demand is for computer technology (31%), communications equipment, including smartphones (32%), industrial equipment (12%), car manufacturing, where the role of semiconductors is rapidly growing and becoming a key competitive advantage for some car manufacturers over others (12%) and household equipment (12%). Separately, according to global statistics, the military-industrial complex accounts for only 1% of the public sector's revenue. Most Russian companies in this sector of the economy are involved in the manufacture of their products for the military industrial complex (further —MIC).

Semiconductor production is mainly located in Taiwan, South Korea and Japan (see *Table*). The shares of the US and China in the world market are almost equal, which is explained by the tough sanction's rhetoric between the two countries.

Fig. 2 shows that South Korea and Japan have the most advanced technologies (less than 20 nanometers) in the production of microprocessors with 56 and 51% respectively. Taiwan (64%) and China (55%) lead in the medium range (more than 28 nanometers), whereas the least-wanted microprocessors of previous generations are still largely produced in Europe (49%).

Seriously determine the possible positions of Russia in the market of microprocessor production, given the sanctions imposed against the Russian economy, as well as the industry's considerable lag in the last 30 years due to Russia's unsuccessful integration into the international division of labour.

The Russian Federation's government released a document titled "Foundations of the Russian Federation's state policy in the field of development of electronic industry for the period up to 2030",[2] which provides the basis for the development of the semiconductor sector. The document identifies key challenges to successful development, including in the field of microprocessors. This should include:

Russia's technology lags in world standards by 10–15 years;

- difficulty with the development of technological processes for the production of microprocessors on thin plates (less than 180 nanometers);
- lack of production equipment and capacities;

[2] Electronics starts with a clean slate. URL: https://www.kommersant.ru/doc/5558844 (accessed on 23.11.2022).

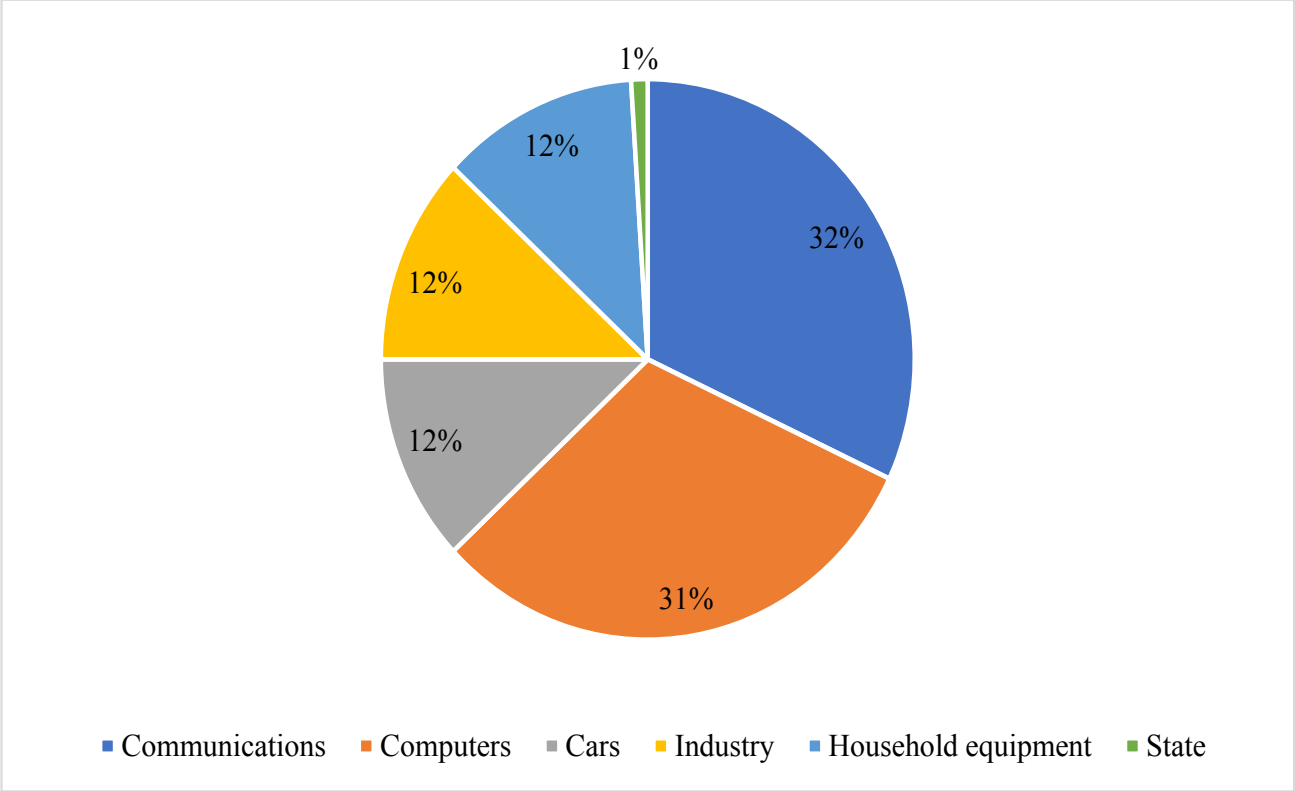


Fig. 1. **The Global Market of Semiconductors (Revenue) by Final Consumer, %, Year 2020**

Source: URL: https://www.trendforce.com/presscenter/news/20210531–10809.html (accessed on 21.11.2022).

- high dependence of the architecture and design of products on foreign technologies and materials;
- low investment attractiveness;
- inability to provide the domestic market with the necessary electronics [15, 16].

Moreover, the cost of production of components in Russia is so high that it cannot compete with other analogues of products, for example, of Asian origin [17].

Another challenge for the sustainable development of this industry within the framework of the national economy is the search and selection of the necessary personnel, including scientists, engineers and other specialists, who could use in their work not only existing technologies, but also engage in their own developments for their subsequent introduction in the production process [18, 19].

This requires significant investment in the development of the semiconductor industry, including the manufacture of microprocessors.

REGULATION OF THE DEVELOPMENT OF RADIOELECTRONICS IN THE RUSSIAN FEDERATION

The authors of the study used data of the Federal Tax Service of Russia (further — FTS) and Rosstat on the type of economic activity associated with the production of computers, electronic and optical products (OKVED 20). In July 2019, Government Decree from 10 July 2019 No. 878 "On measures to stimulate the production of radio-electronic products in the territory of the Russian Federation in the implementation of procurement of goods, works, services for the provision of state and municipal needs, on amendments to Government Decision from 16 September 2016 No. 925 and recognition of certain acts of the Government of the Russia" was decided to form the Unified Register of Russian Radio-electronic Products. The same document approved the rules for the establishment and maintenance of this register. The register of radio-electronic products published by the

Table

The Global Production of Semiconductors by Regions, Number of Units Produced per Month

Region, country	Industrial power (number of produced units)	The share of world market, %
Taiwan	4126	21.8
South Korea	4033	21.3
Japan	3168	16.8
North America	2426	12.8
China	2361	12.5
Europe	1138	6
Rest of the world	1646	8.7
Total	18897	100

Source: IC Insights Report. URL: https://www.techinsights.com/the-mcclean-report-research-bulletin (accessed on 22.11.2022).

Ministry of Industry and Trade of the Russian Federation. The first performances were done in October 2019. The inclusion of the names of products in this register is a condition of the participation of the companies themselves in state and municipal tenders.

There is another register, approved by the same amendment of the Government, established to ensure infrastructure security of the Russian Federation. This document provides the names and codes of the Russian national product classification, which are based on the economic activities of goods, and on which limits are applied when purchasing for state and municipal purposes if they are of foreign origin.

The constraints imposed by the requirement to register both radio-electronic products and their manufacturers limit the number of possible receivers of tax benefits and governmental subsidies. Russian tax legislation provides for organizations producing radio-electronic products, benefits on payment of income tax and insurance contributions to extrabudgetary funds. So corporate income tax is reduced from 20% to 3%,[3] and insurance contributions — from 30 to 7.6%.[4] Profits tax benefit is urgent until the end of 2024.

From 2023 to stimulate investment in capital, a new benefit in the form of an increase coefficient to the depreciation rate not higher than 3[5] is introduced, provided that this equipment is available in a single Register of Russian Radio-electronic Products. This benefit encourages buyers to acquire the main assets of domestic production.

The reduced rates of insurance premiums should reduce the taxpayer's costs of wages, which are taken into account in taxation. The demand for the benefit can be judged by changes in the amounts of funds credited

[3] Para. 1.16 art. 284 Tax Code of the Russian Federation. URL: https://www.consultant.ru/document/cons_doc_LAW_28165/eb9180fc785448d58fe76ef323fb67d1832b9363/ (accessed on 22.09.2023).

[4] Para. 18 pp. 1, para. 8 p. 2 art. 427 Tax Code of the Russian Federation. URL: https://www.consultant.ru/document/cons_doc_LAW_28165/c5c16c86f95c5db63601047b1c0a5942bd77c824/ (accessed on 22.09.2023).

[5] Para. 5 pp. 2 art. 259.3 Tax Code of the Russian Federation. URL: https://www.consultant.ru/document/cons_doc_LAW_28165/ad6e31e62418ce6768a1215342837d033553217e/ (accessed on 22.09.2023).

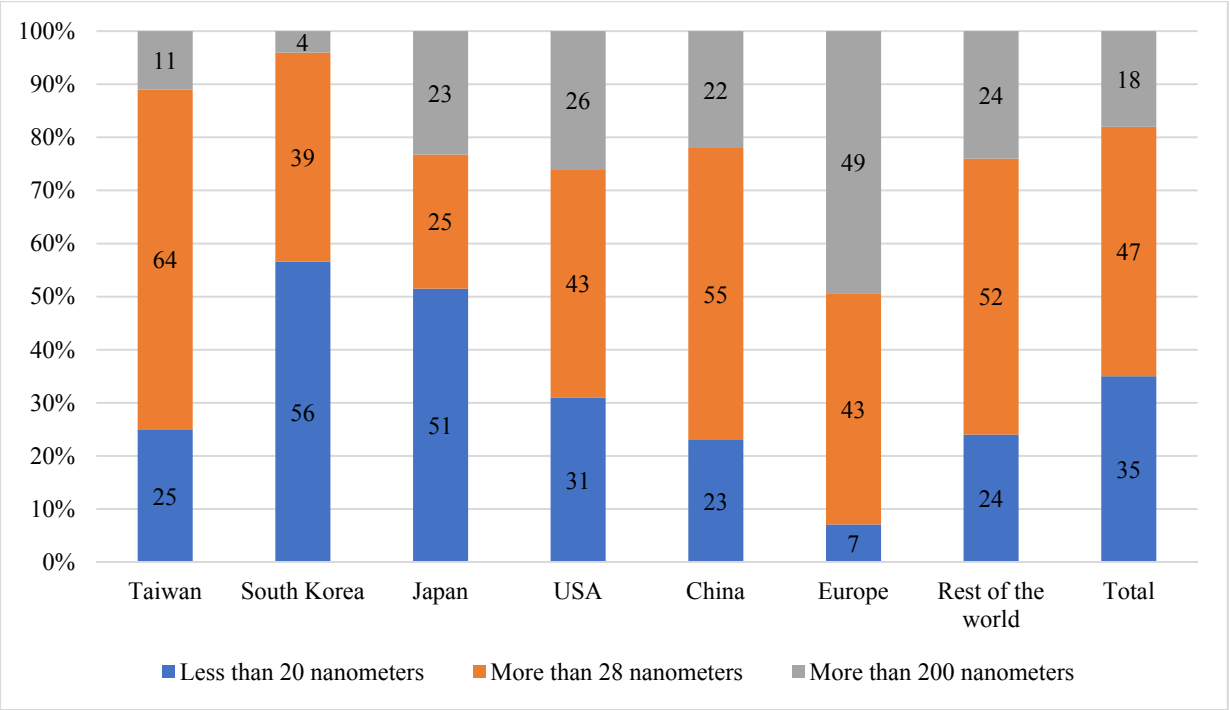


Fig. 2. **The Allocation of Global Production of Semiconductors by Project Norms, %**

Source: IC Insights Report. URL: https://www.techinsights.com/the-mcclean-report-research-bulletin (accessed on 19.11.2022).

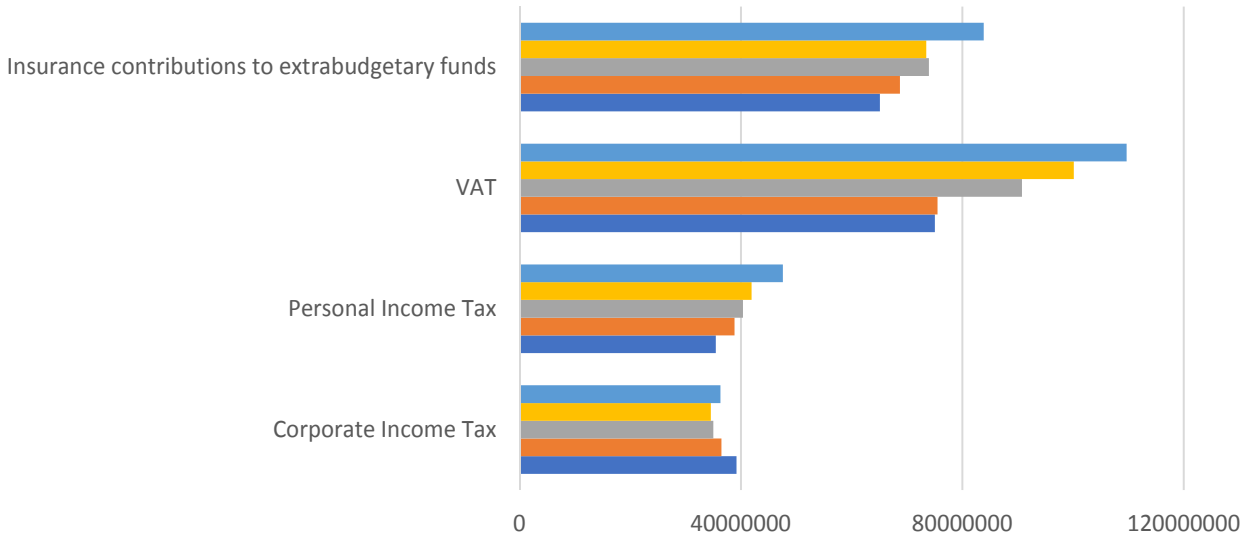
to extrabudgetary funds. They should fall significantly when preference is used. This is supported by data from Russia's FTS (*Fig. 3*). In 2020 there was a decrease of 1% in the deductions to extrabudgetary funds compared to 2019. The further increase in insurance premiums was attributable, according to the authors, to an increase in the average wage of employees engaged in the production of computers, electronic and optical products (*Fig. 4*).

If beneficiary organizations use the release funds to expand staff or to increase wages, there will be an increase in personal income tax (further — PIT) revenues from this category of taxpayers who act as tax agents to their employees. It can be identified using Rosstat (*Fig. 4*), and FTS of Russia (*Fig. 3*). The wages of workers engaged in the production of computers, electronics and optics are traditionally higher than the average for all economic activities, but at the same time in 2021 it showed a higher rate of growth.

The same trend is observed with PIT revenues to the consolidated budget of the Russian Federation (*Fig. 3*). Thus, in 2021, PIT revenue growth compared to the previous year was 13.5%, while in the previous periods from 2018 to 2020 this indicator was 9.5, 3.9 and 3.8% respectively.

Average nominal gross salary in average for all economic activities in 2021 increased by 11.5% compared to 2020, while in organizations engaged in the production of computers, electronic and optical products growth was 14% (*Fig. 4*). During the survey period from 2017 to 2018, this was the first case of exceeding the industry indicator above the average for all activities. Thus, in the period from 2018 to 2020, the growth of the total monthly average was 11.6, 9.5 and 7.2% respectively. These data always exceeded those in the industry surveyed, which were 9.7, 4.8 and 4.9% in the same period, respectively.

Corporate income tax benefits leave more money at the taxpayer's disposal after payment of this fiscal payment. In granting such preferences, the State is interested that these funds should be directed primarily towards investment in equity capital. However,



	Corporate Income Tax	Personal Income Tax	VAT	Insurance contributions to extrabudgetary funds
2021	36285048	47573429	109690205	83852775
2020	34566198	41907076	100128555	73492604
2019	35010160	40358900	90774556	73966919
2018	36460843	38837519	75508420	68715570
2017	39204750	35443215	75053103	65098035

2021 2020 2019 2018 2017

Fig. 3. **Tax Revenues to the Consolidated Budget of the Russian Federation from Organizations Engaged in the Production of Computers, Electronic and Optical Products (Thous. Rubles)**

Source: Data from the Federal Tax Service of Russia according to form 1-NOM. URL: https://www.nalog.gov.ru/rn77/related_activities/statistics_and_analytics/forms/ (accessed on 22.09.2023).

Rosstat data indicate a fall in the physical volume index of investments for the type of economic activity under investigation (*Fig. 5*). At the same time, average indicators of economic activity are significantly better, and not all year's show a decline compared to the previous period. However, the sharp decline in equity investment has been paused after the implementation of income tax benefits in 2020 [20].

RUSSIAN GOVERNMENT SUBSIDY FOR RADIO ELECTRONICS

State stimulation of the radio-electronics industry in the Russian Federation is not limited to tax benefits. The state programme "Development of electronic and radio-electronic industry"[6] provides for the allocation of subsidies to domestic producers of radio electronics. As early as November 2020 by the Order of the Government of the Russian Federation[7] from the reserve fund was allocated 300 000 thous. rubles. The indicator of efficiency of expenditure of these funds was the increase in the share of domestic radio electronic products in the

[6] State programme of the Russian Federation "Development of electronic and radio-electronic industry for 2013–2025" (approved by the Order of the Government of the Russian Federation from 15.12.2012 No. 2396. URL: http://government.ru/rugovclassifier/837/events/ (accessed on 21.02.2023).

[7] Order of the Government of the Russian Federation from 07.11.2020 No. 2893. URL: http://www.publication.pravo.gov.ru/Document/View/0001202011110012 (accessed on 21.02.2023).

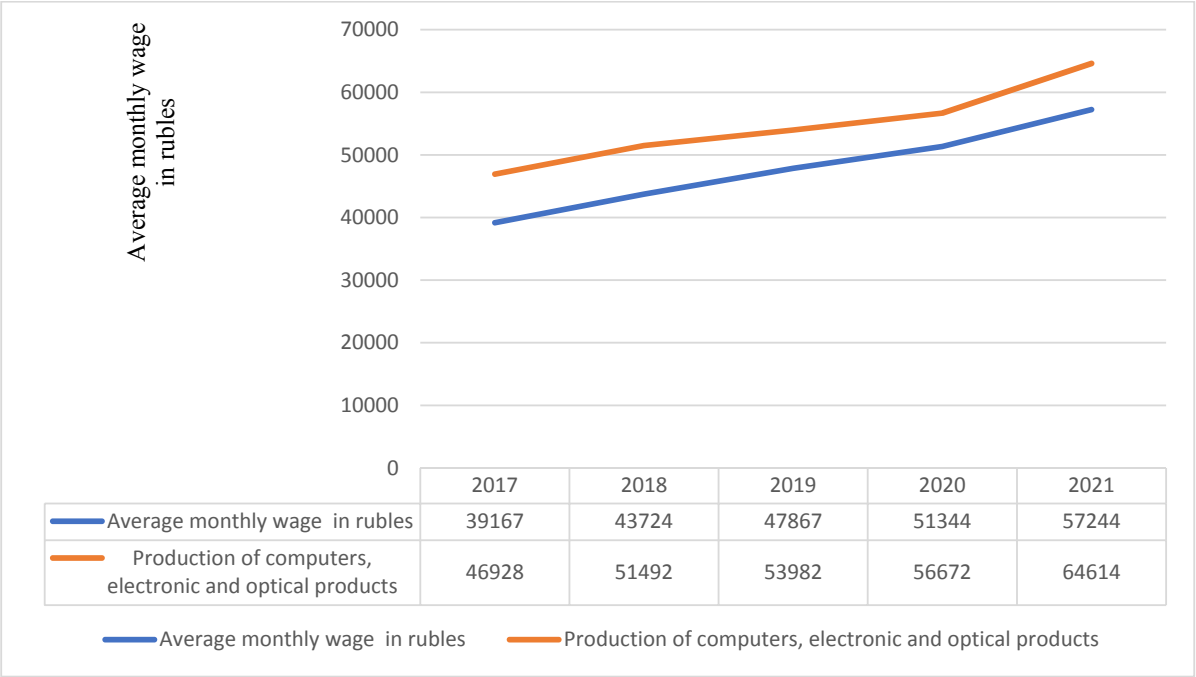


Fig. 4. **Average Monthly Nominal Accrued Wages of Employees (in Rubles)**

Source: Rosstat data URL: https://rosstat.gov.ru/labor_market_employment_salaries (accessed on 21.02.2023).

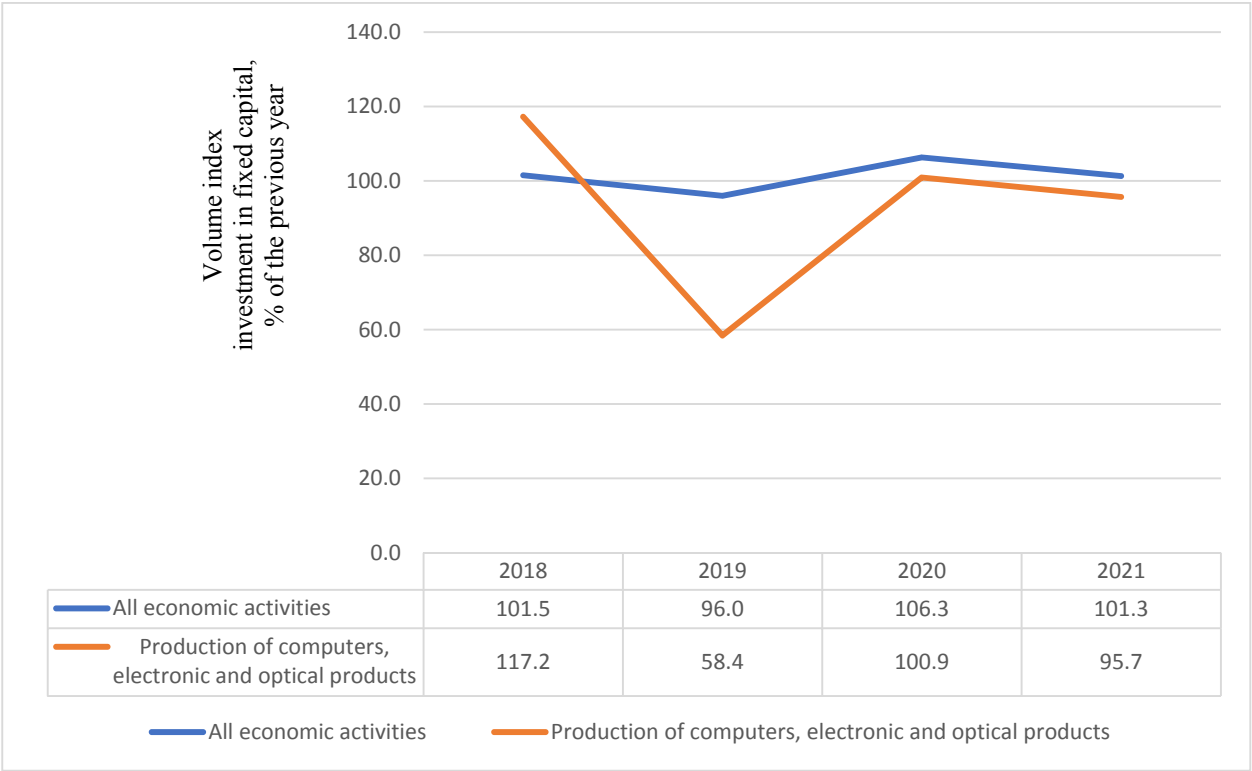


Fig. 5. **Index of the Physical Volume of Investments in Fixed Assets Aimed at Reconstruction and Modernization (in Comparable Prices, in % to the Previous Year)**

Source: Rosstat data. URL: https://rosstat.gov.ru/folder/11189 (accessed on 21.02.2023).

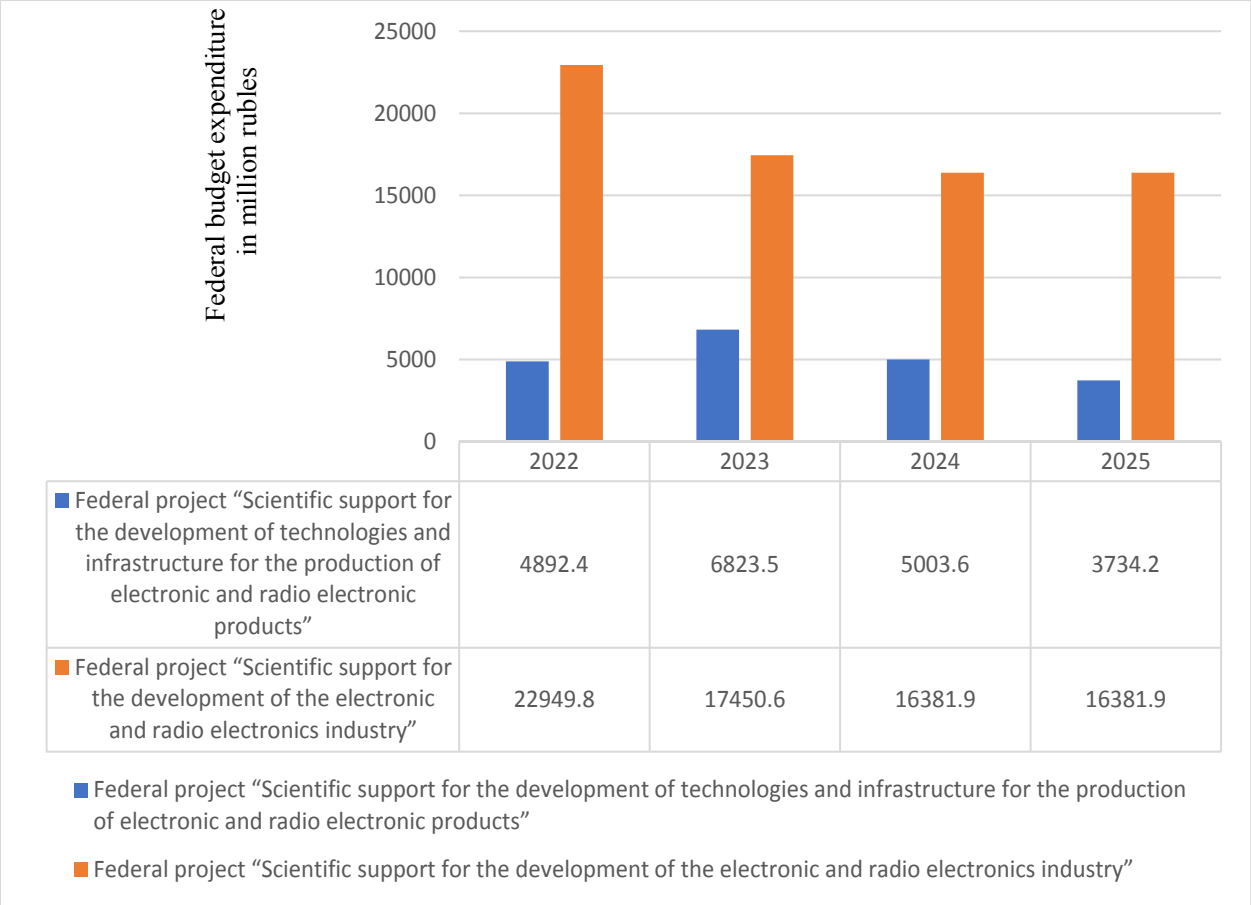


Fig. 6. **Federal Budget Expenditures in 2022–2025 for the Implementation of the State Program "Scientific and Technological Development of the Russian Federation" in Million Rubles**

Source: Explanatory note to the draft federal law "On the federal budget for 2023 and for the planning period of 2024 and 2025". URL: http://council.gov.ru/media/files/Qulh2hVvqtqSKTWVRmOkAeLYvJClXJvi.pdf (accessed on 21.02.2023).

total volume of semiconductors sold on the domestic market. The economic mechanism of subsidies of this kind is to compensate the costs of Russian semiconductors producers for the production of domestic products, the cost of which is higher than that of foreign competitors.

Rules of distribution of subsidies from the federal budget to domestic producers of radio electronics approved by the Government of the Russian Federation Decree from 24.07.2021 No. 1252. According to this document, allocated funds are to be spent to compensate up to 90% of the cost of establishing an electronic component database. Government support is provided on the basis of competitive selection. This document imposes a number of restrictions on potential recipients of federal budget support. Thus, the project for which the state subsidy is granted should be completed within five years. A list of expenses that can be covered by the budgetary resources available is also provided. Wages, R&D, and investment in basic assets are all examples.

Subsequently, the Government of the Russian Federation from 27.09.2021 No. 1619 "On approval of the Rules of granting subsidies from the federal budget to Russian companies for financial support of part of the costs associated with the introduction of Russian products of the radio-electronic industry" approved the rules of compensation from the Federal Budget of expenses already associated

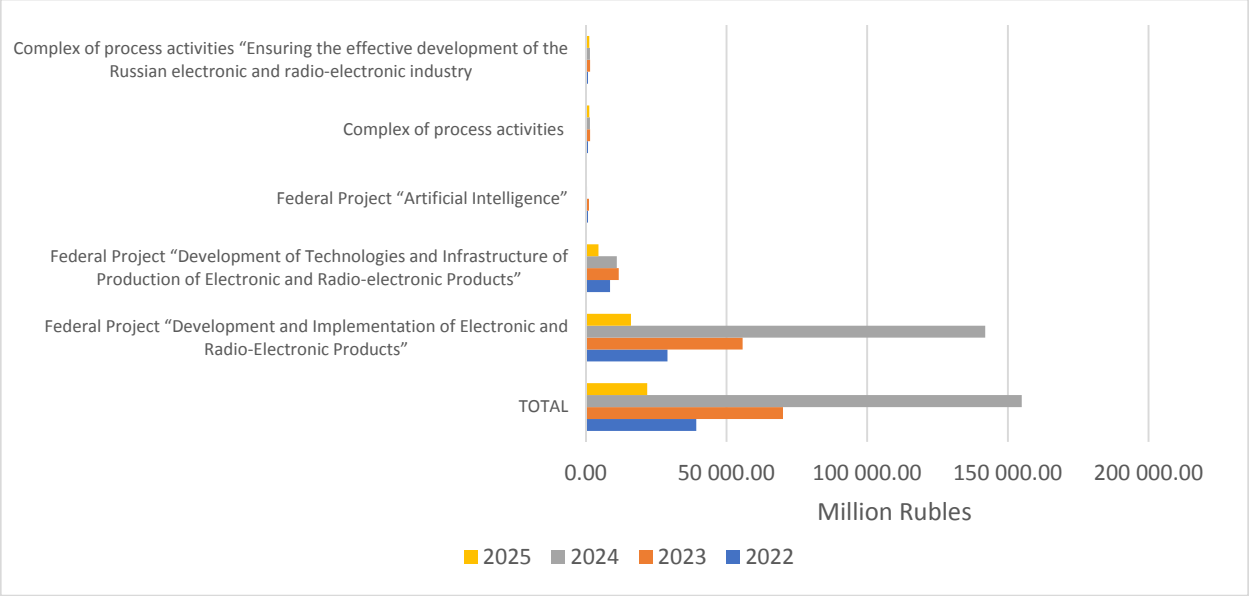


Fig. 7. **Federal Budget Expenditures in 2022–2025 for the Implementation of the State Program "Development of the Electronic and Radio-Electronic Industry" in Mln Rubles**

Source: Explanatory note to the draft federal law "On the federal budget for 2023 and for the planning period of 2024 and 2025". URL: http://council.gov.ru/media/files/Qulh2hVvqtqSKTWVRmOkAeLYvJClXJvi.pdf (accessed on 21.12.2022).

to the implementation of domestic products of radio-electronic industry.

Analysis of the planned expenditure of the federal budget for 2023–2025 allows to make a conclusion about the change in the amount of funds to be allocated in comparison with 2022 for the scientific support of the development of electronic and radio-electronic industry within the framework of the state programme "Scientific and technological development of the Russian Federation" (*Fig. 6*).

But the state programme "Development of electronic and radio-electronic industry" budget appropriations are planned to increase (*Fig. 7*). The main example of this programme is funding for the federal project "Development and implementation of electronic and radio-electronic products". The share of this project in the federal budget expenditure for the development of the radio-electronics industry is 73.88, 79.49, 91.6 and 73.47% in 2022, 2023, 2024 and 2025 respectively.

The federal budget in the departmental structure of expenditure provides for the allocation to the Ministry of Industry and Trade of the Russian Federation for the State Programme of Russia "Development of electronic and radio-electronic industry" in 2023–1 135 292.2 thous. rubles, and in 2024–478 592.8 thous. rubles.[8]

Indicators of the effectiveness of the implementation of the state program "Development of electronic and radio-electronic industry" are the increase in the share of production of domestic electronics industry both in the domestic and world markets with the increase of the volume of the production of such products in monetary equivalent. In addition, the growth in labor productivity and the number of jobs in the industry, as well as the amount of investment in production funds, are taken into account.

CONCLUSION

Based on a review of the international radio-electronics industry, it was discovered that:

[8] Appendix 12 to the Federal Law from 05.12.2022 No. 466 "On the federal budget for 2023 and the planned period of 2024 and 2025". URL: http://www.consultant.ru/document/cons_doc_LAW_433298/ (accessed on 05.01.2023)

• the development of the radio electronics market is a key challenge for most of the world's leading economies, given the sustained growth of the market from year to year by more than 20%;

• Russian radio electronics sector has a number of key problems that prevent successful developments in this sector, namely: Russia's technology lags 10–15 years behind the world level, difficulties with the development of technological processes for the production of microprocessors on thin plates (below 180 nanometers), lack of production equipment and capacities, high dependence of architecture and product design on foreign technologies and materials, low investment attractiveness, inability to provide the domestic market with the necessary electronics, lack of personnel, as well as high cost of production of the final product itself.

According to the results of the analysis of tax benefits for the radio-electronic industry, as well as the statistics of FTS of Russia and Rosstat, the interrelationships and patterns between the measures provided by the state tax benefit of this industry and macroeconomic indicators have been identified. As a result of this condition, the following criteria for assessing the demand and effectiveness of fiscal preferences for the activity under examination have been developed, which can serve as universal indicators of the efficacy of tax benefits for any category of taxpayers:

• a positive change in the rate of wage growth in the industry;

• a decrease in the rates of growth of deductions to extrabudgetary funds compared to the rates for the growth of the wage fund, the amount of which can be estimated by the paid PIT;

• an increase in the number of employees in the industry;

• a growth in the revenue of enterprises of the industry, which is indirectly evidenced by the increase in VAT revenues;

• a positive dynamic of the index of physical volume of investments in capital, which exceeds the rate of growth of this indicator for all types of economic activity;

• a decrease in the share of imports of preferential products.

It concluded that if the mechanisms indicated above are implemented for the purpose of future development and preservation of the domestic radio electronics sector, Russia has every chance of overcoming the significant lag of the economy's industry from other leading economies across the world.

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 16.01.2023; revised on 19.02.2023 and accepted for publication on 28.02.2023. The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-43-54
UDC 336.64(045)
JEL D25

State Support of Investment Projects Within the Framework of an Agreement on the Protection and Promotion of Capital Investments: A Methodological Rationale

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ABSTRACT

The subject of research is economic interactions related to the implementation of an investment project within the framework of an agreement on the protection and promotion of investments (hereinafter referred to as the APCI). **Purpose:** methodological substantiation of the expediency of providing state support measures to ensure the minimum profitability of an investment project implemented within the framework of the APCI. **Objectives:** to propose an indicator that reflects the minimum profitability of an investment project, the mechanism for its usage to determine state support measures, additional state support measures in cases where they are not sufficiently established in the legislation. **Methods:** analysis of approaches to determining the discount rate; statistical (observation, grouping, method of indicators) for calculating industry-specific ROIC values; content analysis to select state support measures. **Results:** it is proposed to use the ROIC indicator as the minimum profitability of a commercial investment project. The indicator was calculated according to the data of all organizations that are not subjects of medium and small enterprises operating in the period 2012–2021. The sample included 133 organizations that make up eight subclasses of Russian classifier of types of economic activity (pulp and paper production; production of fertilizers and nitrogen compounds; production of pesticides, etc.; production of paints, varnishes, etc.; production of pharmaceutical substances; production of medicines; activities in the field of telecommunications; development of computer software). Based on the data from 1011 observations, the median value of ROIC for each subclass was calculated, the reliability of which is confirmed by the approved minimum rates of return on invested capital for calculating the tariffs of regulated organizations. A mechanism is proposed for using ROIC to determine state support measures within the framework of the APCI, including: determining the median value of ROIC for foreign economic activity, calculating ROIC for an investment project, and determining state support measures by their ratio. As additional measures of state support within the framework of the APCI, it is proposed to establish tax preferences (lower tax rates, tax benefits, tax deductions), as well as accelerated depreciation of fixed assets. The proposed developments create a methodological basis for substantiating the provision of various state support measures within the framework of the APCI.

Keywords: an agreement on the protection and promotion of capital investments; state support of investment projects; stabilization clause; budget subsidies; discount rate for the investment project; minimum profitability of the investment project; return on invested capital (ROIC); government support measures based on ROIC

For citation: **Tyutyukina E.B., Egorova D.A. State support of investment projects within the framework of an agreement on the protection and promotion of capital investments: A methodological rationale. *Finance: Theory and Practice*. 2023;27(5):43-54. DOI: 10.26794/2587-5671-2023-27-5-43-54**

INTRODUCTION

Federal Law from 01.04.2020 No. 69 "On the Protection and Promotion of Capital Investments in the Russian Federation" [1] (further — Federal Law No. 69) provides for state support measures (further — state support) for organizations implementing investment projects (further — OIP), that have concluded an agreement on the protection and promotion of capital investments (SPIC) with public law entity (further — PLE). Investment projects (further — IP) have to satisfy the following criteria:

1) to be new, to be implemented in the following areas:

- creation, construction, reconstruction, modernization of real estate objects or complex of related property objects and their subsequent operation;
- creation and use of results of intellectual activity or means of individualization;

2) have strategic importance for the economic development of the country (refer to a specific sphere of the economy);[2]

3) to be done for the purpose of profit and/or other desirable result, such as preventing or minimizing negative environmental impacts;

4) have a minimum capital investment [depending on the scope of activity and the type of public law entity (further — PLE), that is a party to the SPIC].

In accordance with Federal Law No. 69, the Government of the Russian Federation, in addition to the state support measures established in this law, can introduce other measures, as the criterion for which the minimum return on investment project (further — MROI) is claimed to be ensured.[3] At the same time, there are no clarifications on this issue in Federal Law No. 69.

In our view, in the SPIC framework, the MROI indicator should be used to justify both the OIP' state support measures already provided to Federal Law No. 69 and the introduction of new ones.

THE SELECTION OF AN INDICATOR WITH THE LOWEST RETURN ON INVESTMENT

The indicator reflecting the MROI is the discount rate used in the calculation of the cost effectiveness of the investment project (indicators NPV, PI, DPP) [1]. Scientific literature offers different approaches to its calculation.

Most authors consider the WACC (weighted average cost of capital) method as a discount rate [2–5]. It is noted that in practice, the CAPM model is mainly used to calculate the value of the company's equity [6]. S. V. Kuzina and P. K. Kuzin recommend applying the value of capital (WACC) of the project to determine value for an economically deprived investment project, and using the enterprise's WACC discount rate for an enterprise-integrated project when it is difficult to allocate cash flows on it [3, 4]. They also recommend the use of the WACC method only if the project's residual cash flow cannot be estimated or when the investment budget has not been approved at the stage of the initial feasibility study of the investment project, and the ROE is the fairest estimate of the value of equity. The complication of the practical implementation of WACC in emerging capital markets, according to N. V. Voronina and V. G. Zaretskaya, is determining what value to use in calculations as a discount rate (factual for a period, average for several periods, or prediction) [5]. M. Jacobs notes that, despite the prevalence of the WACC method, in practice companies rely on a discount rate above the weighted average value of capital to take account of additional risks [7]. The

[1] Federal Law from 01.04.2020. No. 69 "On the Protection and Promotion of Capital Investments in the Russian Federation". Consultant Plus. URL: https://www.consultant.ru (accessed on 20.02.2023).

[2] Federal Law from 28.06.2022. No. 226 "On Amendments to the Federal Law "On the Protection and Promotion of Capital Investments in the Russian Federation". Consultant Plus. URL: https://www.consultant.ru (accessed on 20.02.2023).

[3] Federal Law from 28.06.2022. No. 226 "On Amendments to the Federal Law "On the Protection and Promotion of Capital Investments in the Russian Federation". Consultant Plus. URL: https://www.consultant.ru (accessed on 20.02.2023).

WACC indicator is used in the Russian economy as a minimum return on invested capital (ROIC) in the calculation of tariffs for services of natural monopolies,[4] determined by the formula[5]:

$$NI = 0.3 \cdot (GBY + RPI_m) + 0.7 \cdot (GBY + RPE_m), \quad (1)$$

where GBY — risk-free rate proposed by the Ministry of Economic Development of the Russian Federation (equal to the average ruble government bonds yield), %; $RPI_м$ — risk premium for investing in debt liabilities (may not be less than 3%); $RPE_м$ — risk premium for investment in equity (defined by the regulatory authorities and not less than 6%).

This approach is acceptable in this case because the problem of limiting tariff growth is solved, and the profitability of regulated companies is ensured through budgetary subsidy.For companies, however, IP can only be considered cost-effective provided the following conditions are achieved:

$$IRR \succ WACC, \quad (2)$$

where IRR — internal rate of yield, characterizing the maximum yield of IP.

It contrasts an IP's minimum and maximum achievable yield, with an IP considered effective when its yield exceeds the minimum.

According to the SPIC paradigm, IP realization is the development of real estate objects (the results of the intellectual activity) and their subsequent commercialization (another positive impact). Therefore, for OIP, IP yield is the return in the form of the results of operational (current) activity on the capital invested in the project. Providing MROI at the WACC level for OIP is not cost-effective.

The discount rate is sufficiently justified by the cumulative method [2–4]. As noted by A. Komzolov et al. [2], its advantage is the ability to evaluate specific risks, which is especially important in changing circumstances, and its disadvantage is the expert approach to their evaluation, which reduces objectivity [2]. It should be noted that the cumulative method is used in Russia to calculate the discount rate for a public partner when implementing PPP-projects.[6] However, as N.V. Voronina and V.G. Zaretskaya note, taking all risk variables into account significantly increases the discount rate, making investment projects ineffective [5].

Other approaches to calculating the discount rate are less common. For example, A. Toleugazy recommends using *ROA* and

[4] Order of FAS of Russia from 14.10.2021. No. 1108/21 "On approval of the minimum rate of return on invested capital for the calculation of tariffs in the sphere of water supply and drainage using the return on investment capital created before (after) the transition to tariff regulation with the application of the return upon investment capital method for the long-term regulation period with the beginning of the long period of regulation in 2022" (registered with the Ministry of Justice of Russia from 28.12.2021. No. 66633). Consultant Plus. URL: https://www.consultant.ru (accessed on 20.02.2023). Decree of the Government of the Russian Federation from 29.12.2011. No. 1178 (ed. 01.09.2022) "On pricing in the field of regulated prices (tariffs) in the electricity industry" (together with "Basics of pricing for regulated price (tariffs) in electrical power industry", "Rules of state regulation (revision, application) of prices (targets) in electric power industry"). Consultant Plus. URL: https://www.consultant.ru (accessed on 20.02.2023). Order of FTS of Russia from 27.12.2013. No. 1746 (ed. 05.07.2022) "On approval of the Methodical Guidelines for the calculation of regulated tariffs in the sphere of water supply and sanitation" (registered in the Ministry of Justice of Russia from 25.02.2014. No. 31412). Consultant Plus. URL: https://www.consultant.ru (accessed on 20.02.2023). Order of the Ministry of Economic Development of Russia from 30.11.2015. No. 894 "On approval of the Methodology for evaluating the effectiveness of the public-private partnership project, the project of the municipal-private partnership and determining their comparative advantage" (registered in the Russian Justice Ministry from 30.12.2015. No. 40375). Consultant Plus. URL: https://www.consultant.ru (accessed on 20.02.2023).

[5] Order of FTS of Russia from 27.12.2013. No. 1746 (ed. 05.07.2022) "On approval of the Methodical Guidelines for the calculation of regulated tariffs in the sphere of water supply and sanitation" (registered in the Ministry of Justice of Russia from 25.02.2014. No. 31412). Consultant Plus. URL: https://www.consultant.ru (accessed on 20.02.2023).

[6] Order of the Ministry of Economic Development of Russia from 30.11.2015. No. 894 "On approval of the Methodology for evaluating the effectiveness of the public-private partnership project, the project of the municipal-private partnership and determining their comparative advantage" (registered in the Russian Justice Ministry from 30.12.2015. No. 40375). Consultant Plus. URL: https://www.consultant.ru (accessed on 20.02.2023).

ROE, indicators, assuming that they account for all of the risks associated with a specific type of activity, as opposed to the WACC, which is based on capital market interest rates [8]. D. Chai et al. [9] suggest the use of the multiplier method (P/E), and a number of authors — suggest the *ROCE* (*ROIC*) indicator [10]. For example, I. Yu. Lukasevich [11], K. Arjunan [12–15] consider that for commercial investment projects the return on invested capital should exceed its value (*ROIC* > *WACC*), so this indicator can be used as a discount rate. A similar position is shared by O.K.S. Emiola et al., considering *ROIC* as a criterion for ensuring the minimum required return when selecting projects into the portfolio [16].

It should be noted that the implementation of Federal Law No. 69 is intended to protect and promote specifically the invested capital, because under SPIC capital investments mean income OIP invested in IP at the pre-investment and investment stages, which can be both own and borrowed.[7] Therefore, the most reasonable for determining the minimum return on an investment project for the purposes of Federal Law No. 69 is the ROIC.

The *ROIC* indicator has the following advantages:

- other analytical tools, it indicates the results of the company's the main (operational) activities in their most basic form (*ROE*, *ROA*)[8];
- not only gives a more accurate measure of the return, but also allows to compare it with the cost of attracting capital (*WACC*) in order to evaluate the quality of the investment of the company [1];
- it has industry specificity. Investment projects implemented for operational activities can be considered to a certain extent as projects-analogue for organizations of the same industry/type of economic activity, then the indicator can characterize industry levels of return-on-investment projects and be considered within the SPIC as MROI. Under the SPIC, the MROI can be the median value of the ROIC calculated for each type of economic activity.

In the literature, two approaches can be identified to calculate the return on invested capital in the operational activities of the company:

1) formulas (3), (4) [17], (5) [18] based on operating profit:

$$ROIC = \frac{OI_t * (1-T)}{BVofIC_{t-1}}, \quad (3)$$

$$ROIC = \frac{OI_t * (1-T)}{ABVofIC}, \quad (4)$$

$$ROIC = \frac{NOPAT}{IC}, \quad (5)$$

where *ROIC* — return on invested capital; OI_t — operating income for the period t; T — corporate tax rate; $BVofIC_{t-1}$ — book value of invested capital; *ABVofIC* — average book value of invested capital; *NOPAT* — net operating profit after taxes; *IC* — invested capital.

A. Damodaran uses the following formula (6) to determine the invested capital:

$$IC = BV_D + BV_{Eq} - Cash, \quad (6)$$

where BV_D — book value of debt; BV_{Eq} — book value of equity; and *Cash*;

2) formulas (7) and (9) based on operational cash flow [17]:

$$CashROIC = \frac{OI_t * (1-T) + D\&A}{GFA + Non - cashWC}, \quad (7)$$

$$GFA = NFA + AD, \quad (8)$$

[7] Federal Law from 28.06.2022. No.226 "On Amendments to the Federal Law "On the Protection and Promotion of Capital Investments in the Russian Federation". Consultant Plus. URL: https://www.consultant.ru (accessed on 20.02.2023).

[8] The ROA lacks the necessary proportionality between the numerator and the denominator, the ROE incorporates the financing structure to the core activity.

where *CashROIC* — cash on invested capital; $D\&A$ — depreciation & amortization; *GFA* gross fixed assets; $Non-cashWC$ — cash working capital; *NFA* — net fixed assets; *AD* — accumulated depreciation;

$$CFROI = \frac{OCF_t}{ABVofIC}, \quad (9)$$

where *CFROI* — cash flow returns on investments; OCF_t — operating cash flow for the period t.

The differences between the formulas (7) and (9) are that, in one case, investments are taken into account and, in another, invested capital.

ALGORITM OF CALCULATION OF ROIC IN QUALITY OF MINIMAL RETURN OF AN INVESTMENT PROJECT

The algorithm for calculating the *ROIC* on accounting data is presented in *Fig. 1*.

Table 1 presents the results of the *ROIC* estimate by type of economic activity, which may include *SPICs* for IP implementation (*Table 1*).[9]

The composition of the organizations included in the sample was based on the following criteria:

- company is not included in the register of medium and small companies;
- company operating, not in the process of reorganization and liquidation;
- accounting statements (RAS) available in full for the period 2012–2021.

The selection comprised all Russian groups that matched the defined criteria.[10]

The dynamics of the *ROIC*, having the minimum and maximum value of the type of economic activity considered, are presented in *Fig. 2 and 3*.

The validity of the calculations carried out (the ratio between the return on invested capital of regulated and commercial entities) is confirmed, in particular, by the approved minimum rates of return-on-investment capital for the calculation of tariffs in the sphere of heat supply for the long-term period of regulation,[11] which after the transition to the regulation of the tariffs is 9.27%.

DISCUSSION OF SPIC ROIC-BASED GOVERNMENT SUPPORT MEASURES

All possible measures of state support of the *OIP* in implementation of the IP under the *SPIC* are presented in *Table 2*.

Given that the State support measures in Federal Law No. 69 are intended to protect and promote capital investments in order to guarantee the required level of return, we believe that their implementation is only justified in the conditions that follow:

$$ROIC_{av} \le ROIC_{med}, \quad (10)$$

where $ROIC_{av}$ — average annual ROIC for the SPIC's operational implementation of the IP cycle; $ROIC_{med}$ — median value of ROIC calculated for the given type of economic activity.

Otherwise, the formula (11) follows that IP is commercially effective:

$$ROIC_{av} \ge ROIC_{med}. \quad (11)$$

Therefore, the use of OIP of all state support measures under the concluded SPIC, provided for by Federal Law No. 69, will further increase its competitiveness, distorting the conditions of market competition in this type of economic activity.

[9] Federal Law from 28.06.2022. No. 226 "On Amendments to the Federal Law "On the Protection and Promotion of Capital Investments in the Russian Federation". Consultant Plus. URL: https://www.consultant.ru (accessed on 20.02.2023).

[10] Contractor Verification and Analysis Service Rusorofile. URL: https://www.rusprofile.ru/about (accessed on 12.03.2023).

[11] Decree of the Government of the Russian Federation from 29.12.2011. No. 1178 (ed. 01.09.2022) "On pricing in the field of regulated prices (tariffs) in the electricity industry" (together with "Basics of pricing for regulated price (tariffs) in electrical power industry", "Rules of state regulation (revision, application) of prices (targets) in electric power industry"). Consultant Plus. URL: https://www.consultant.ru (accessed on 20.02.2023)

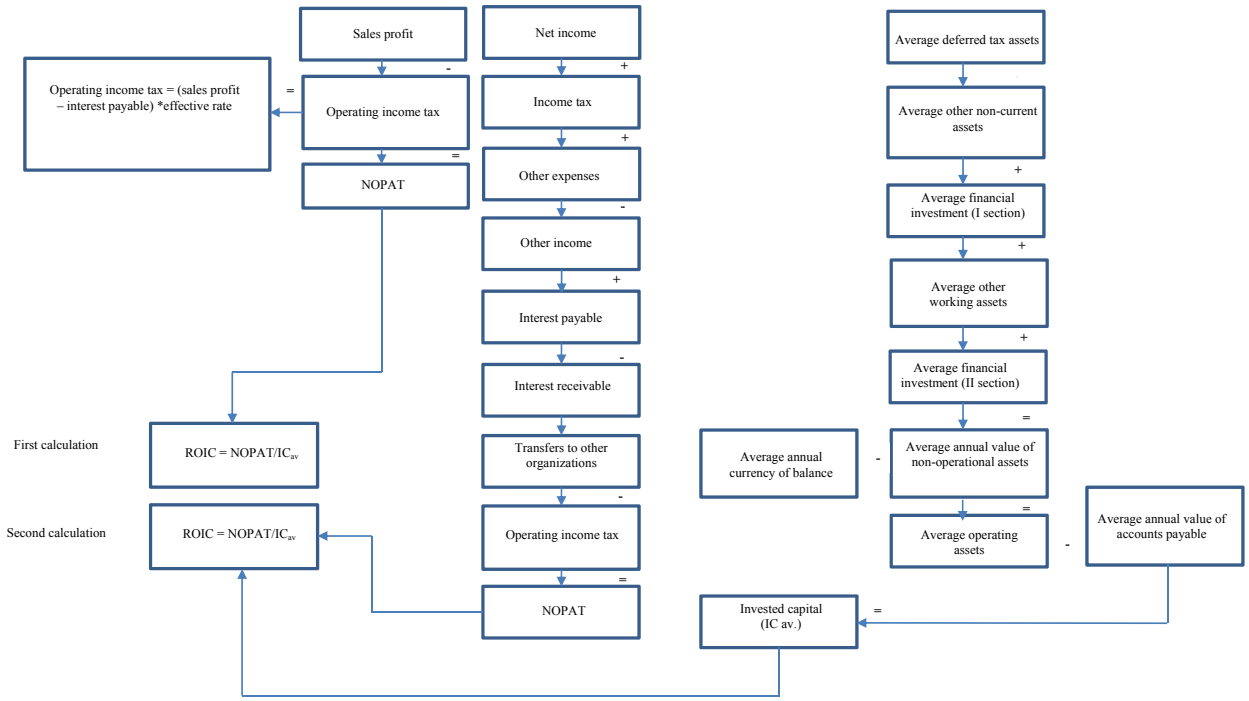

Fig. 1. **Algorithm for Calculating the ROIC Indicator According to Accounting Data**

Source: Compiled by the authors.

The mechanism for the use of the *ROIC* for the application of State support measures in the conclusion of the SPIC may be as follows:

1. Determination of $ROIC_{med}$ by type of economic activity in which IP can be implemented using SPIC.

Currently, Rosstat uses data from financial statements and the State Information Resource of the Accounting Statements of the FTS of the Russian Federation to calculate specific indicators of organizations' activity by type of economic activity in the section named "Financial Results and Effectiveness of the Activities of the Organizations" [in particular, the profitability of products (works, services); the return on assets of organizations, etc.].[12] Similarly, each year Rosstat can calculate the *ROIC*, which in a greater degree, compared to the calculated indicator of the profitability of assets of organizations, characterizes the industry performance of the organizations. The *ROIC* will thus include data for all organizations operating in the reporting year.

The calculation of $ROIC_{med}$ by type of economic activity can be carried out in the government information system "Investment"[13] (further — GIS-Investment) on the basis of Rosstat data and be available for use by all SPIC participants.

2. The calculation of OIP of the $ROIC_{av}$ at the date of conclusion of the SPIC.

Created in accordance with Federal Law No. 69 with the intention of providing information on IP[14] support procedures. A business plan and financial model for the deployed IP are introduced as part of the GIS-Investment process. For the formation of data on the determination of the $ROIC_{av}$ in GIS-Investment should integrate the data of the forecast accounting (financial) reporting on the planned to implement IP, which are usually part of the financial section

[12] Russian Statistical Yearbook. Rosstat. Moscow, 2022:342–345. URL: https://rosstat.gov.ru/storage/mediabank/Ejegodnik_2022.pdf (accessed on 26.03.2023).

[13] Federal Law from 28.06.2022. No. 226 "On Amendments to the Federal Law "On the Protection and Promotion of Capital Investments in the Russian Federation". Consultant Plus. URL: https://www.consultant.ru (accessed on 20.02.2023).

[14] Federal Law from 28.06.2022. No. 226 "On Amendments to the Federal Law "On the Protection and Promotion of Capital Investments in the Russian Federation". Consultant Plus. URL: https://www.consultant.ru (accessed on 20.02.2023).

Table 1

ROIC Data by Types of Economic Activity

No.	Russian Classifier	Number of organizations in the sample	Volume of observations*	Median value		
				NOPAT thous. rubles	IC thous. rubles	ROIC, %
1	Activity code 17.1 "Production of cellulose, wood, paper and cardboard"	39	390	258 698	1 100 153	18
2	Activity code 20.15 "Production of fertilizers and nitrogen compounds"	6	52	11 725 056	15 088 598	26
3	Activity code 20.2 "Production of pesticides and other agrochemical products"	12	120	37 590	22 360	30
4	Activity code 20.3 "Production of paints, varnishes and similar materials for coatings, printing inks and mastics"	13	130	126 028	273 989	26
5	Activity code 21.1 "Production of pharmaceutical substances"	6	60	61 163	384 215	21
6	Activity code 21.2 "Production of medicinal products and materials"	15	150	410 990	1 146 116	40
7	Activity code 61 "Telecommunications activities" (subsidiaries)	26	291	69 156	598 881	16
8	Activity code 61 "Telecommunications activities" (parent companies)	5		40 153 963	183 623 404	23
9	Activity code 62 "Computer software development, telecommunications consultancy and other related services"	11	88	22 483	41 974	12

Source: Author's calculations.

Note: * Number of ROIC indicators included in the median calculation.

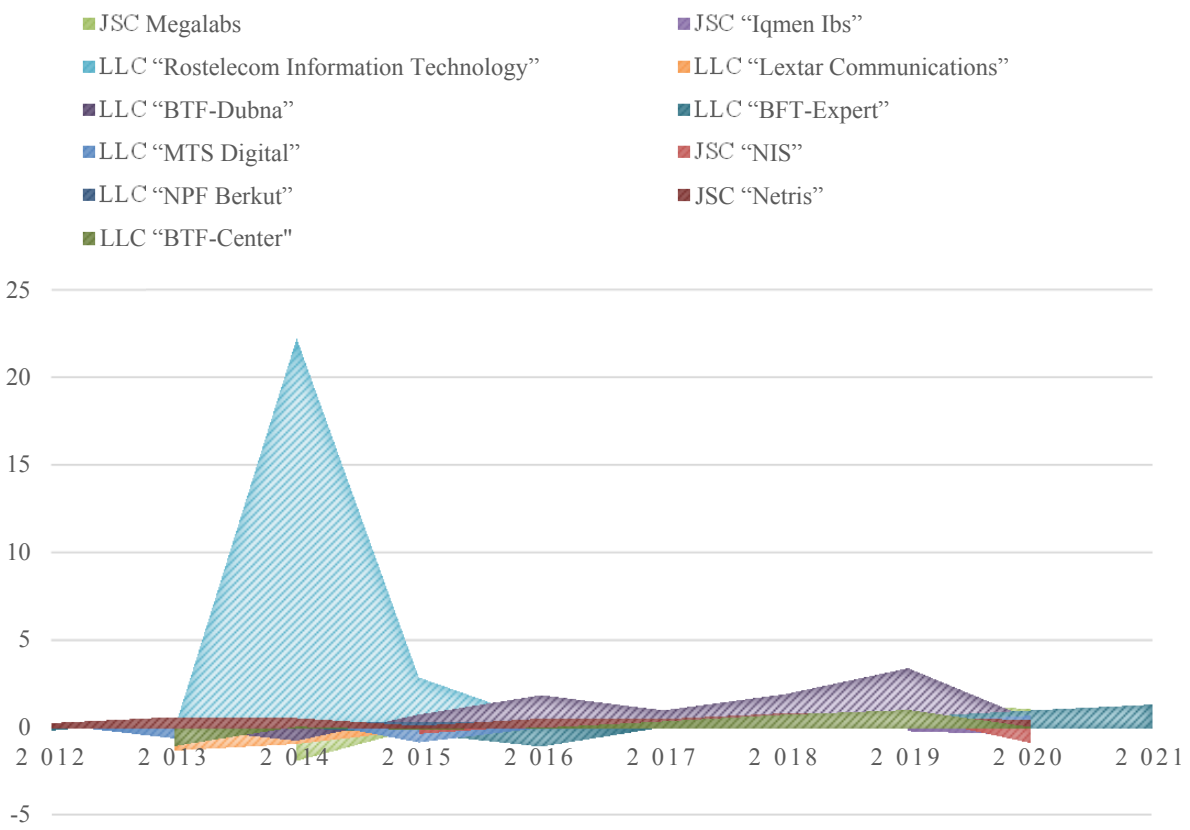

Fig. 2. **Dynamics of the *ROIC* Indicator for Companies Included in Russian Classifier of Types of Economic Activity, Code 62 (62.01 and 62.02)**

Source: Author's calculations.

of the business plan IP. On the day the SPIC concludes, this will forecast the value of $ROIC_{av}$ by IP.

3. SPIC determination of OIP support measures in accordance with the calculated $ROIC_{av}$.

In cases where the ratio between the forecast value of $ROIC_{av}$ by IP and $ROIC_{med}$ by the relevant type of economic activity corresponds to the formula (10), the OIP at the conclusion of the SPIC may be granted all state support measures provided for by Federal Law No. 69.

If the ratio between the forecast $ROIC_{av}$ for IP *и* $ROIC_{med}$ for the relevant type of economic activity corresponds to the formula (11), then it is economically reasonable for the OIP to provide only the support measures that are implemented within the framework of the investment activity of OIP associated with the implementation of the IP when concluding the *SPIC* (*Table 2*).

It should be noted that the Russian legislation provides the most measures of state support IP for special investment contracts (further — SIC), SPIC and concession agreements.

Since the SIC and the *SPIC* address practically similar conditions, it is advisable to use the State support measures applied in SIC (this mechanism has already demonstrated its effectiveness) as an additional state support measure to ensure the MROI implemented in the framework of *SPIC*. In total, these should be indirect financial measures, namely:

1) establishment of reduced tax rates, tax benefits and other preferences (including special procedure and payment periods, procedure of calculation of taxes) on the following types of tax: corporate income tax, corporate property tax, transport and land taxes;

2) for the purpose of computing corporate income tax, accelerated asset depreciation is

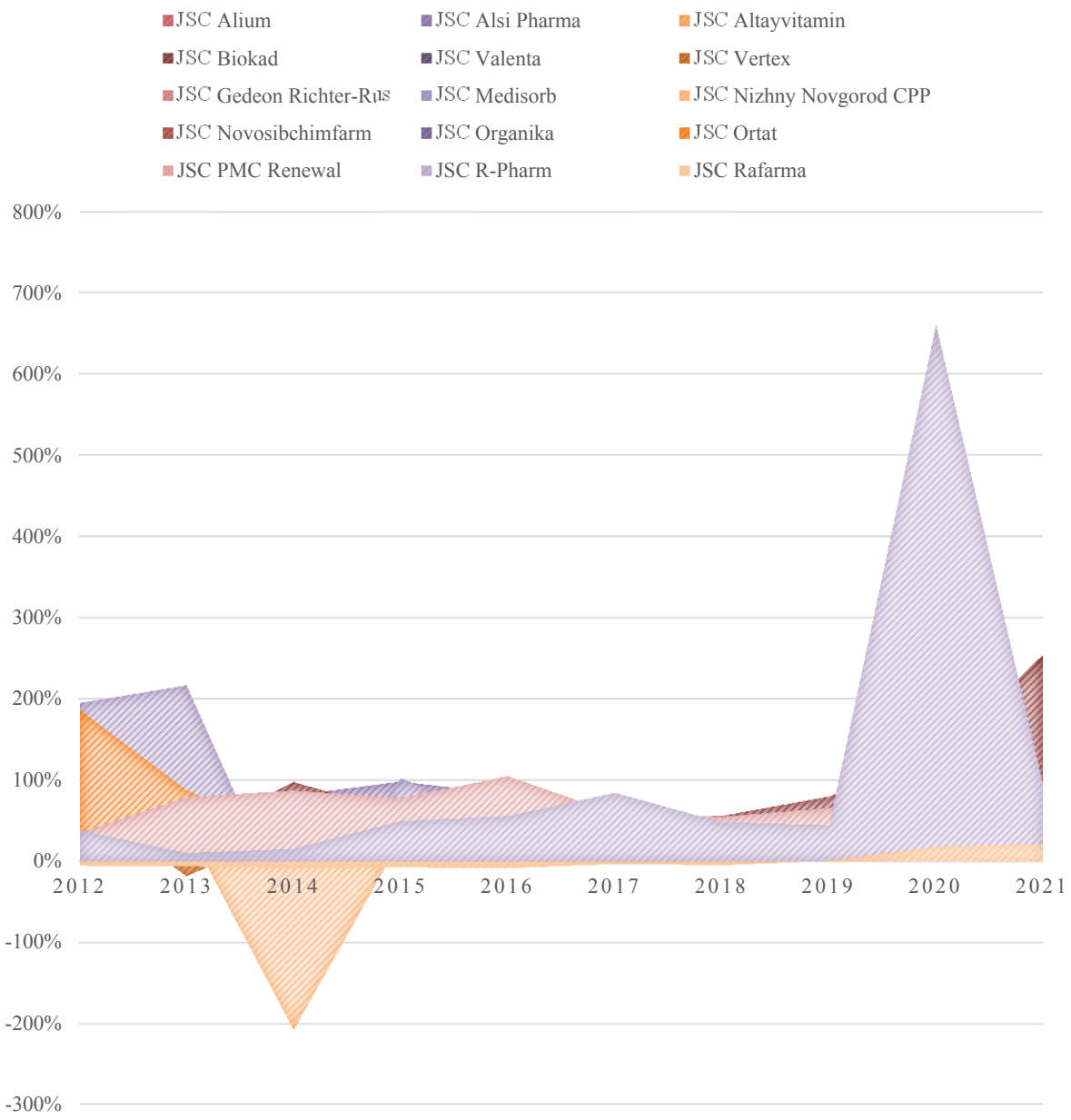

Fig. 3. **Dynamics of the *ROIC* Indicator For Companies Included in Russian Classifier of Types of Economic Activity, Code 21.2**

Source: Author's calculations.

used for SIC-produced items falling under the first through seventh deprecation groups;

3) use of the tax deduction by a private partner, regardless of the existence of a public partner, as initially provided by Federal Law No. 69. At present, this is possible if the *SPIC* party is the Russian Federation. For the OIP, this form of reimbursement would be more appropriate and transparent for tax monitoring within the framework of the *SPIC*.

CONCLUSION

The results of the study allow us to draw the following conclusions:

On the basis of the analysis of different approaches to the choice of discount rate, reflecting the minimum level of IP

Table 2

State Support Measures for the Organization Implementing the Project under the Agreement on the Protection and Support of Capital Investments

No.	State Support of the OIP			
	Measure	Period	Maximum volume	Type of activity within the implementation of the IP
1	Application of the stabilization clause in the following areas of legislation			
1.1	Customs	During the SPIC period	Unlimited	Operating
1.2	Budget	During the SPIC period, equal to the period of State support measure		Investment
1.3.	Land	Within three years of the SPIC's implementation date		Investment, operating
1.4	Urban planning			Investment
1.5	Ecologic			Operating
1.6	Forestry			Operating
2	Cost recovery in accordance with budget legislation	5 years for supporting infrastructure and IP, 10 years — for associated infrastructure	100% for associated, 50% — for providing infrastructure and IP, but not more than the amount of compulsory OIP payments associated with IP implementation	Investment, operating
3	Compensation for real damages OIP by law enforcement agencies	Not before the year after the year of the decision regarding reimbursement		Operating
4	Budget investment	Article 80 of the Budget Code		
5	State guarantees	Article 115.2 of the Budget Code, the Federal Law on the Federal Budget for the next financial year (next financial year and planned period), the decision of the Government of the Russian Federation and agreement on provision of state guarantee to Russia		
6	Features of the application of tax legislation	During the SPIC period, but not beyond the maximum permissible period of stabilization clause	Unlimited	Investment, operating

Source: Compiled by the authors.

returns, for OIPs (commercial organizations implementing IP within *SPIC*), it is proposed to use the *ROIC* indicator. Its advantage over other indicators (reflects the result of the main activity, takes into account the character of the industry, evaluates the quality of investments) is shown. The MROI is proposed to be the median value of the *ROIC* by type of economic activity.

A mechanism for calculating *ROIC* and its use for determining State support measures under the *SPIC* is proposed, including: an algorithm for the calculation of the *ROIC*; determining the median value of *ROIC* by type of economic activity as MROI; calculating the *ROIC* by IP; determination of State aid measures by their ratio (*ROIC* by type of economic activity and *ROIC* by IP). Testing of

the *ROIC* median calculation on the example of nine types of economic activity showed the reliability of the results obtained, which are consistent with the published return on invested capital for regulated activities.

As additional state support measures under the *SPIC*, it is proposed to enable OIP to apply tax deductions regardless of public partner status, as well as to use successful tax preferences (reduced tax rates, tax benefits, tax deductions) and accelerated depreciation of assets to calculate corporate income tax for the implementation of the SIC.

ACKNOWLEDGEMENTS

The article was prepared based on the results of research at the expense of budgetary funds under the state assignment to the Financial University for 2022 (VTK-GZ-PI-16-22). Financial University, Moscow, Russia.

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 12.03.2023; revised on 27.04.2023 and accepted for publication on 26.05.2023. The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-55-66
UDC 336.717.061.1(045)
JEL E50, E51, E52, G10, G21

Directions for Improving the Activities of Regional Banks in the Republic of Tatarstan

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ABSTRACT

The **purpose** of this study is to develop tools for assessing the state of regional banks and to justify decisions on the allocation of resources between their business areas by adapting existing methods of banking management to the new economic environment. The authors apply both general **scientific methods** (induction, deduction, analysis, synthesis) and **special methods**: systematic and retrospective analysis of existing developments in bank decisions. The **results** of the application of these methods are the mathematical models describing the functioning of the credit-deposit and transaction of commercial banks of Tatarstan in the past three years from the point of elasticity of actives and liabilities' substitution. In the paper, we systematized the indicators of actives and liabilities of the five largest commercial banks in Tatarstan in 2019–2022, we approved the equations that characterize these actives and liabilities' substitution elasticity in MS Excel. The **conclusion** is that in most cases, there is a unitary elasticity of their mutual substitution, which leads to the conclusion that the Tatarstan banking system is currently in the growth stage of a new life cycle, which began in 2014, after the Russian economy entered new realities due to sanctions pressure. The recommendations were formulated for the banks of Tatarstan in terms of improving the quality of loan portfolios in new conditions: they should improve the methods of making decisions about the loans for companies' business activities which are first created.

Keywords: regional banks; transactional banking; credit and deposit activity; derivative function; management decision-making

For citation: **Gumerov M.F., Rizvanova I.A. Directions for improving the activities of regional banks in the Republic of Tatarstan. *Finance: Theory and Practice*. 2023;27(5):55-66. DOI: 10.26794/2587-5671-2023-27-5-55-66**

INTRODUCTION

The gaps in the survey of regional banks are largely attributable to the dynamic development of the banking sector, the explosive introduction of digital technologies and services in banking, the emergence of fundamentally new external and internal factors with significant potential and scientific interest for further study. The main factors that have influenced the activities of regional banks over the last 10 years are: consolidation of the banking sector since 2014; accelerated digitization of the economy; significant increase in bank expenditure, including due to the need to invest in the development of financial technologies and regulatory requirements.[1] The directions of the study, which characterize individual components of regional banks, are presented quite widely in the domestic literature. According to the study [1], regional banks are currently being segmented: a greater number of local banks identify priority segments of the banking market. The authors of the paper [2] note that the introduction by the Bank of Russia in 2019 of two types of licenses and division of banks into banks with universal and basic licenses did not lead to a decrease in the concentration in the banking sector, but, on the contrary, only contributed to it. The authors of the study [2–4] proposed to develop proportional regulation mechanisms with a risk-oriented approach as a solution to the problems of concentration of the banking system [5]. Furthermore, the study [6] suggests grouping regional banks based on their financial resilience for improved regulations. In addition, the study [7] confirms and supports the need to construct and develop a unified regional platform to integrate regional banks' resources and efforts in the context of risks. A number of authors [8–10] propose directions for the development of regional banks in the new reality: improving the role of regional banking and consolidating the category of "regional significant bank" for the most effective of them; introducing a new system of indicators for assessing the systemic significance of regional banks; and forming an attractive investment infrastructure for the region.

The study's goals are:

1) development of the scientific and methodological foundations of the activities of regional banks in the Republic of Tatarstan in the conditions of the new reality;

2) analysis of quantitative and qualitative aspects of the development of regional banks on the Republic of Tatarstan;

3) development of system models — production functions, describing the features of the functioning of the credit and deposit and transaction directions of the business of regional banking in the Republic of Tatarstan in modern conditions;

4) development of recommendations for regional banks in the Republic of Tatarstan in terms of the development of individual business areas, taking into account the parameters of production functions describing their functioning.

The scientific novelty of this study is the development of a toolkit to justify decisions on the distribution of resources among regional banks' business areas based on the synthesis of existing methods of assessing their financial condition and the mathematical-modelling apparatus of production functions.

RESULTS

Result 1

In the results of this study, the regional banks are allocated using the approach currently applied by the Bank of Russia, based on the place of registration of the credit institution.

[1] In federal networks: how regional banks survive. ExpertRA. 2020. URL: https://raexpert.ru/researches/banks/fed_banks_2020/?ysclid=lfrw8k252u11418127 (accessed on 28.03.2023). Not a single budget: this is what develops regional banks. RBC. 2021. URL: https://trends.rbc.ru/trends/innovation/cmrm/60ab9c319a794702c55ee34e (accessed on 28.03.2023). Does the economy need regional banks. ExpertUral. 2021. URL: https://expert-ural.com/articles/nuzhny-li-ekonomike-regionalnye-banki.html?ysclid=lfrw8rl1fj758419000 (accessed on 28.03.2023).

Table 1

List of Regional Banks in the Republic of Tatarstan

No.	Title of the bank	Information about the divisions
1	PJSC "AK BARS" BANK	Additional offices – 214
2	LLC Bank "Avers"	Additional offices – 5
3	JSC "TATSOTSBANK"	Additional offices – 39
4	PJSC "AKIBANK"	Additional offices – 7
5	JSCB "Energobank"	Additional offices – 25
6	JSC "Bank Zarechye"	Affiliates – 1 Additional offices – 1
7	LLC "Bank of Kazan"	Additional offices – 11
8	JSC "IK Bank"	Affiliates – 1 Additional offices – 3
9	LLC "Bank 131"	–
10	LLC "AvtoCrediBank"	Additional offices – 1
11	LLC "Kamkombank"	Additional offices – 13
12	LLC "ALTYNBANK"	Additional offices – 5
13	JSC "Avtogradbank"	Affiliates – 1 Additional offices – 18

Source: Compiled by the authors according to the Bank of Russia. URL: http://www.cbr.ru/statistics/UDStat.aspx? TblID=302–09 (accessed on 15.11.2022).

For a more in-depth study of the questions raised, the authors made a sample of regional banks by region Republic of Tatarstan — a subject of the Russian Federation, which is part of the Volga Federal District. This sample is supported by the fact that this region presently has the most regional banks registered; additionally, according to the rating agency "Expert RA",[2] regional banks of the Republic of Tatarstan rank first in the rating of the financial sustainability of regional banking systems. The list of regional banks per region is presented in *Table 1*.

In the Republic of Tatarstan, as at 01.11.2022, there are 59 credit organizations. The volume of payments made through credit institutions located in the territory of Tatarstan, for the first half of 2022 is 4851.3 bln rubles (for comparison, in the first half of 2021 amounted to 3854.8 bln rubles).[3] Detailed status of funds of clients of Tatarstan banks for the last 3 years is presented in *Fig. 1*.

The volume of deposits opened in the regional banks of the entity increased by 34% by the end of 2022 compared to 2019 and amounted to 381 966 mln rubles. It's important to note that by the end of 2020, the population and legal entities in Tatarstan had given their savings to regional banks: the proportion of

[2] Analysis Expert RA: official website of the rating agency "Expert RA". Moscow. URL: https://raexpert.ru/researches/banks/fed_banks_2020/ (accessed on 05.04.2023).

[3] Databases of the Bank of Russia: official website of the Central Bank of the Russian Federation. URL: http://www.cbr.ru/statistics/UDStat.aspx? TblID=302–09 (accessed on 15.11.2022).

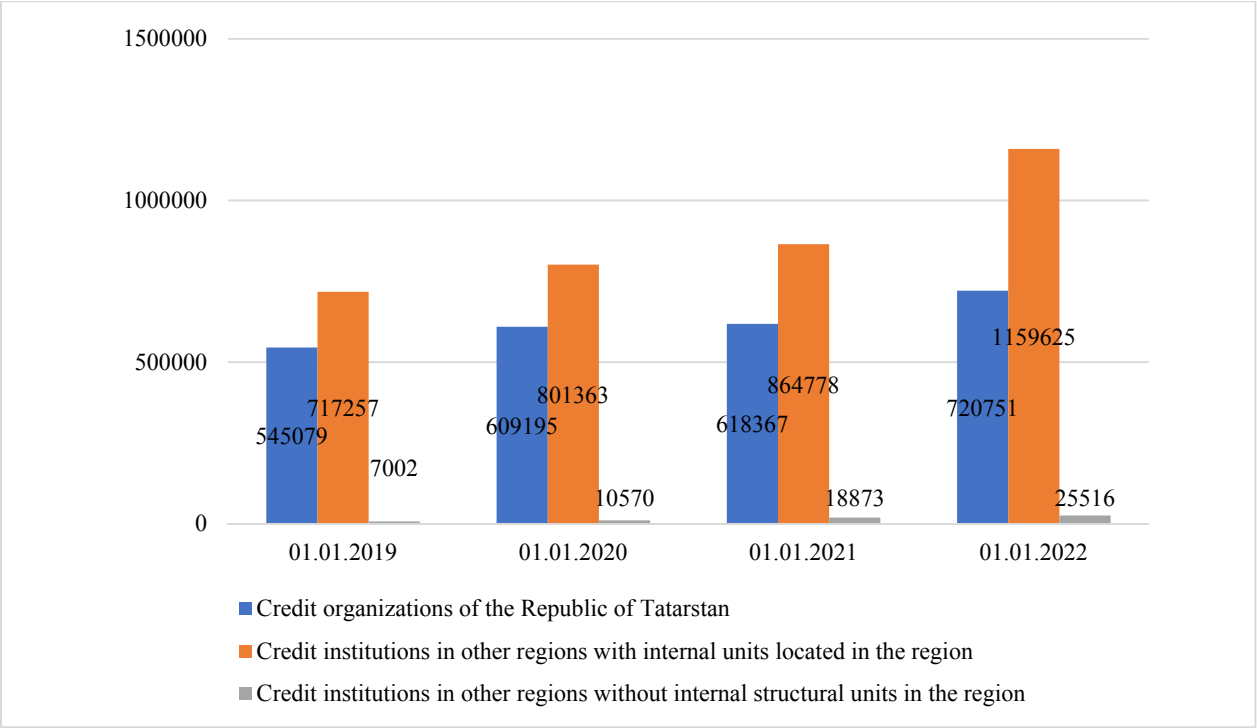

Fig. 1. **Funds of Non-Credit Clients Placed in Credit Institutions, Mln Rubles**

Source: Compiled by the authors according to the Bank of Russia. URL: http://www.cbr.ru/statistics/UDStat.aspx? TblID=302–09 (accessed on 15.11.2022).

deposits opened in the Republic's regional bank was 77.5% (291 926 mln rubles), while the proportion of open deposits in credit institutions in other regions with structural units in the entity was 22.5% (84 699 mln rubles). However, by the end of 2022, the situation is different: the share of deposits opened in regional banks has decreased to 62.6%. Fears, mistrust of monetary policy due to the spread of false information about an approaching market default, insufficient financial literacy of the population [11], and doubts about the financial resilience of regional banks and increased confidence in large banks (as the practice of recovery and state assistance during crises to larger and systemically significant banks is widespread) may all be contributing factors.

According to *Fig. 2*, the volume of loans granted to small and medium-sized enterprises (further — SMEs) in Tatarstan increased by 34% in October 2022 compared to the same period in 2019, to 240 365 mln rubles, while outstanding debt decreased by 38% to 9778 mln rubles in October 2022, compared to the same period last year.

The decrease in outstanding debt on loans granted to SMEs (SMEs) in Tatarstan is due, on the one hand, to the growth of gross regional product (further — GRP). For the reporting year 2021 it amounted to 3.4 trillion rubles, which is 3.8% more than in the analyzed period (GRP per capita was 862.4 thousand rubles). On the other hand, the reduction of unemployment by 1.0 p.p.— to 2.6%.

Consider transaction income of regional banks of Tatarstan (TOP-5 by size of assets).

According to *Fig. 3*, PJSC "AK BARS" BANK accounts for the highest volume of transaction business revenue, with a growth rate of 11% in the last year and 87% in the past 5 years. However, according to *Table 2*, the share of transaction income in the bank's total income is insignificant and is only 1.74% by the beginning of 2022. At the same time, in the last five years, the share has increased slightly: from 1.47 to 1.74%. The JSC "TATSOTSBANK" is interesting from a point of analysis. Since

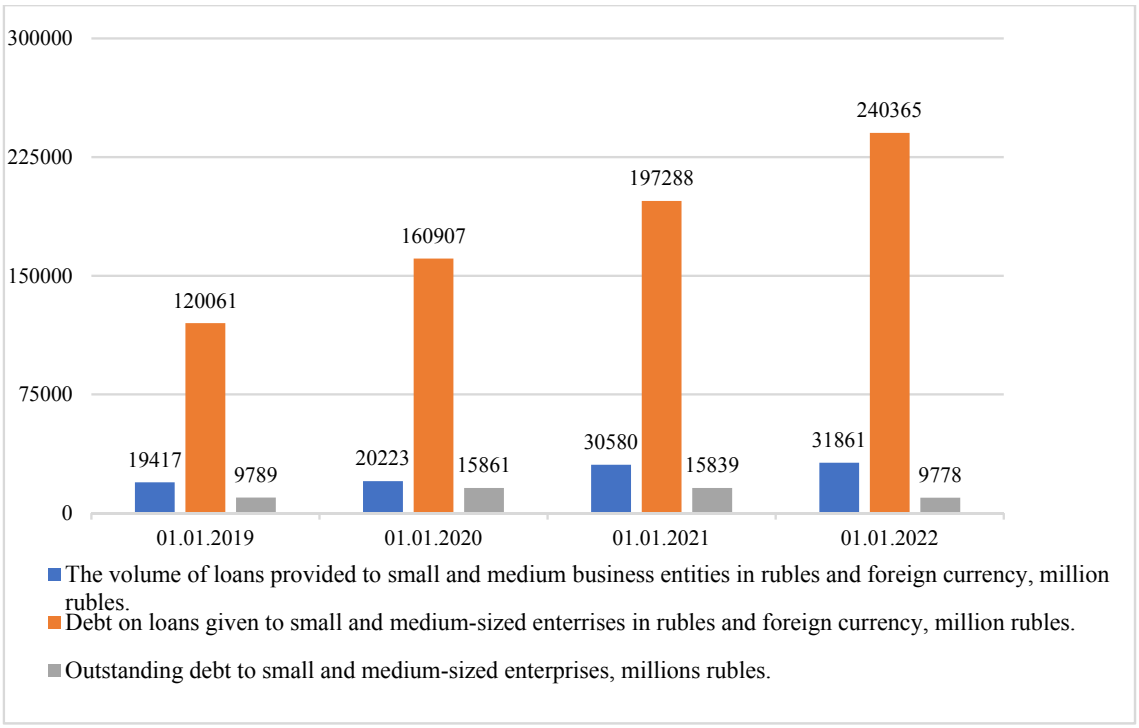

Fig. 2. **Loans Granted to Small and Medium-Sized Businesses in the Republic of Tatarstan for 2019–2022, Mln Rubles**

Source: Compiled by the authors according to the Bank of Russia. URL: http://www.cbr.ru/statistics/UDStat.aspx? TblID=302–09 (accessed on 15.11.2022).

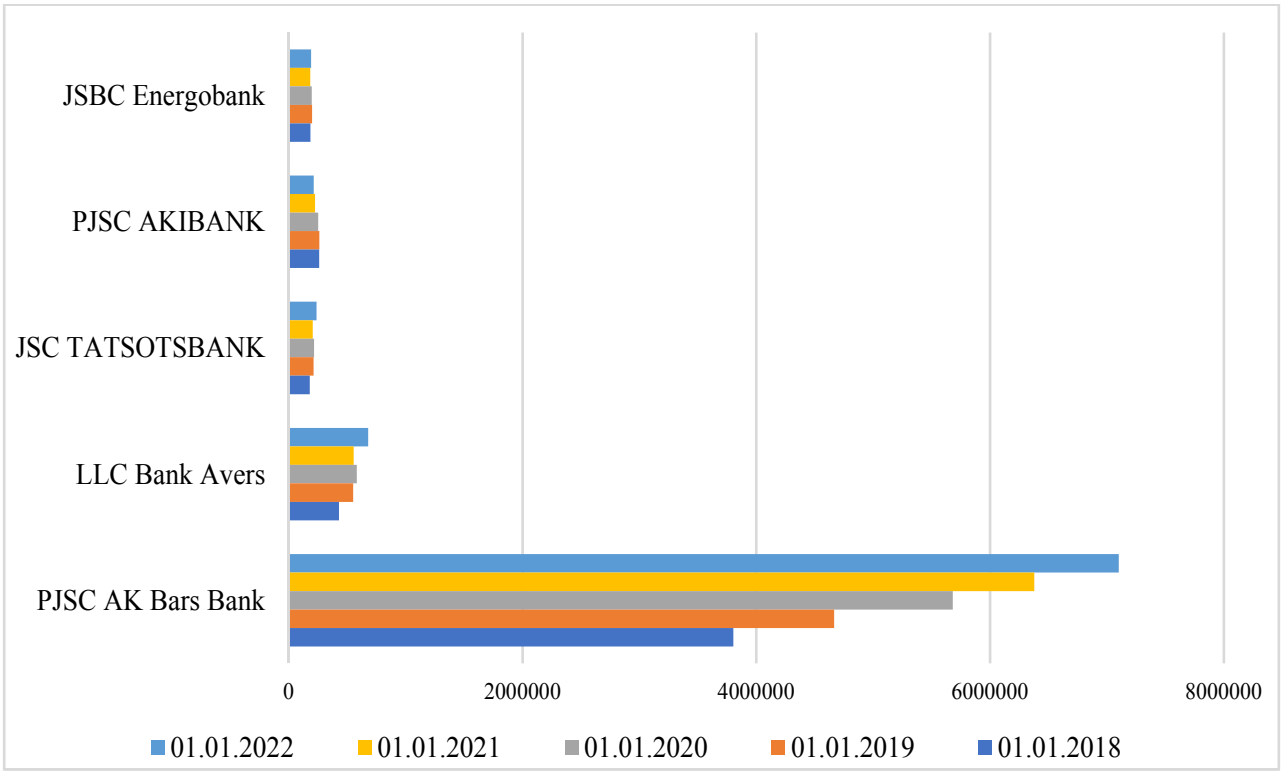

Fig. 3. **Transaction Income of the Analyzed Banks, 2018–2022, Million Rubles**

Source: Compiled by the authors according to the SPARK database. URL: http: www.spark-interfax.ru/ (accessed on 13.12.2022).

Table 2

The Share of Transactional Business Revenues in Total Revenues of the Analyzed Banks, 2018–2022, %

Title of the bank in Tatarstan	01.01.2018	01.01.2019	01.01.2020	01.01.2021	01.01.2022
PJSC "AK BARS" BANK	1.47	1.91	2.46	1.24	1.74
LLC Bank "Avers"	0.45	0.57	1.11	0.82	1.06
JSC "TATSOTSBANK"	4.18	5.53	5.75	4.61	5.29
PJSC "AKIBANK"	2.93	3.06	3.54	2.75	3.31
JSCB "Energobank"	1.05	1.17	1.17	0.94	0.97

Source: Compiled by the authors according to the SPARK database. URL: http: www.spark-interfax.ru/ (accessed on 13.12.2022).

2018 the bank has gradually increased the share of transaction revenue in total revenue and at the end of 2022 is 5.29%, with the rate of growth of transactional revenue for the last year was 16% (237 502 mln rubles).

The transaction banking business, due in particular to significant investments in IT-technology, developed mainly with large banks. However, given the recent shifts in the economy, particularly the fact that many universally licensed banks confront sanctions (for example, PJSC VTB Bank has been subject to sanctions since 2014), transaction banking business will grow rapidly in smaller banks, particularly regional banks.

Result 2

The paper identified the relationship of the indicators of the banking sector of Tatarstan with the change of phases of its life cycle as a system through models with constant elasticity of substitution (further — CES). The details are presented in works [12–14], в in this article it is adapted to describe the processes of the activities of regional banks in modern conditions.

The following methodology is implemented for the analysis:

1. The economic systems modeled are two areas of business of the regional banks of Tatarstan — credit-deposit and transaction.

2. The factor of large development in the system of credit and deposit business of banks is funds attracted for deposits, because banks develop a fundamental possibility to increase the volume of lending transactions at their expense. Money presented in the form of loans is a factor of intensive development of the business system in question, because in the course of their placement banks improve their technology of conducting borrowing transactions, forcing the invested money units to create new interest income.

3. In the transaction business system, money provided in the form of loans are relocated to the place of the factor of extensive development, and instead of the factor of intensive development, the funds are placed on client settlement accounts. The issuance of a loan by the bank to the client is accompanied by the opening of an account to which the credit funds are credited, i.e. recently issued loans in the system of bank transaction business serve as a beginning point for large-scale expansion.

4. For both modeled banking business systems, the quantitative characteristics

Table 3

Quantitative Characteristics of the Credit and Deposit Business System of Regional Banks of Tatarstan in 2019–2022

Annual period	Percent incomes (system's total product)		Sum of the loans (intensive development's factor)		Sum of the deposits (extensive development's factor)	
	Ab. value, thous. rub.	Log. value	Ab. value, thous. rub.	Log. value	Ab. value, thous. rub.	Log. value
2019	104 151 836	18.4614	120 061 000	18.6035	285 658 000	19.4703
2020	99 537 290	18.4160	160 907 000	18.8963	291 926 000	19.4920
2021	81 397 973	18.2149	197 288 000	19.1002	352 195 000	19.6797
2022	81 111 649	18.2113	240 365 000	19.2977	381 966 000	19.7608

Source: Author's calculations.

of the factors of extensive and intensive development selected in the previous paragraph, as well as the products of system activity, are analysed for the period 2019–2022. Their logarithmed values are calculated, and in the application MS Excel with the help of the function *Data — > Data Analysis–> Regression* the coefficients for equations of the type (1) describing the functioning of the credit-deposit and transaction business systems of regional banks of the Republic of Tatarstan in the current state are computed.

Basic data for calculating coefficients of the credit and deposit business model of regional banks of Tatarstan are presented in *Table 3*.

The result of the calculations obtained coefficients for the function describing the system of credit and deposit business of regional banks of Tatarstan:

$$\ln(P) = -1.22 * \ln(F_{exten}) + 2.12 * \ln(F_{inten}). \quad (1)$$

The conclusions that follow can be derived from knowledge of the model coefficients:

1) the ratio of the relationship of the amount of interest income (product of the system's work) with the value of the deposits attracted (extensive development factor) has a negative value. This suggests that further consolidation of these factors will result in a decline in the resulting indicator, i.e. banks will simply be unable to profitably place new cash attracted to deposits, reducing their business's profitability. The goal of the Republic of Tatarstan's regional banks at the moment is to make effective use of the funds attracted for deposits at this time without further expansion;

2) the ratio of the relationship between interest income and the amount of loans granted (intense growth factor) is positive. This confirms the previous paragraph's conclusion that it is now important to Tatarstan's regional banks to build up their credit portfolios and improve their quality using the funds already pulled up for deposits. Only in this way will they be able to increase interest income;

3) the aggregate elasticity indicator of the mutual substitution of the two types of components in the credit and deposit business system is 2.12–1.22 = 0.9, which is close enough to 1 to be considered significant. That is, deposits and loans as factors of the development of the modeled system for its normal development must maintain the

Table 4

Quantitative Characteristics of the Transactional Business System of Regional Banks of Tatarstan in 2019–2022

Year	Transactional incomes (system's total product)		Sum of money on the clients' accounts (intensive development's factor)		Sum of loans (extensive development's factor)	
	Ab. value, thous. rub.	Log. value	Ab. value, thous. rub.	Log. value	Ab. value, thous. rub.	Log. value
2019	5 887 989	15.5884	545 079 000	20.1164	120 061 000	18.6035
2020	6 925 814	15.7508	609 195 000	20.2276	160 907 000	18.8963
2021	7 547 068	15.8367	618 367 000	20.2426	197 288 000	19.1002
2022	8 422 447	15.9464	720 751 000	20.3958	240 365 000	19.2977

Source: Author's calculations.

current proportional ratio. It also means that, in addition to not having to increase the amount of funds raised on deposits, as stated in the previous two paragraphs, Tatarstan's regional banks must lower this amount, substituting it with cash raised through the issuance of securities.

The general conclusion on the state of the credit and deposit business system of the regional banks of the Republic of Tatarstan is that at present it is at the stage of the life cycle that can be characterized as the completion of the phase of growth with the transition to maturity. At this stage of the development of the system, the scope of the extensive development factor cannot be expanded, but at its current level, the quality of the use of the intensive development factor must be improved.

Applicable to credit and deposit business, this thesis is specified in the form of a recommendation for regional banks of the Republic of Tatarstan to improve their methods of formation and management of credit portfolios in all areas of this work, such as: a) assess a borrower's solvency; b) activity to secure loans; c) selection of flexible service modes for particularly important borrowers.

In order to build a model of the operation of the transaction business system of regional banks in Tatarstan in 2019–2022, data presented in *Table 4*.

Model for transaction business system of regional banks of the Republic of Tatarstan with specific coefficients:

$$\ln(P) = 0.35 * \ln(F_{exten}) + 0.45 * \ln(F_{inten}). \quad (2)$$

Based on the values of the model's coefficients, the following conclusions can be drawn about the current state of the transaction business system of the Republic of Tatarstan's regional banks:

1) the coefficient of the relationship of the amount of transaction income (product of the system) with the value of the loans issued (factor of extensive development) has a positive value. In other words, the increase in the volume of loans expands the scale of

transactions on settlement accounts, which increases transaction revenues;

2) the coefficient of transaction revenue with the amount of funds on the client's account (intense growth factor) is also positive, but greater than the previous factor (0.45 versus 0.35). This is totally rational, given that this component directly influences the system's outcome and previous one does so indirectly through the system;

3) the total constant elasticity of substitution of two types of factors for the transaction business system is equal to 0.8. It is less than the similar indicator in the credit and deposit business system. It also implies that, when compared to the credit and deposit business of these same banks, the factors of extensive and intensive development in the transaction business of the Republic of Tatarstan are less close to the single and closer to zero elasticity of mutual substitution.

Thus, the calculation of coefficients for the mathematical model of transaction business complements the conclusion made earlier on the basis of a similar model for the credit and deposit direction of the work of regional banks of the Republic of Tatarstan. Their current priority is to build up their credit portfolios, as well as to improve their quality in terms of the solvency of borrowers and the security of their liabilities. This factor is equally important for the further progressive development of both areas of business of the regional banks of Tatarstan, as considered in the present study.

The formulated conclusion about the need for regional banks of the Republic of Tatarstan to develop credit operations in the current situation is also confirmed by the general view of *Table 3* presented earlier, which shows that in the previous four years, regional banks of the Republic of Tatarstan used only about 50–70% of the funds attracted for deposits for lending, which partly violates the consistency of active and passive operations.

According to the research conducted on the basis of built mathematical models, both the modeled business directions of the Republic of Tatarstan's regional banks — credit-deposit and transaction — are now in the growth phase of the life cycle (we are talking about the lifecycle of this system, which began in 2015). In both directions, the elasticity of the mutual substitution of factors is close to the single, but it has not yet moved to the indicators at which it is possible to fully substitute the factors of extensive and intense growth with the possibility of abandoning extensive development in favor of intensive growth.

After all, according to the theory of systems, every system that functions for a long time develops in a spiral, where one life cycle is replaced by a new one, and the next one by a new, etc. With regard to the regional banks of the Republic of Tatarstan, 2014–2016 marked the end of the life cycle of their development, which actually lasted since the beginning of the 1990s, i.e. since the emergence of the banks themselves in Russia as a whole and in each of its regions. The start of the new life cycle of regional banks of the Republic of Tatarstan is linked to three events in 2014–2016:

1) start a sanctions campaign in the West;

2) the previous event required regional banks in the Republic of Tatarstan to restructure their business models, but many regional banking market participants failed to rise to the task. Also, a strong blow to the activities of the regional banks of Tatarstan was that among the "outsiders" were two very large by the standards of the region of the bank — "Tatfondbank" and "Spurt-Bank". This has led to the transition of the entire system into a bifurcation state, where the vast majority of its qualitative and quantitative characteristics change radically;

3) legal entities registered in the region, forming the corporate segment of the regional banks of Tatarstan, suffered great losses in the wave of crisis caused by the first waves of anti-Russian sanctions, and also began to change their business models, including in terms of the use of all types of banking services:

lending, deposits and settlement and cash services.

In the following years, new negative circumstances have arisen and continue to appear, affecting the movement of regional banks of Tatarstan along the trajectory of a new life cycle — this is the crisis in the context of the coronavirus pandemic in 2020–2021, and a new wave of more severe sanctions. However, the regional banks of Tatarstan, regardless of the wishes of their stakeholders', should move further along this trajectory, and the primary means of ensuring this task should be to build a customer lending practice that is adequate to the new macroeconomic realities and capable of giving a mutually beneficial synergistic effect for both the banks themselves and for their corporate borrowers in the region.

CONCLUSION

The digital transformation of the banking sector of the Russian economy, the current geopolitical situation, and macroeconomic instability takes the study of issues concerning regional banks to a new level. The importance of the results of the study lies in obtaining a new adaptive model of development for regional banks of the Republic of Tatarstan, ensuring the dynamic adequacy of the methods applied to the changing conditions of functioning of regional banking.

The mathematical models built in the course of the study — the production functions of the transaction and credit-deposit business systems of regional banks — demonstrate their passage through a phase of growth in a new life cycle, the beginning of which is connected with the restructuring of the entire domestic economy since 2014 in connection with the formation of new economic realities due to the strengthening of geopolitical sanctions. In these situations, the priority for the Republic of Tatarstan's regional banks is to improve the practice of lending to corporate clients in order, on the one hand, to adapt to the new macroeconomic conditions, and on the other — to contribute to the restoration in the national economy of the added value creation links most affected by the sanctions pressure.

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 27.03.2023; revised on 27.04.2023 and accepted for publication on 28.04.2023.
The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-67-75
UDC 336.71(045)
JEL G21

Central Credit Institution: Forgotten History and Possible Innovations in Modern Conditions

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ABSTRACT

The subject of the study is the historical experience of creating the Central Credit Institution of urban public banks of the Russian Empire and the possibility of its application in modern conditions. **The purpose** of the study **is** to develop practical measures to create a special banking association of local banks on the terms formulated by the Bank of Russia for the purpose of discussion with financial market participants, representatives of the expert and scientific community's. **The relevance** of the study is due to the request of the Bank of Russia, the Association of Banks of Russia in the search for new approaches to expanding the development potential of local banks through the creation of special banking associations. The United State Archives of the Orenburg Region served as the research location. The research methodology is based on the use of historical and logical analysis methods. The development of the Central Credit Institution of urban public banks at the beginning of the last century was studied in relation to its historical context and various stages of preparation. The surviving justifications, draft constituent documents, draft charter may be of interest when developing specific practical proposals for the creation of a special banking association of modern local banks with them accepting joint liability for each other's obligations, maintaining partial operational independence and delegating a number of functions to the parent bank. It is concluded that the results of the study can be applied by the Bank of Russia, the Association of Banks of Russia and proactive local banks to develop practical measures for the creation of a special banking association of local banks declared by the Bank of Russia.

Keywords: special banking association; Central credit institution; charter; city council; city public bank

For citation: **Zverkova T.N. Central credit institution: Forgotten history and possible innovations in modern conditions. *Finance: Theory and Practice*. 2023;27(5):67-75. DOI: 10.26794/2587-5671-2023-27-5-67-75**

INTRODUCTION

At the end of September 2022, the Association of Russian Banks prepared and provided to the banking community an informational and analytical overview "Banks and the infrastructure of the financial market in the context of modern challenges", the release of which was devoted to 19th International Banking Forum, which was held from 21–24 September 2022 in Kazan.

In this review, the Association of Russian Banks noted that in the framework of further consolidation, but already on a voluntary basis, the Bank of Russia has identified a new approach to expanding the development capacity of local banks.[1] The regulator noted that it was prepared to support the formation of special banking associations in exchange for banks recognizing solidarity responsibility for each other's obligations, the preservation of partial operational autonomy, and the delegation of a number of functions to the main bank.[2]

In the statement it released for public discussion, the Bank of Russia stated that "work will be performed to expand the development capacity of regional banks and increase their ability to participate in lending. If market participants express an interest in cooperating, the Bank of Russia is ready to consider regulatory decisions and contribute to the development of operational approaches to the formation of special banking associations with the banks accepting solidarity responsibility for each other's obligations, the preservation of partial operational independence, and the delegation of a number of functions to the main bank".[3]

The Association of banks of Russia consider that this innovation deserves a deep and comprehensive discussion before translating it into the plane of practical solutions.

Given the high level of interest in innovation, we reviewed recent scientific research that is relevant to our topic. According to the analysis, most of the studies [1–7] are aimed at investigating and studying the current state of local banks, as well as their involvement in the economies of the regions. The other part of the researchers [8–13] focused more on studying the history of the emergence and formation of city's public banks as elements of the banking system of the Russian Empire. Experience of city's public banks performing social functions studied in the papers [14–17]. The practical possibilities of applying the experience of city's public banks of the Russian Empire in modern conditions are considered in the papers [18–20]. Thus, most of the research in the scientific literature is aimed at studying the history of the Russian banking system, the prerequisites and stages of the emergence of urban public banks, as well as questions of the general characteristics of the development of urban banks and conditions of their functioning. We identified no work on the history of the formation of special banking associations with the purpose of supporting existing Russian city public banks in the development of their activities, with the banks accepting solidarity responsibility for each other's obligations, the preservation of partial operational independence, and the delegation of a number of functions to the main bank. Therefore, our research was aimed at studying archival documents of the State Budgetary Institution "United State Archive of the Orenburg Region" (SBI "USAOR"), in which we found a number of interesting evidence of the beginning of the 20 centuries, concerning the creation of

To explain the formation of the association of banks with regional headquarters, all Russian banks are divided into two conditional categories in our study: federal and local banks. Local banks often receive funds from local depositors and lend mainly to local borrowers.

[2] Banks and infrastructure of the financial market in the context of modern challenges. Information and analytical review. September, 2022. URL: https://asros.ru/news/asros/opublikovano-informatsionno-analiticheskoe-obozrenie-banki-i-infrastruktura-finansovogo-rynka-v-uslo/ (accessed on 07.10.2022).

[3] Bank of Russia. Financial market: new challenges in modern conditions. Moscow; 2022. URL: http://www.cbr.ru/content/document/file/139354/financial_market_20220804.pdf (accessed on 07.10.2022).

the historical prototype of "special banking associations".

PRE-HISTORY OF THE QUESTION OF A CENTRAL CREDIT INSTITUTION

On 3 April 1912 the Orenburg City Duma received a report (request) from the Special Office on the credit part of the Ministry of Finance from 10.03.1912 No. 3251. In it, the director Davydov explained that there have been numerous submissions from city administrations about the desirability of the establishment of a Central Bank for City Public Banks (Central Credit Institution) with a request to convene a congress of representatives of city administrates to clarify the main provisions of the organization of the credit institution.

The Special Office on Credit would like to know the opinion of all city governments with city banks on the "designated" issue.

In view of this, the Credit Office submissively requested the Orenburg City Duma to give its opinion on the following issues[4]:

1. Is it now necessary to establish a Central Bank to act as a coordinating organization for all cities public banks?
2. In the scenario where the first question is answered positively, which type of bank, shareholder or mutual, would be appropriate for this?
3. In which city should the bank be located?

The Board of Directors of the Orenburg City Public Bank responded to the following questions:

Question 1. It seems very necessary, because only by establishing the Central Bank can the city banks get out of the impasse, they are currently in.

The bank's activities will, of course, be revived by its relations with all the city banks, which could not have been established without the Central Bank. For example, of the bank sent 16.09.1911 to fifteen other city banks proposals to enter correspondence only seven banks responded, of them six — in a positive sense and one — in negative, while the remaining eight have not responded to this day.[5]

Under these conditions, the expenditure will not justify the expenditures; but, with the foundation of the Central Bank, when money transfers and other orders from city banks will be sent exclusively to the city bank, profit can be expected from this activity.

Question 2. Undoubtedly — on a mutual basis. Due to the former limited activities of banks and the very situation of most urban banks have rather scarce amounts of own capital (base and reserve) and therefore there is no need to allow for this, so to speak, family business, external elements.

Question 3. In Moscow, as a large central and richest city, there is still no city bank, which may serve as a barrier, and then you will have to agree on this issue with most other banks.[6]

After studying the received report of the Orenburg City Public Bank, the City Board agreed with it and 16.05.1912 sent the report No. 53 to the City Duma virtually unchanged.[7]

Further study of archival materials of the Orenburg region has opened up to us a rather little known and little studied issue of the preparation of draft documents on the establishment of the Central credit institution of city public banks and their discussion in the city councils throughout Russia.

[4] Materials on the establishment of a Central Bank for city's public banks. State Budgetary Institution "United State Archive of the Orenburg Region" (SBI "USAOR"). Fund 41. Inventory 1. Repository 391. P. 1.

[5] Materials on the establishment of a Central Bank for city's public banks. State Budgetary Institution "United State Archive of the Orenburg Region" (SBI "USAOR"). Fund 41. Inventory 1. Repository 391.

[6] Materials on the establishment of a Central Bank for city's public banks. State Budgetary Institution "United State Archive of the Orenburg Region" (SBI "USAOR"). Fund 41. Inventory 1. Repository 391. P. 3.

[7] Materials on the establishment of a Central Bank for city's public banks. State Budgetary Institution "United State Archive of the Orenburg Region" (SBI "USAOR"). Fund 41. Inventory 1. Repository 391. P. 6.

In the archival funds of the State Budgetary Institution "United State Archive of the Orenburg Region" (SBI "USAOR") the documents of the Saratov City Duma on the establishment of a Central Credit Institution that unites all existing city banks have been preserved.

Initially, the proposal to establish a Central Credit Institution for City Public Banks was proposed and heard by the Saratov City Duma at the meetings of 15 June 1911 and 9 August 1911. The city administrator has submitted a petition. About this decision of the Saratov City Duma, the Board of Saratov City Public Bank brought to the attention of the Boards of other city banks.[8]

On 10 March 1912, the Special Office for the Credit Section of the Ministry of Finance sent Circular No. 3251 from 10 March 1912 to the city councils, which we presented at the beginning of our study.

The following replies were received from the municipalities of other cities on this circular before 10 March 1913:

- of the 297 city banks that existed before 1 January 1912–47 were located in provincial cities. Of them, 24 responded; 22 cities voted in favor of the need for such a bank, and 2 — voted against. For the organization of the bank on mutual basis, 19 voted, for shareholders — 2, and one city left this question unanswered. With regard to the location of the bank, 8 voted for Moscow, 11 — for St. Petersburg, 2 — for both these cities and one city left this question unanswered;
- of the 250 county banks — 171 responded. Of them, 15 cities expressed their opposition to the need for such a bank, the rest — in favor of the need. Of the latter, 95 voted for the establishment of the bank on a mutual basis, 21 — on a share-owned basis, and 40 did not specify on what basis the bank should be built. With regard to the location of the bank, 86 voted for Moscow, 24 — for St. Petersburg. The others either did not comment on the issue or indicated the provincial cities.[9]

According to the data below, most cities have expressed support for the establishment of a mutual bank.

Despite the cities' united opinion and active work on the construction of the Central Credit Institution for city public banks, the process of preparing for the constituent congress progressed slowly. The initiators of the Bank acknowledged that the situation in which the Central Credit Institution was established could remain indefinitely long. According to information received from the Special Office on the credit part, the Congress could only be convened when the basic provisions to be considered by the Congress have been precisely elaborated.

The cities' only response was that the bank should be created on a mutually beneficial basis, and hence its operational capital is comprised of membership contributions. All other fundamental provisions had to be implemented by Congress.

The options proposed by the Duma enabled the Central Credit Institution to be governed democratically.

HISTORY OF THE DISCUSSION OF THE CHARTER OF THE CENTRAL CREDIT INSTITUTION

The project Charter of the Central Credit Institution of the City of Public Banks stipulated that the purpose of the central credit institution is to assist existing in Russia urban public banks in the development of their activities, the possibility to expand their operating funds and to place their capital to increase their interest and production of all the transactions provided by the Charter.

The draft Charter of the Central Credit Institution clearly stipulated the rights and obligations of its members (participants)

[8] Materials on the establishment of a Central Bank for city's public banks. State Budgetary Institution "United State Archive of the Orenburg Region" (SBI "USAOR"). Fund 41. Inventory 1. Repository 391. P. 8.

[9] Materials on the establishment of a Central Bank for city's public banks. State Budgetary Institution "United State Archive of the Orenburg Region" (SBI "USAOR"). Fund 41. Inventory 1. Repository 391.

and the joint responsibility of the bank's obligations.

Only Russian city public banks could be members (participants) of the Central Credit Institution. They could use the credit, share in the profits generated by the transactions, and were accountable for its losses under the terms of the Charter.[10]

Each of the city's public banks at the time of membership of the Central Credit Institution had to deposit in cash at least ten per cent of the amount of the exchange loan opened to him and to issue in the prescribed form an undertaking that it would assume responsibility for the central credit institution's operations at the level of the open loan.[11]

Each City Public Bank's contribution to the operational funds cannot be less than 500 rubles.

Liability of members for losses and liabilities of the Central Credit Institution to third parties was limited to the amount of the loan open to each member.

For example, more than a century ago, the innovation of creating special banking unions with banks accepting solidarity responsibility for each other's obligations, the preservation of partial operational autonomy, and the delegation of a number of functions to the main bank was not only studied, but also deeply and comprehensively worked out and translated into the plane of practical decision-making.

City banks operating in cities where there are branches of share banks were forced by fate to enter the path of competition with these banks, so as not to go in the tail in the sense of reducing their operations. As a result, city banks gradually opened new operations that had not been practiced so far. The desire to retain the same customers as before the intensified establishment in the province of share bank offices required city credit institutions to change the nature of their operations precisely in the direction of their adaptability to the needs and conveniences of customers, according to the model of the share bank, where this client began to significantly move due to the diversity of operations and great convenience.[12]

Naturally, city credit institutions were forced to search for more efficient methods in order to be more competitive. If they desired to change the legal framework that restricted their activities, they would need to organize themselves even more so that, when it came time to expand their operations, they could depend on the Central Credit Institution's constant and reliable backing in terms of funding.

As was promptly noted at the conference of representatives of the city banks in St. Petersburg, it was considered that the Central Credit Institution could have a significant role in the provision of resources to the city banks.

The planned international relations of the Central Credit Institution enabled city authorities to realize their loans abroad through it, and all the profits that were transferred to trade unions and consortia of shareholders could remain in the hands of the city administrations.

According to the aggregate balance sheet of the city banks as of 1 January 1910 (publication Special Office on the Credit Part of the Ministry of Finance), only 45 municipal banks with capital (base and reserve) of more than 25.5 mln rubles were located in provincial cities. In addition, there were 279 city banks located in county cities with a capital of more than 29 mln

[10] Materials on the establishment of a Central Bank for city's public banks. State Budgetary Institution "United State Archive of the Orenburg Region" (SBI "USAOR"). Fund 41. Inventory 1. Repository 391.

[11] Materials on the establishment of a Central Bank for city's public banks. State Budgetary Institution "United State Archive of the Orenburg Region" (SBI "USAOR"). Fund 41. Inventory 1. Repository 391.

[12] Materials on the establishment of a Central Bank for city's public banks. State Budgetary Institution "United State Archive of the Orenburg Region" (SBI "USAOR"). Fund 41. Inventory 1. Repository 391. P. 11.

rubles. It would seem evident that, with an appropriate organization, credit institutions with basic and reserve capital of more than 50 mln rubles could "dominate the money market and occupy a place due to their solidity among other equity credit institutes, operating very broadly with much smaller basic capital and having a large influence on the monetary market only because the city credit institution operates separately".[13]

At the beginning of June 1912, the Board of Orenburg City Bank prepared its comments and submitted them to the Orenburg City Board. At the end of the summer of 1912, the Municipal Duma sent to the Special Office for the Credit Section of the Ministry of Finance a copy of the Journal of the City Duma from 22 August 1912 No. 235 on the establishment of a Central Bank for city public banks. The government of Orenburg City Public Bank and the city administration said that the convening of the congress of representatives of the cities on the question of the establishment of the Central Credit Institution is necessary and decided to join the petition of the Saratov City Duma to convene representatives for the discussion of the project of the bank.[14]

Unfortunately, these documents in the archive case No. 391 of description 1 of fund 41 ends. Our attempts to find documents on further developments in the establishment of the Central Credit Institution openly available in the media and on the Internet have not yet been successful. We could not find information on further results of the convening of the congress.

But, in our view, it is important that in the history of the banking system of Russia, quite significant attempts were made to improve the existing system of interaction between city public banks.

CONCLUSION

The study allows the formulation of proposals regarding the requirement of using the Central Credit Institution's founding experience in current conditions.

The macroeconomic conditions of banking activities are currently characterized by instability and low predictability due to increased risks, notably geopolitical, according to the Bank of Russia. Similar to one hundred years ago, the banking industry focuses on capital adequacy and liquidity. Capital deficits, along with the short-term nature of the predominant share of the banking sector's liabilities, serve as factors to curb the lending dynamics of the Russian economy.[15]

As the Bank of Russia notes in its study, the Russian banking sector is dominated by federal banks, and their role has increased in recent years.[16] They play a significant role in the system for attracting individual deposits, issuing retail and corporate ruble loans, and drawing in deposits from non-financial organizations. The advantages of the scale effect, the ability to diversify risks through operations in other regions, and the chance to further improve lending through involvement in government programs all contribute to the federal banks' leadership position.[17]

Modern local banks, in order to retain their clients, as they did a hundred years ago, are engaged in competition with major federal banks and must constantly expand their operations according to the needs and conveniences of customers. The dispersed

[13] Materials on the establishment of a Central Bank for city's public banks. State Budgetary Institution "United State Archive of the Orenburg Region" (SBI "USAOR"). Fund 41. Inventory 1. Repository 391. P. 11.

[14] Materials on the establishment of a Central Bank for city's public banks. State Budgetary Institution "United State Archive of the Orenburg Region" (SBI "USAOR"). Fund 41. Inventory 1. Repository 391. P. 16.

[15] News of the Association. Published information and analytical overview "Banks and financial market infrastructure in the context of modern challenges". URL: https://asros.ru/news/asros/opublikovano-informatsionno-analiticheskoe-obozrenie-banki-i-infrastruktura-inansovogo-rynka-v-uslo/ (accessed on 07.10.2022).

[16] As of 1 October 2022, there are 328 banks (225 banks with universal license, 103 with basic license) and 34 non-bank credit institutions operating in the Russian banking sector.

[17] URL: https://www.cbr.ru/Collection/Collection/File/40903/overview_2021.pdf (accessed on 07.10.2022).

local banks, having all together large capital as they did a hundred years ago, cannot, in the absence of a consolidating body, "consolidate" their resources and create strong competition with the big banks.

The Association of Russian Banks (ARB) and the Association of Banks "Russia" are a joint organization of federal and local banks and, in fact, perform "representative" functions aimed at defending the interests of members of the associations in the legislative bodies, the Bank of Russia and other federal ministries and departments.[18]

In today's difficult conditions, local banks need a new approach to consolidating their own strengths and capital through the creation of their own special banking associations, namely local banking, with banks accepting solidarity of responsibility for each other's obligations.

The principles that were established when the Central Credit Institution was founded are still applicable today. Those who lead the formation of a modern special banking association could depend on:

- the principles of the creation of the main bank of the association as a settlement, deposit and lending bank for local bank members;
- the principles of capital formation of the main bank;
- a list of the actions performed;
- the amount of membership fees;
- the amount of credit that a member of the association could receive in the main bank;
- the limits of liability of a member of the association for the operations of the main bank;
- the principles of the management of the association and the representation of members in the management.

In order to master innovation, we must go through "missed" stages where we must once again reproduce conditions, requirements, and relationship types that we have already experienced in the past. It is the application of historical experience that will allow the creation of a special association of banks with the "practical" purpose of assisting existing local banks in the development of their activities, expanding capacity and increasing opportunities for participation in lending, replenishing the working funds with the acceptance by the banks of solidarity responsibility for the obligations of each other, preserving partial operational independence and delegating a number of functions to the "main bank".

The creation of such a consolidation would enable local banks not only to have an association with representative functions, but also to have a real functioning mechanism, allowing joint capital to support their activities and support in crisis situations, which could give local bankers a chance to unite in competition both at the regional and international level, enabling, inter alia, to obtain cheap loans abroad, as most of them are not subject to sanctions.

[18] The Association of Russian Banks (ARB) is a non-governmental non-profit organization representing the interests of the Russian banking community. The main task of the Association is the implementation of the country's banking program, creating conditions for the effective functioning and development of the banking system of Russia and ensuring its stability, protection of the rights, interests of banks and conditions for fair market competition. URL: https://arb.ru/arb/about/ (accessed on 07.10.2022). The Association of Banks "Russia" is the center of analytical, expert work of the banking community. The activities of the Association "Russia" are aimed at: increasing the capitalization of banks and creating conditions for the formation of long-term investment resources; strengthening confidence in the domestic banking sector by investors and depositors. URL: https://asros.ru/about/ (accessed on 07.10.2022).

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Conflicts of Interest Statement: The author has no conflicts of interest to declare.

The article was submitted on 09.10.2022; revised on 30.11.2022 and accepted for publication on 26.12.2022.
The author read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-76-89
JEL C5, E1

Inventory and Financial Performance Selected Publicly Listed Manufacturing Indonesian and German Companies

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ABSTRACT

Inventory management is a fundamental supply chain management phase that affects the country's economy. The **purpose** of the study is to determine the effectiveness of inventory management and its impact on the financial performance in the factoring industry, as it has become one of the leading sectors in boosting the development of the national economy. Descriptive and quantitative **methods** were used, which mainly relied on financial data for 2013–2017 on the selected publicly listed manufacturing companies in Indonesia and Germany based on the LQ45 and DAX stock index, respectively. Several software programs (Microsoft Excel, SPSS, and AMOS) were used for solving the inventory-financial performance and value analysis based on Structural Equation Modeling. The **results** of the study confirm that inventory performance significantly influences financial performance, as the p-value is below 5%. Inventory performance has an explanatory power of 30.6% for financial performance. An increase in inventory performance will increase financial performance as well. Each indicator has an explanatory power of DSI (101.2%), INVTO (96.4%), FGI (63.3%), WIP (58.3%), and RMI (51.7%) towards inventory performance, which will increase performance as well. For financial performance, each indicator has an explanatory power of ROIC (97.0%); ROE (85.1%); ROA (76.9%); GR (46.7%); PM (5.6%), and OM (5.3%) towards financial performance, which will also contribute to improved efficiency.

***Keywords*:** inventory; financial performance; public listed; manufacturing companies

For citation: **Anantadjaya S.P.D., Carmelita P.W., Juhara S., Irdiana S., Moridu I., Susanti E., Nawangwulan I.M. Inventory and financial performance selected publicly listed manufacturing indonesian and german companies. *Finance: Theory and Practice*. 2023;27(5):76-89. DOI: 10.26794/2587-5671-2023-27-5-76-89**

INTRODUCTION

Supply chain management has been introduced since the era of mass customization. A network is formed by collaborating on facilities, inventory, transportation, information, sourcing, and pricing while providing high flexibility and proper relationship to the customer's demand. Supply chain management aims to ensure a high level of product availability that generates value for the customer while keeping process costs low [1]. To align decision phases with business strategy, an organization should understand the market served by analyzing the quantity, response time, variety, service level, price, and product innovation rate. Then, define the organization's core competencies, especially in multiple supply chains since they will have different requirements. An organization should be able to determine its supply chain capabilities in 6 significant areas: facilities, inventory, transportation, information, sourcing, and pricing [1, 2].

As the market becomes more competitive than ever, a plethora of people coming from different sectors, such as education and industries, are captivated by the term inventory management, mainly its practices in organizations such as satisfying the customer and how they can maintain their position in the market [3]. Inventory has become one of the primary sources of revenue generation and consecutive earnings for the company because

it represents valuable assets that most businesses acquire. Inventory management is a fundamental phase in supply chain management as it influences the country's economic performance [4]. Thus, industrial economists must study market behavior and its changes in supply and demand. In addition, the ability of consumers and suppliers to replace over time and the assurance the marketplaces have on price to allocate goods regulate the market operation [5]. Inventory is associated with a company's production and distribution processes [6, 7], where certain factors affect the inventory systems used. The excellent knowledge and availability of new methods, the level of protectionism, the rate of inflation, the bold international competition, the changes in political system and technology, and the growing consumer expectations are examples of the external factors impacting inventory management [8]. Managing inventories at the right time in the correct quantity is necessary because recent studies have shown that most of the total funds performed are tied up in current assets, of which inventory is the most compelling component in the manufacturing industry. Better inventory management could alter what is perceived as idle resources to economic value by delivering capital productively and disregarding additional investments [3].

Indonesia's economic outlook brought about changes in inventories in Indonesia, as shown by the World Bank. Considering the recent financial performance due to the growth of private and government consumption with more than 240 million residents, Indonesia has become an investment target for many overseas companies[9]. Seeing Germany as the 4th most significant investor in Indonesia and the most influential trading partner of Europe, Indonesia and Germany have agreed to boost cooperation in the economic sector, as confirmed by the Ministry of Foreign Affairs of the Republic of Indonesia and German Foreign Minister in the Asia Pacific Business Conference.[1] German economic outlook resembles robust business investments, prudent financial management, and past fundamental reforms,[2] which all affect the manufacturing industry's inventories.[3] The German economy is driven by extensive, varied, innovative manufacturing and technology-oriented industry developments.

This study will analyze deeper how strong inventory performance as represented by raw material ("RMI"), work-in-process ("WIP"), finished goods ("FGI"), inventory turnover ("INVTO"), and days sales of inventory ("DSI") will impact the financial health as represented by gross profit margin ("GR"), operating margin ("OM"), net profit margin ("PM"), return on asset ("ROA"), return on equity ("ROE"), and return on invested capital ("ROIC") based on selected publicly-listed manufacturing companies in Indonesia and Germany during 2013–2017. The selection of data comes from selected publicly listed manufacturing companies in Indonesia and Germany because, in the initial analysis of the comparison chart of contribution to GDP, during 2013–2017, Indonesia's position was almost the same as Germany's, which contributes about 20% to GDP.[4] This is also done as a comparison so that Indonesia can be juxtaposed with a country that has long been known as an industrial and manufacturing country. So that Indonesia's position can also be seen in the development and progress in the manufacturing sector, both domestically and internationally.

DATA AND METHODOLOGY

A. Data Set

This study uses secondary data as the data collection method. The secondary data consists of information discussed in the literature review. The data is obtained from selected publicly-listed manufacturing companies in Indonesia and Germany listed by the LQ45 and DAX stock index,

[1] Indonesia, Germany Increase Economic Cooperation. URL: https://en.tempo.co/read/news/2018/09/15/056921677/Indonesia-Germany-Increase-Economic-Cooperation, 2018 (accessed on 01.11.2022).

[2] International Monetary Fund Staff. Germany's Economic Outlook in Six Charts. URL: https://www.imf.org/en/News/Articles/2018/07/03/na070318-germanys-economic-outlook-in-six-charts, 2018 (accessed on 01.11.2022).

[3] Organization for Economic Co-operation and Development. Germany — Economic Forecast Summary (November 2018). URL: http://www.oecd.org/economy/germany-economic-forecast-summary.htm, 2018 (accessed on 01.11.2022).

[4] Organization for Economic Co-operation and Development. Germany — Economic Forecast Summary (November 2018). URL: http://www.oecd.org/economy/germany-economic-forecast-summary.htm, 2018 (accessed on 01.11.2022).

respectively.[5] The calculation for descriptive-quantitative research, which aims to describe or identify the characteristics of variables in given situations and support various aspects of the existing phenomena using references, such as academic textbooks, journals, and other articles on previous studies on manufacturing firm performance analysis, to describe, explain, and validate research findings [10].

The study will analyze inventory performance and financial performance for each data. Inventory valuation significantly impacts reported profit levels since it relates to the cost of goods sold. Inventory is crucial in the component of a current ratio, where existing assets are divided by current liabilities [11].

The population of this study is 618 publicly listed Indonesian companies based on the Indonesia Stock Exchange as of October 2018[6] and 523 companies listed in the Frankfurt Stock Exchange as categorized by Prime Standard, General Standard, and Scale as of October 2018.[7] According to the Frankfurt Stock Exchange, a Regulated Market or General Standard is an EU-regulated market under the Securities Trading Act.

This is where the abbreviation LQ, which represents liquid, comes from. Firms must fulfill the criteria to be eligible to be included in the LQ45 index. 30 selected German blue-chip stocks were traded on the Frankfurt Stock Exchange using free float shares in the index calculation for equities. It measures the German economy and is a reference point for various financial products. The DAX index is calculated as price indices to record pure price performance, performance indices to reinvest all dividends completely, and net return indices to reinstate the net divided. They are also subject to a quarterly basis based on the "Fast Entry" (the company has an equal or better rank than 25 in DAX for both criteria) and "Fast Exit" (the company is below 45 in DAX for either measure of free-float market capitalization or order book volume in terms of ranking) rules, with a stricter barrier than for the regular reviews.

B. Methodology

The starting point for developing financial performance is problem identification, where the background details of the topic are discussed up to conclusions and recommendations, where the results will then be presented and analyzed thoroughly. The research will be conducted in three segments: data collection, analysis, and conclusion. In the first segment of the study, quantitative data will be collected from Bloomberg Terminal, financial statements, and annual reports provided by selected publicly listed manufacturing companies in Indonesia and Germany. The next segment covers the analysis of data collected in the first segment. The inventory performance sub-variables are RMI, WIP, FGI, INVTO, and DSI. The quantitative data will be used from selected publicly listed manufacturing companies in Indonesia and Germany to calculate PM, GR, OM, ROA, ROE, and ROIC, all representing financial performance.

Inventory performance follows several equations for RMI, WIP, FGI, INVTO, and DSI. Inventory turnover is calculated by dividing the cost of goods sold by the amount of inventory. The financial health of an organization could be determined by performing a rudimentary analysis with either horizontal, vertical, or ratio analysis, then forming basic conclusions about its financial health [7, 12–14]. The financial performance measurement follows several equations for GR, OM, PM, ROA, ROE, and ROIC of selected publicly listed manufacturing companies in Indonesia and Germany.

Several software (Microsoft Excel, SPSS, and AMOS) statistical programs will be used to solve the inventory-financial performance problem and help calculate the correlation value. The number of samples for this study will be calculated using an online sample size calculator from *Raosoft, Inc.*,[8] to measure the sample size needed [15, 16].

[5] The data retrieved from the Bloomberg Terminal database. URL: official websites such as www.idx.co.id and www.deutsche-boerse.com, financial statements, and annual reports during 2013–2017 (accessed on 01.11.2022).

[6] Indonesia Stock Exchange. List of Stocks. URL: https://www.idx.co.id/data-pasar/data-saham/daftar-saham/., 2018 (accessed on 01.11.2022).

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[8] The calculation data using online software official websites. URL: http://www.raosoft.com/samplesize.html (accessed on 01.11.2022).

Table 1

Revised Sample Data Allowed to Run in AMOS

Sample	Number of Companies	Sample	Number of Companies	Sampling Method
Publicly listed companies on Indonesia Stock Exchange	618	Publicly listed companies on Frankfurt Stock Exchange	523	Clustered
Grouped by the central board	308	Grouped by Prime Standard	322	Clustered
Listed in LQ45 Stock Index for highest liquidity	45	Listed in DAX Stock Index for most increased liquidity	30	Stratified
Complete data to support the study.	12	Exclusive data to support the analysis.	12	Stratified

Source: Premier Data.

This study uses probability sampling due to the presence of calculations and consideration of probability [17]. The software AMOS is used as the sampling method for this study. A minimum sample of 120 data is allowed in AMOS [18, 19]. *Table 1* below outlines the sampling method. Clustered sampling will be applied as it refers to the members of the population being selected randomly from naturally appearing in groups, or "clustered" and stratified sampling will be employed in this study.

Validity testing also measures whether the data gathered can be used in the research. It identifies whether the study's relationship can be depicted from the data using the second approach. Valid data is one where the connection to be measured is significant. The one used in this study will be the KMO & Bartlett's Test using SPSS software with a test chart. Valid data is one where the relationship to be quantified is significant[17, 20, 25].

Cronbach's Alpha in SPSS is one of the approaches to measuring data reliability. Reliability is the degree to which measurements and results using a research instrument are consistent and yield low errors. If the value of Cronbach's Alpha > 0.50, then it is reliable; if the value of Cronbach's Alpha < 0.50, then it is not reliable [17–19].

RESULTS AND DISCUSSION

This section will discuss several keys to financial performance, followed by an Industry Overview, Process Data Testing using AMOS and SPSS Software, Interpretation of Path Analysis, and Managerial Decisions/Implications.

A. Industry Overview

A. 1. Indonesian Manufacturing Industry

Indonesia ranks 4 out of 15 countries worldwide whose manufacturing sector's contribution to GDP is more than 10% [6]. The Central Statistics Agency of Indonesia recorded that non-oil and gas exports from the processing industry from January to November 2017 increased to 14.25% compared to 2016. In the first semester of 2017, the exports of non-oil and gas processing industries reached 59.78 bln USD compared to 54.32 bln USD in 2016, an increase of 10.05%.[9] The positive performance of the national manufacturing industry was recorded by Indonesia's Purchasing Manager Index from 48.6 in July to 50.7 in August 2017, as released by Nikkei and Markit. In the Q3 of 2017, the most contributing industry to Indonesia's GDP, with almost 18%, was the non-oil and gas processing industry, with a growth of 5.49%, higher than the economic growth of 5.06%. *Fig. 1* shows that the value of the manufacturing sector's contribution to GDP is around 20%, which is still above the average value in the world at 16%. Indonesia's position is still below the average value of East Asia and Pacific countries.[10]

[9] Badan Pusat Statistik. Pertumbuhan Produksi Industri Manufaktur Besar dan Sedang Triwulan IV Tahun 2017 Naik Sebesar 5,15 persen dan Pertumbuhan Produksi Industri Manufaktur Mikro dan Kecil Triwulan IV-2017 Naik Sebesar 4,59 persen. URL: https://www.bps.go.id/pressrelease/2018/02/01/1479/ (accessed on 01.11.2022).

[10] World Bank Group. GDP Growth (Annua l%). URL: https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=EG., 2019 (accessed on 01.11.2022).

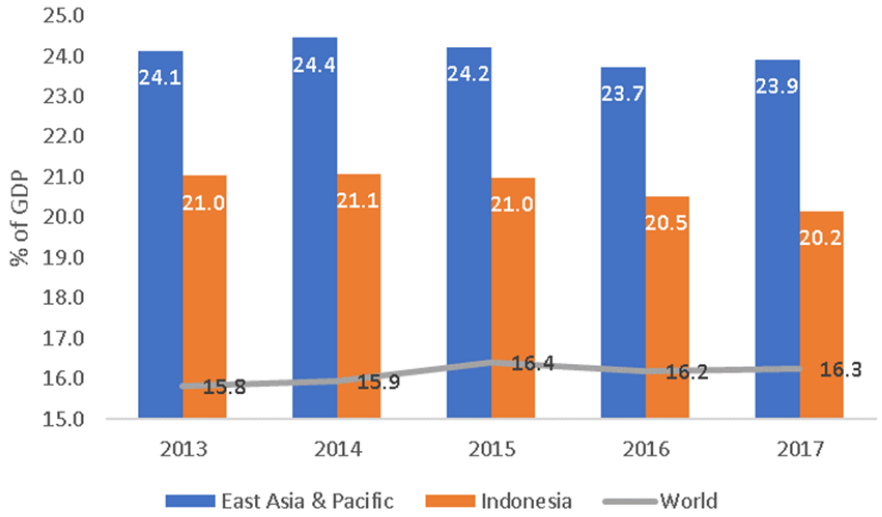

Fig. 1. **Indonesian Manufacturing Sector Contribution to GDP**

Source: World Bank Group.

A. 2. German Manufacturing Industry

The manufacturing sector became the most critical sector, accounting for almost 80% of total production in Germany. Since 1979, industrial production in Germany has averaged 1.5%, where some output decreased, namely consumer to –4.1%, capital to –1.8%, intermediate goods –1.0%, energy production dropped by 3.1%, and construction activity dropped to 1.7%.[11] The share of industry in gross value added contributed to 23%, making it the highest among the G7 countries (Canada, France, Italy, Japan, U.K, and the U.S.A.). Manufacturing sector contribution to German GDP is shown in *Fig. 2.* that the value of the German manufacturing sector's contribution to GDP is around 20%, which is still above the average value in the world at 16%. Germany's position is also above the average value of Europe, Central Asia and High-Income countries by around 13–15%. In 2016, almost 50% of Germany's GDP was represented by the exports of goods and services, mainly manufactured goods from high-quality, high-value-added sectors like Machinery and Transportation.[12] The manufacturing industry contributed 23.4% to Germany's gross value, 12.7% to France, and 10.1% to the UK. The highest contributing industry was the automotive industry, with 425 billion euros out of 1,893 billion euros in the turnover of manufacturing companies in 2017. According to the data and information services business, IHS Markit, Germany PMI is based on five individual indexes: New Orders (30%), Output (25%), Employment (20%), Suppliers' Delivery Times (15%), and Stock of Items Purchased (10%) that were taken from a survey of 500 industrial firms and fell by 0.3% in December 2018 to 51.5%. It was because of the poor expansion in the manufacturing sector since 2016, the decline in new orders, and the accumulation of finished goods stocks and backlogs of work. Also, the recent news about Brexit, trade frictions, and the fall-off in the automotive industry impacted business confidence in Germany.[13]

B. Process Data Testing using AMOS and SPSS Software

B 1. Descriptive Analysis

From the evaluation data, the inventory performance indicators significantly influence the financial performance of the selected publicly listed manufacturing companies in Indonesia and

[11] Trading Economics. Germany DAX 30 Stock Market Index. URL: https://tradingeconomics.com/germany/stock-market., 2018 (accessed on 01.11.2022).

[12] Global Manufacturing & Industrialisation Summit. The Future of Manufacturing — Germany, PricewaterhouseCoopers, LLP. 2018.

[13] Focus Economics. Industry in Germany. Economic Forecasts from the World's Leading Economists. URL: https://www.focus-economics.com/country-indicator/germany/industry. 2019 (accessed on 01.11.2022).

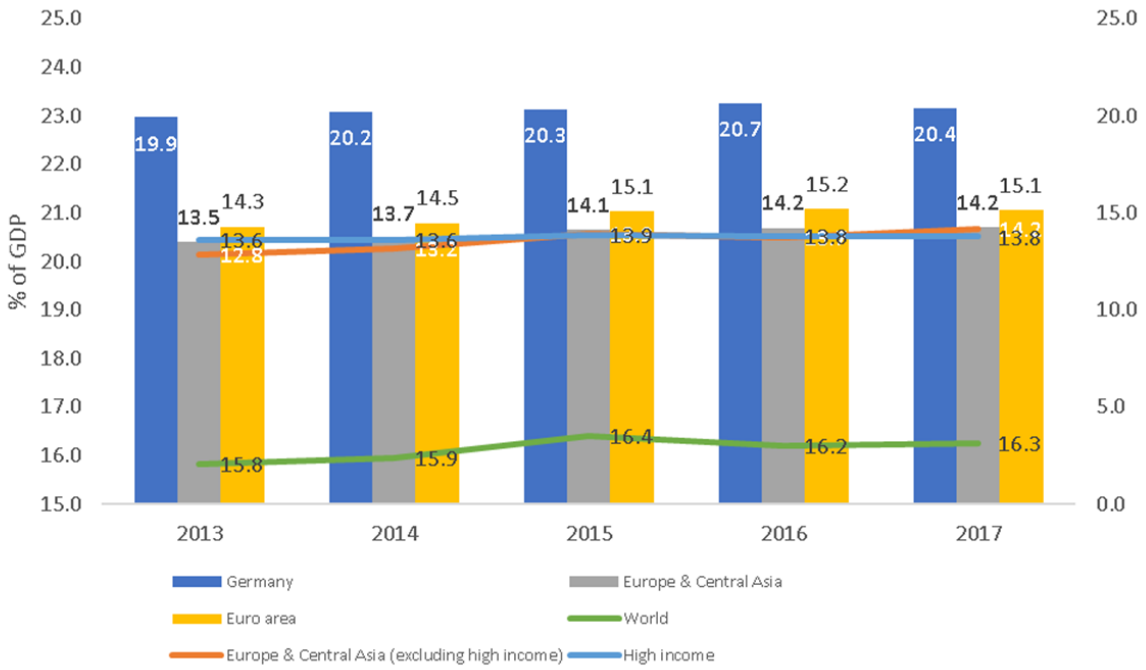

Fig. 2. **German Manufacturing Sector Contribution to GDP**

Source: World Bank Group.

Germany based on the LQ45 and DAX stock index, respectively. The inventory performance indicators that significantly influence financial performance from study data will be tested, and every variable must be examined to determine their reliability and validity. A list of variables will be listed in *Table 2* and *Table 3* below.

There are 11 observed variables in financial performance prediction. However, other variables must be considered when calculating with AMOS. Those other variables are the degree of error in which each observed variable will have some degree of error. The degree of error represents the external factors that may affect the value of that variable, which will not be discussed in this study. A model is created using the AMOS software to better understand where each variable is placed.

The result of AMOS is measured by the Goodness of Fit Model to determine whether the expected values of the model's variables fit well with observed variables. The Goodness of Fit Criteria being calculated is GFI, AGFI, RMSEA, and TLI.

B 2. Reliability and Validity Testing

Determining the study's information, validity and reliability are crucial because, along the process, some information might suggest that it parallels or contradicts each other. This would create complexity for the researcher in finding the answers, whether the information is generally applicable, and captures the intended phenomenon. The data should be put into the SPSS software to process its reliability with Cronbach's Alpha to measure the internal consistency. In *Table 4* below, the result of Cronbach's Alpha is .756 or 75.6%,[14] which means the data is reliable [19, 21].

The validity test is done using the SPSS software program with KMO and Bartlett's Test method to measure the adequacy of sampling thoroughly and measures sampling adequacy for each indicator shown in *Table 5* [22].

Based on the KMO and Bartlett's Test table above, the KMO value obtained from the study was 0.680 or 68.0%. By comparing the KMO and Bartlett's Test size table, the results obtained indicate that the KMO value of the research results is included in the excellent category because they it is in the range of 0.60–0.69 [23].

[14] Institute for Digital Research and Education. What Does Cronbach's Alpha Mean. URL: https://stats.idre.ucla.edu/spss/faq/what-does-cronbachs-alpha-mean/, 2019 (accessed on 01.11.2022).

Table 2

Descriptive Analysis

	N	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
DSI	120	72.43	4.101	44.922	2,018.028	.949	.221	.700	.438
RMI	120	16.09	1.348	14.770	218.158	1.791	.221	4.588	.438
WIP	120	7.74	1.087	11.907	141.770	3.002	.221	9.761	.438
FGI	120	35.99	2.278	24.951	622.551	1.162	.221	1.263	.438
INVTO	120	70.79	3.927	43.023	1,851.009	.800	.221	.137	.438
GR	120	.3091	.01438	.15752	.025	.690	.221	-.418	.438
PM	120	.0794	.00399	.04372	.002	.607	.221	1.021	.438
OM	120	.2343	.11780	1.29042	1.665	10.927	.221	119.591	.438
ROA	120	2.2753	.26756	2.93102	8.591	.955	.221	.073	.438
ROE	120	6.6060	1.01121	11.07723	122.705	.669	.221	15.506	.438
ROIC	120	4.5563	.57269	6.27345	39.356	2.498	.221	12.070	.438
Valid N (listwise)	120								

Source: Premier Data.

Table 3

List of Variables Used for Financial Performance

Variables for Inventory Performance	Variables for Financial Performance
RMI, WIP, FGI, INVTO, and DSI	GR, PM, OM, ROA, ROE, and ROIC

Source: Premier Data.

The result of the data analysis using AMOS in *Table 6* shows that the GFI is 0.771. In this study, the RMSEA shows 0.198, and according to Hooper, Coughlan, and Mullen (2008), the measurement model is valid when the RMSEA value is lower than 1 [10]. Another indicator to test the model's fitness is the TLI, which in this study is 0.736 or 73.6%. The TLI value states the degree of compatibility of the model. According to some research [24, 25] the measurement model is marginally fit as it is close to 95%.

The structure of the model needs to be tested to ensure that each exogenous variable indeed affects its endogenous variables. The exogenous variables include RMI, WIP, FGI, INVTO, DSI GR, PM, OM, ROA, ROE, and ROIC. On the other hand, endogenous variables are inventory performance and financial performance. Every variable is accompanied by a degree of error next to it, representing external factors that influence the value of that variable.

As shown by *Table 7* above, it can be stated that there is a fundamental relationship between the exogenous variables and endogenous variables, as no negative numbers are indicated. In addition, this can be seen by looking at the P value, especially with ***, which means that the relationship between variables is significant. Inventory performance has 30.6% explanatory power toward financial performance. The relationship is substantial because the p-value is still below 5%. However, PM and OM sub-variables have a p-value of more than 5%, meaning they are insignificant.

C. Interpretation Of Path Analysis

The final step in testing inventory and financial performance is analyzing the path diagram created from processing data using AMOS software. The figure below indicates the overall model used in testing inventory and financial performance, including inventory performance formed by five

Table 4

Reliability Test

Case Processing Summary			
		N	%
Cases	Valid	120	100,0
	Excluded	0	,0
	Total	120	100,0
a. Listwise deletion based on all variables in the procedure.			

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,756	,820	11

Source: Premier Data.

Table 5

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**,680**
Bartlett's Test of Sphericity	Approx. Chi-Square	992,437
	df	55
	Sig.	,000

Source: Premier Data.

Table 6

Data Analysis Result

Model	RMR	GFI	AGFI	TLI rho2
Default model	13.050	**.771**	**.649**	**.736**
Saturated model	.000	1.000		
Independence model	272.339	.400	.280	.000
Model	**RMSEA**	**LO 90**	**HI 90**	**PCLOSE**
Default model	0.198	.175	.223	.000
Independence model	.386	.366	.407	.000

Source: Premier Data.

exogenous variables and financial performance created by six exogenous variables. *Table 8* below shows that inventory performance indicators are RMI, WIP, FGI, INVTO, and DSI. These five indicator variables correlate with inventory performance.

The value in *Table 7* proves that DSI has the highest correlation value towards inventory performance, which is 101.2%, compared to the other indicator variables. When the variable of inventory performance is increased by 1, the DSI will increase by 101.2%, or in other words, the DSI has 101.2% explanatory power towards financial performance. The variation of DSI that can influence the inventory performance of selected publicly listed manufacturing

Table 7

Standardized Regression Weights

			Estimate	S.E.	C.R.	P
FinPerf	<—	InvPerf	,001	,000	2,943	,003
INVTO	<—	InvPerf	1,000			
FGI	<—	InvPerf	,381	,043	8,826	***
WIP	<—	InvPerf	,167	,021	7,787	***
RMI	<—	InvPerf	,184	,028	6,607	***
DSI	<—	InvPerf	1,095	,029	38,154	***
GR	<—	FinPerf	1,000			
PM	<—	FinPerf	,034	,056	,598	,550
OM	<—	FinPerf	,926	1,655	,559	,576
ROA	<—	FinPerf	30,657	5,968	5,137	***
ROE	<—	FinPerf	128,327	24,064	5,333	***
ROIC	<—	FinPerf	82,768	15,178	5,453	***

Source: Premier Data.

companies in Indonesia and Germany is 102.41%. In comparison, RMI is considered to have the weakest correlation value with inventory performance. The hen variable of financial performance is increased by 1. Thus, the RMI will only increase by 51.7%, or in other words, RMI only has 51.7% explanatory power towards inventory performance. Theoretically, DSI informs how fast companies can sell products to generate a more considerable profit measured in an average number of days. The lower the number compared to the industry average the more productive the company is in managing its inventory and generating income [25, 26].

The value in *Table 9* proves that ROIC has the highest correlation value towards financial performance, 97.0%, compared to the other indicator variables. When the variable of economic performance is increased by 1, the ROIC will increase by 97.0%, or, in other words, the ROIC has 97.0% explanatory power towards financial performance. The variation of ROIC that can influence the financial performance of selected publicly listed manufacturing companies in Indonesia and Germany is 94.09%. At the same time, OM is considered to have the weakest correlation value with financial performance. When the variable of economic performance is increased by 1, the OM will only increase by 5.3%, or, in other words, the OM only has 5.3% explanatory power towards financial performance.

There is a significant influence between inventory and financial performance. This is because inventory performance has 30.6% explanatory power towards financial performance on the selected publicly listed manufacturing companies in Indonesia and Germany based on the LQ45 and DAX stock index, respectively. The correlational level falls under the low positive (negative) correlation category, as shown in the table below. Since the number in the estimate column is positive, a direct relationship is established between inventory performance and financial performance. As inventory performance increases, so does financial performance by about 30%.

Furthermore, the p-value is 0.3%, which means that the relationship between inventory performance and financial performance is significant as the p-value is below 5%. The circle shapes with "e" symbols represent a degree of error representing unobserved external factors that can influence the variable, as shown in *Fig. 3* below.

Table 8

Inventory Performance Indicator Correlation Value

			Standard Regression Weights (R)	Standard Multiple Correlation Value (R squared)
DSI	<—-	InvPerf	1.012	102.41%
INVTO	<—-	InvPerf	0.964	92.93%
FGI	<—-	InvPerf	0.633	40.07%
WIP	<—-	InvPerf	0.583	33.99%
RMI	<—-	InvPerf	0.517	26.73%

Source: Premier Data.

Table 9

Financial Performance Indicator Correlation Value

Indicator	Standard Regression Weights (R)	Standard Multiple Correlation Value (R squared)
ROIC	0.97	94.09%
ROE	0.851	72.42%
ROA	0.769	59.14%
GR	0.467	21.81%
PM	0.056	0.31%
OM	0.053	0.28%

Source: Premier Data.

D. Managerial Decisions / Implications

There are several findings from other studies that conclude inventory performance influences financial performance. For example, indicate the positive relationship between inventory management and financial performance variables in some selected manufacturing companies in Mogadishu. Discovering the inventory management practices used in manufacturing companies and examining the relationship between inventory management and financial performance in manufacturing companies have been the study's objectives [4, 7, 20, 27].

This research found a positive correlation between inventory management practices and the financial performance of sugar manufacturing companies in Kenya. Also, the relationship between financial and inventory performance with its discrete inventory components, such as RMI, WIP, and FGI of manufacturing firms in India. The researchers categorized the inventory into three significant categories: RMI, WIP, and FGI. The researchers found that FGI is negatively associated with financial performance, while RMI and WIP did not show any impact on gross profit margin adjusted with sales [9, 12].

There is a moderately positive relationship between FGI and ROA because some researchers believe that ROA is closely correlated with inventories [28]. Therefore, the easiest way to relate FGI to ROA is by clicking FGI to asset turnover ratio and ROS. Firstly, the asset turnover ratio is an indicator of efficiency or productivity. It means that the higher the asset turnover ratio, the more sales the company generates per unit asset. Secondly, ROA can also be related to inventories through ROS ("Return on Sales"). It has also been observed that inventory management practices are correlated. ROS has a strong positive correlation with strategic supplier partnerships. Strategic supplier partnerships are essential for firms when picking suppliers who will become their business partners to supply their products. The strength of the correlation differs between inventory types. RMI has the highest correlation

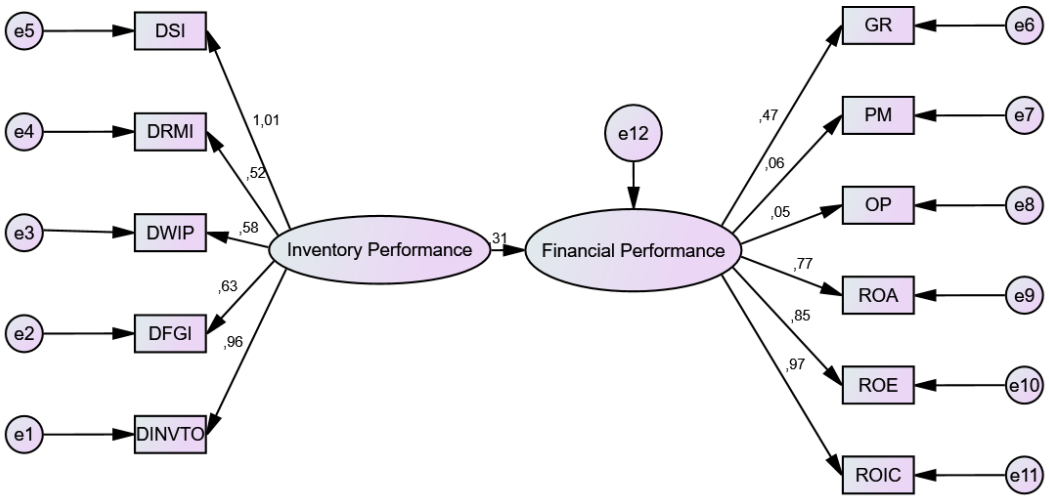

Fig. 3. **SEM Research Model**

Source: Premier Data.

with all financial performance measures, but WIP has a higher correlation only with gross profit, while FGI is highly correlated with operating profit measures.

This result also proves that effective and efficient inventory cost management, including the cost of FGI inventories, would lead to higher profitability, as the entire profitability of firms is tied to the volume of products sold, which has a direct relationship with the quality of the product. The correlation between inventory turnover and GR lies in the item called COGS. Inventory turnover is used to make better pricing and production decisions, leverage promotions to move excess inventory, and schedule new inventories. In the income statement, inventory appears under the COGS account. An overall decrease in inventory cost results in lower COGS because less is spent on rent, insurance, theft, spoilage, utilities, and other things. COGS is considered a crucial metric on the financial statement as it is subtracted from a company's sales to get its gross profit; therefore, as the COGS decreases, the gross profit will increase. Thus, since companies intend to drive profitability, sales growth could increase inventory turnover because the firms will have lower inventory levels to start and end a period, lowering the carrying cost.

CONCLUDING REMARKS

Inventory performance significantly influences financial performance as the p-value below 5% ensures that each exogenous variable affects its endogenous variables. The exogenous variables include RMI, WIP, FGI, INVTO, DSI GR, PM, OM, ROA, ROE, and ROIC, calculated to find Standardized Regression Weights. Inventory performance has an explanatory power of 30.6% toward financial performance. Since the relationship is positive, an increase in inventory performance will increase financial performance as well. DSI has an explanatory power of 101.2%; INVTO has an explanatory power of 96.4%; FGI has an explanatory power of 63.3%; WIP has an explanatory power of 58.3%, and RMI has an explanatory power of 51.7% towards inventory performance. The increased value in DSI, INVTO, FGI, WIP, and RMI will also affect inventory performance.

ROIC has an explanatory power of 97.0%; ROE has an explanatory power of 85.1%; ROA has an explanatory power of 76.9%; GR has an explanatory power of 46.7%; PM has an explanatory power of 5.6%, and OM has an explanatory power of 5.3% towards financial performance. The increased value in ROIC, ROE, ROA, GR, PM, and OM will also improve financial performance.

The results support the supply chain management literature's claim that inventory performance significantly influences financial performance as measured by profitability ratios since this study is based on correlations and does not prove causality between the variables of inventory performance and financial performance. This study is limited to

data available in public databases. The conclusions of this study should not be generalized beyond its scope. Data are gathered as a single entity and do not account for the complexity of firms that perform in more than one manufacturing facility.

Financial performance and inventory performance measures and results in this study should be interpreted accordingly. However, prior literature studies have documented many positive turnarounds in manufacturing companies because the higher the level of inventories preserved by a firm, the lower its rate of return. In addition, companies should have effective and efficient operations by optimizing the inventory level to generate better income.

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S. Irdiana — critical analysis of literature, interpretation of research results.
I. Moridu — collection of statistical data.
E. Susanti — results presentation in the form of tables and graphs.
I.M. Nawangwulan — work on the English version of the article.

Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 01.12.2022; revised on 22.12.2022 and accepted for publication on 26.01.2023. The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-90-103
UDC 336.64(045)
JEL G32, Z23

New Financial Fair Play Requirements in the Context of Global Restrictions

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ABSTRACT

The **purpose** of the paper is to develop recommendations for Russian football clubs aimed at strengthening their financial stability. The **subject** of the study is the UEFA financial fair play rules and their impact on the financial stability of football clubs. The **relevance** of the paper is confirmed by the changes taking place in financial regulation of football clubs by the UEFA and the Football Union of Russia (FUR), which are caused by the global crisis and have not yet been studied in the scientific literature, which confirms the **novelty** of the study. The authors' method is an analysis of the editions of the UEFA financial fair play rules and FUR licensing rules that have been in effect since 2011, along with any violations and subsequent sanctions. The annual reports of European public football clubs, studies of consulting companies, and academic publications in this field were also considered. This paper helped identify the chronology of financial rules in football and directions for their improvement. The authors conducted a detailed analysis of financial performance of club football in Europe and Russia, taking into account the impact of the pandemic, revealed the main problems and ways to solve them based on best practices. The **results** of the research included recommendations for football clubs aimed at compliance with financial requirements of UEFA and FUR as well as ensuring the long-term sustainability of the Russian football industry.

Keywords: economics of sports; finance in sports; economics of football; finance in football; financial management in football

For citation: **Solntsev I.V., Kudryaeva A.G. New financial fair play requirements in the context of global restrictions.** ***Finance: Theory and Practice.*** **2023;27(5):90-103. DOI: 10.26794/2587-5671-2023-27-5-90-103**

INTRODUCTION

Particularly, with the start of the COVID-19 pandemic problem, which exposed the need to change the financial control system in the football industry, financial regulatory policies in Europe are now under criticism.

Rules of financial fair play (further — FFP) were introduced by UEFA in 2011 following the record financial difficulties of European football clubs: 664 clubs in the top leagues of the UEFA member countries showed a total loss of 1 bln 675 mln euros.

The annual growth in payrolls, as well as transfer payments to clubs and agents, has been a significant requirement for controlling and regulating football clubs' finances. According to UEFA, in 2007–2011, European top-league clubs spent on wages, bonuses, prizes, taxes and social contributions between 62 and 71% of the club's total income per season, adversely affecting the ability to invest in football development, and sometimes failing to cover non-football-related regular expenses.

At the same time, leading clubs often invested in the purchase of player's money shareholders, without thinking about payback [1–3]. This led to a weakening of the competitive balance, as clubs that "lived on the means" could no longer compete with the top-teams.

Excessive spending on players prevented investments in infrastructure, development of children's and youth football, as well as new business areas. For example, "for the period 2006–2014 the total net investment in the development of French football clubs from the top leagues amounted to only about 3.6% of their revenues" [4].

The financial FFP rules themselves are part of the general regulations on the licensing of European clubs to participate in the

Champions League, the Europa League and the Conference League. Despite the fact that the UEFA regulations on club licensing provide about 35 different requirements to licensors, the 2 fundamental principles around which the majority of disputes arise — are the absence of a club's default debt and the "break-even rules". These requirements, their limitations, as well as high-profile breaches, have already been discussed quite in detail in the existing literature [1, 2, 4–14], so we will focus on the FFP reform and proposals to comply with them.

The basic method used in the study was the analysis of the following documents:

- UEFA Licensing Regulations;[1]
- Licensing Benchmarking Report for the period 2010–2021;[2]
- Reports of the UEFA Club Financial Control Body;[3]
- Reports of consulting companies;[4]
- Annual reports of football clubs;[5]
- Order of the Court of Arbitration for Sport.[6]

- The national rules for licensing clubs in the top-5 leagues of Europe and Russia were further analyzed (*Table 1*).

National regulation is not static and is regularly adapted to current conditions. For example, in December 2021, the RFS added several new recommended financial criteria, which will be required from the season 2023/2024. The first criterion is called "financial stability" and requires clubs to have accounts and hold funds in reliable banks of the Russian Federation, which are among the top-100 banks in the country. The second criterion measures the net liabilities of clubs in relation to the amount of assets. The latest new criterion measures the cost of players (wages, transfer costs, tax and insurance deductions) and is expressed as a percentage of the operating revenue. At the end of 2021 of the reporting year, this percentage will be 85, but it will have to be below 70 already from 2024. This criterion was introduced due to the fact that many national football clubs are characterized by large payrolls, and thus RFS seeks to limit expenses on players and their wages.

VIOLATION OF FFP RULES

According to UEFA, only 8 clubs were investigated in the 2021/2022 season (*Fig. 1*). Moreover, all of them violated the rule on overdue accounts payable, followed by financial sanctions in the amount of 75–350 thous. euros (except for F.C. AEK, whose violations UEFA considered too significant, imposing a penalty of 1.5 million euros and withholding 15% of future revenues from European competitions). A review of sanctions for violation of FFP rules is presented in *Fig. 2*.

Thus, financial regulation in football is carried out at the international and national levels, has existed for a long period of time and solves the important task of ensuring the financial sustainability of competitors. The purpose of this research — is to develop recommendations for clubs to adapt to the new reality based on an analysis of global

[1] UEFA Club Licensing and Financial Sustainability Regulation. Edition 2022. URL: https://editorial.uefa.com/resources/0274–14dc03ef33b9–3e2caa872860–1000/20220408_club_licensing_and_financial_sustainability_regulations_2022-en.pdf (accessed on 05.07.2022).

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Table 1

Comparison of National Financial Regulation Systems and UEFA FFP

League / Characteristics	Basic principle of financial regulation	Main financial criteria and indicators	Possible sanctions for non-compliance
La Liga (Spain)a	Maximum individual wages and restrictions on excessive spending	– Income and expenses for 3 seasons; – forecast budget; – net worth; – component cost; – adjusted obligations of the club	– Reduction of component cost in the next season; – budget adjustment
EPL (UK)b	Solvency to creditors and limitation of losses	– Financial result for the previous 3 seasons; – fairness of contracts and transactions; – absence of overdue accounts payable; – current and future financial information; – information on players and transfers	– Deduction of debt from League income; – deduction of points; – penalties; – ban on the registration of players
Bundesliga (Germany)c	Financial accountability and solvency to creditors	– Cash and liquidity ratio; – absence of overdue accounts payable; – current and future financial information; – information on players and transfers, marketing and sponsoring contracts; – legal and organizational information	– Abolition of licensing procedures; – denial of license; – penalties; – ban on the registration of players; – control measures for the elimination of deficiencies
Serie A (Italy)d	Solvency to creditors and limitation of losses	– Financial result for the previous 3 seasons; – absence of overdue accounts payable; – financial statements and legal information for the previous season; – information on players and transfers	– Penalties; – deduction of points in the licensed season
League 1 (France)e	Sports investments shouldn't extend above the club's financial capabilities	– Monthly and annual reports on wages, players, transfers; – absence of overdue accounts payable; – three-year forecast budget; — "depletion of losses by owners' investments"	– Ban on the registration of players; – limit of application; – penalties; – deduction of points; – downgrade to a lower league; – removal of responsible managers

Table 1 (continued)

League / Characteristics	Basic principle of financial regulation	Main financial criteria and indicators	Possible sanctions for non-compliance
RPL (Russia)f	Financial accountability and solvency to creditors	– Financial and legal information; – forecast financial information; – break-even within 3 years; – information about players and agent debt; – absence of overdue accounts payable; – debt withdrawal to the RFS, UEFA and interregional federations; – limit on wages and transfers; – debt limit	– Penalties; – revocation of license; – denial of license; – ban on the registration of players; – limit of application; – balance restrictions on transfers
UEFA (Europe)	Achievement of break even and "living by means"	– Break-even within 3 years; – absence of overdue accounts payable; – legal and financial information about the organization	– Penalties; – denial of license; – recommendations, budget monitoring; – limit of application

Source: Compiled by the authors.

Note:

[a] Liga nacional de futbol profesional. Standards for the preparation of the budgets of clubs and sads. Full text and annexes. La Liga. 2021. URL: https://assets.laliga.com/assets/2021/08/12/originals/c53d54179cc68e9215f82a058325468d.pdf (accessed on 05.07.2022);

[b] The FA. Premier League Handbook. Season 2020/2021. 2020. URL: https://resources.premierleague.com/premierleague/document/2020/09/11/dc7e76c1-f78d-45a2-be4a-4c6bc33368fa/2020–21-PL-Handbook-110920.pdf (accessed on 05.07.2022);

[c] DFL. Lizenzierungsordnung (LO). 2019. URL: https://media.dfl.de/sites/2/2019/06/Lizenzierungsordnung-LO-2019–05–16-Stand.pdf (accessed on 05.07.2022);

[d] Lega Nazionale Professionisti Serie A. Sistema Licenze Nazionali 2016. LNP. 2016. URL: https://www.legaseriea.it/uploads/default/attachments/documentazione/documentazione_m/814/files/allegati/895/sistema_licenze_nazionali_2016–2017_serie_a.pdf (accessed on 05.07.2022);

[e] DNCG. Direction Nationale du Contrôle de Gestion. 2008–2009 saison. 2008. URL: https://web.archive.org/web/20100331205939/http://www.lfp.fr/reglements/pdf/statuts/DNCG.pdf (accessed on 05.07.2022);

[f] RFU. Rules of Football Union of Russia on licensing of football clubs in the Russian Federation, edition 5.0. 2021. URL: https://static.rfs.ru/documents/1/61e7dbdf86a03.pdf (accessed on 05.07.2022);

[g] UEFA Club Licensing and Financial Sustainability Regulation. Edition 2022. 2022. URL: https://editorial.uefa.com/resources/0274–14dc03ef33b9–3e2caa872860–1000/20220408_club_licensing_and_financial_sustainability_regulations_2022-en.pdf (accessed on 05.07.2022).

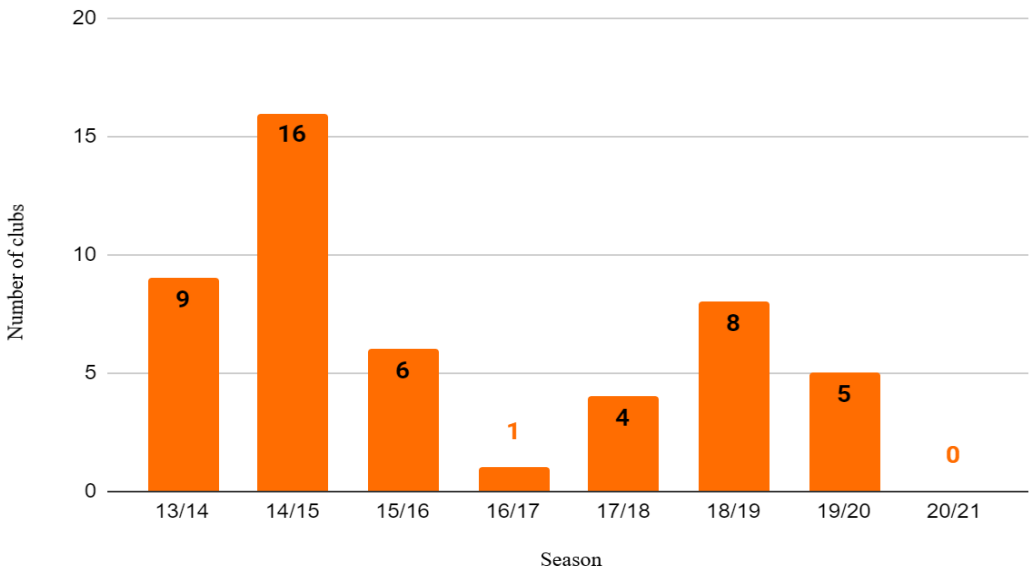

Fig. 1. **Number of Clubs (Open Cases) that Violated the UEFA Break-Even Rule**

Source: Compiled by the authors.

developments that are taking effect, in order to determine their effects on club finances and regulatory changes.

INFLUENCE OF THE COVID-19 PANDEMIC

UEFA recognized the club's difficulties as a result of lower revenue and the possibility of non-compliance with the FFP program. For example, in the 2020/2021 season, UEFA did not apply sanctions against clubs due to a violation of the break-even rule, as the new sanctions would further aggravate the financial situation of European football clubs.

Additionally, UEFA has implemented a variety of measures that have reduced the financial regulations for participation in European tournaments as a result of the global economic crisis. Firstly, clubs were given extra time to cover all their debts to creditors. Secondly, clubs could provide information on their receivables so that no other clubs would fail to pay their obligations to them and did so on time. Thirdly, during the licensing process in the 2020/2021 season, the 2020 financial year was not taken into account, which was subsequently combined with the 2021 financial year for the purposes of monitoring break even for the 2021/2022 season (thus, the club assessment for the 2021/2022 season covered 4 financial periods — 2018, 2019, 2020 and 2021). The impact of the pandemic on the financial performance of European clubs is presented in *Table 2*.

The fall in the income part of the budget is mainly due to the decrease in revenue from tickets and match-day. In the league period, clubs lost about 66–88% of these revenues in 2021, depending on the format of the season (with play in winter or with break) and national restrictions. Of course, due to attendance restrictions and lockdown, commercial revenues from the use of facilities outside games days have also decreased: during the pandemic period, they have declined by approximately 76%. It is hardly surprising that the pandemic caused a 7% decline in direct merchandising revenue in the fiscal years 2020 and 2021 (for clubs that earlier).

The other, rather large part of the club's revenue — from sponsors, in 2020 decreased slightly, by 3%. At the same time, the leading clubs in Europe, on the contrary, showed a rise in revenue by this indicator, so the slight decrease is due to the revaluation of sponsorship contracts of medium and small

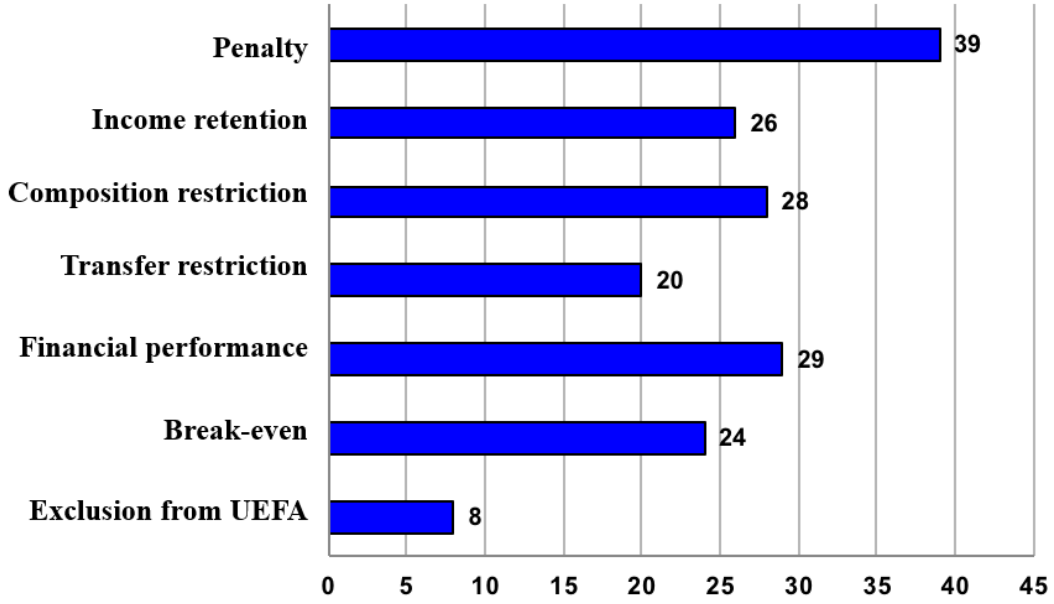

Fig. 2. **Frequency of Sanctions Applied for Violation of the Break-Even Requirement by the CFCB and UEFA**

Source: Compiled by the authors.

clubs of Europe. In the whole, the trend to increase sponsorship contracts (and, not least, the number of sponsors in the club) continued during the pandemic, which indicates the growing interest in football by companies, and also caused by the advent of football sponsoring bookmakers. 19% of all major sponsors in Europe's top divisions are sports betting and gambling companies.

Despite the steady growth of TV rights revenues, in 2020, European football clubs lost around 14% of this item's income, which is equivalent to 1.2 bln euros, due to cancellation/transfer of matches, a decline in TV audiences, which led to some major broadcasters' contracts being revised, and due to the transfer of revenues to 2021. Therefore, in 2021 the revenue from television contracts continued to grow, some clubs showed an increase in revenue under this article, and 5 clubs in Europe (Manchester City, Manchester United, Bayern, Barcelona and Real Madrid) exceeded the 200 mln euro for the 2020/2021 season. The global growth trend in TV revenue is supported by factors such as the growing popularity of football, competition caused by the arrival of new players and OTT-platforms, the rise in the number of digital channels.

A similar situation occurred with the income of clubs from competitions under the auspices of UEFA. In 2020, the incomes fell by the same 14% due to the revision of a number of UEFA contracts (with sponsors, broadcasters, etc.), but already in 2021 a new tournament was founded — the Conference League. UEFA announces increased prize fund to more than 2.7 bln euros per year to be distributed between 96 clubs participating in three club competitions. The general dynamics of income of European clubs is presented in *Fig. 3*.

At the same time, the dynamics of the growth of incomes is quite significantly different for the top-leagues and all the others (*Fig. 4*).

The next indicator that requires analysis to assess the effectiveness of FFP is wage costs. Since 2012, these expenses have increased by 56.5%, or 5.2 bln euros. It should be noted that this growth is due to the increase in the wages of players, which accounts for 70–80% of all payments of employees of the club (*Fig. 5*).

Table 2

Impact of the COVID-19 Pandemic on Key Financial Indicators of European and Russian Football Clubs

Revenue item	2018	2019	2020	Change from 2019 to 2020, %
INCOME				
TV rights	7.9	8.3	7.1	–14.46
Tickets and match-day	3.1	3.3	2.5	–24.24
UEFA payments	2.1	2.8	2.4	–14.29
Sponsorship and merchandising	6.4	6.9	6.6	–4.35
Other income	1.6	1.7	1.8	5.88
EXPENSES				
Wages of player	10.3	11.3	11.1	–1.77
Wages of other staff	3.4	3.5	3.3	–5.71
Operating expenses	6.9	7.3	7	–4.11
Net operating expenses	1.005	1.03	2	194.17
Net transfer costs	–	0.5	1.4	180.00
FINANCIAL PERFORMANCE				
Net worth	9.01	10.3	9.3	–9.71
Transfer accounts payable	5.1	5.7	6.5	14.04
Operating profit / loss	0.7	0.9	–1.01	–212.22
Pre-tax profit	0.5	–0.1	–3.09	–3090.00

Source: Compiled by the authors.

The reduction in operational costs has been influenced by the lack of spectators and the prospect of reducing the cost of organizing games and friendly games. Since only part of the 2020 pandemic season was affected, the decrease in operational costs was insignificant — about 4% compared to 2019. At the same time, long-term liabilities and bank loans grew by 7%.

By 2013, the first financial period when the break-even rule was introduced, football clubs showed steady operating losses. Since the introduction of this requirement until the start of the pandemic, the clubs showed a steady operating profit, which has never fallen below the 700 mln euro since 2014 (*Fig. 6*).

CHANGE OF UEFA'S FINANCIAL REGULATION

When it became evident in 2020 that the clubs' revenues were drastically declining, experts spoke back about the need to change the FFP rules during the crisis. UEFA has confirmed that the rules will be revised and the updated club licensing regulations will come into force in the spring of 2022. The regulations of 7 April 2022 do not differ from the previous versions.

Updated rules emphasize the club's net worth, which must be either positive for the previous year's monitoring period or show a change in the direction of an increase of more than 10% from the previous reporting period.

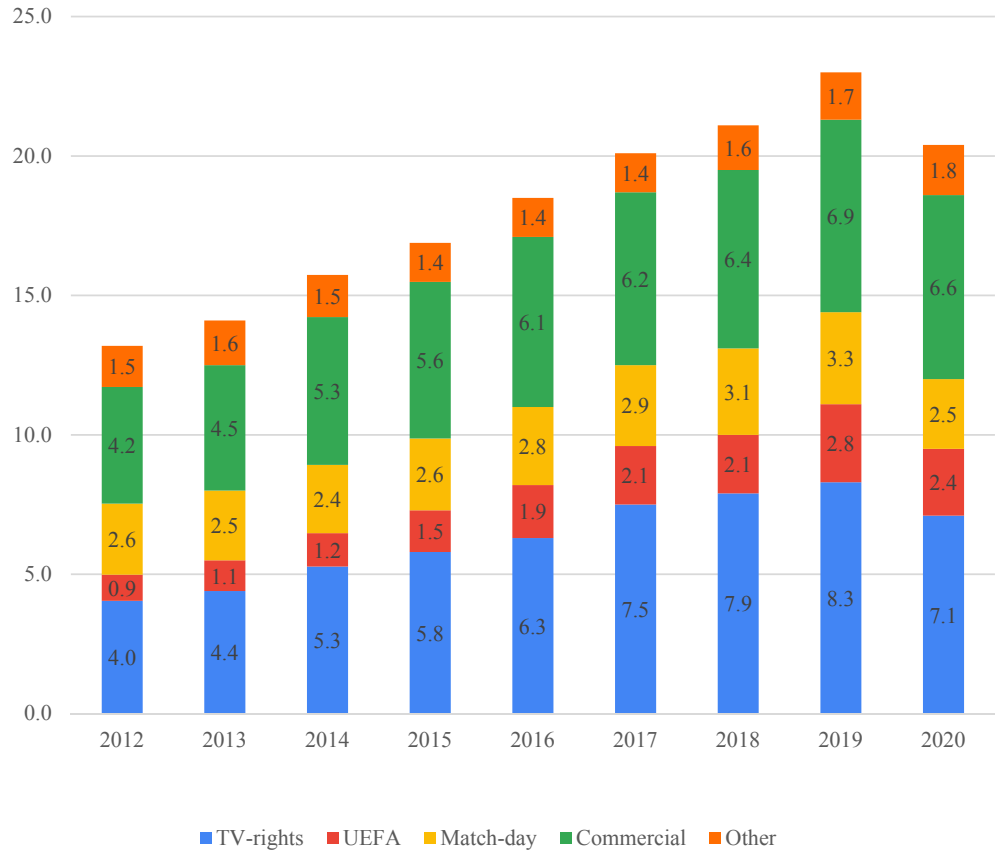

Fig. 3. **Dynamics of the Main Income Items of Football Clubs in Europe for 2012–2020**

Source: Compiled by the authors.

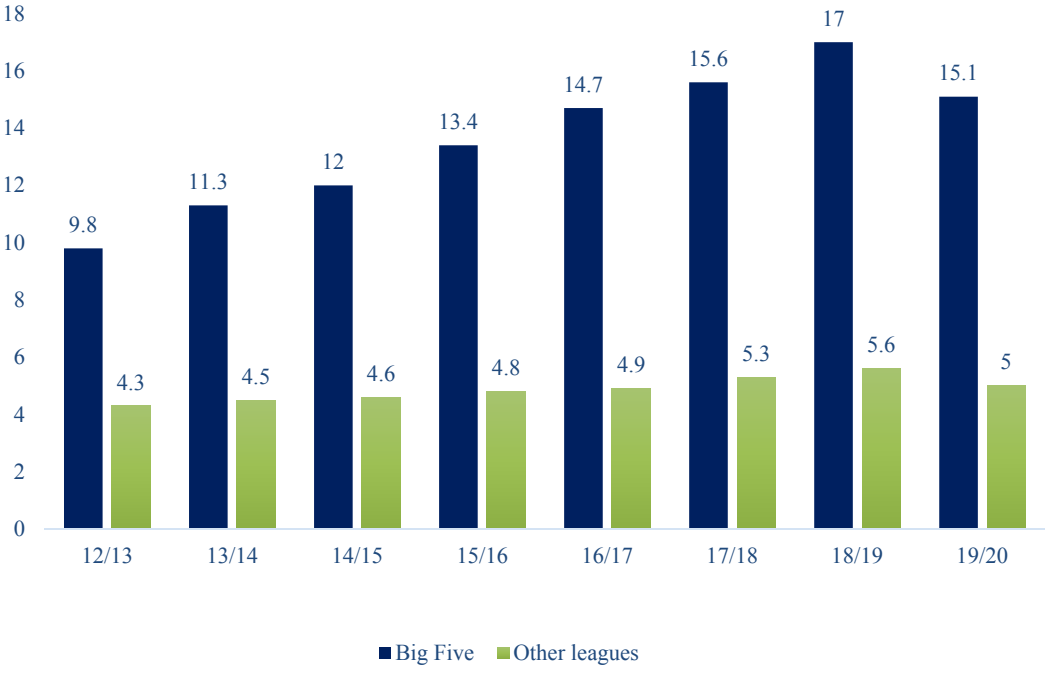

Fig. 4. **Dynamics of Football Club Revenues in the Big Five Countries and in other Leagues for 2012–2020**

Source: Compiled by the authors.

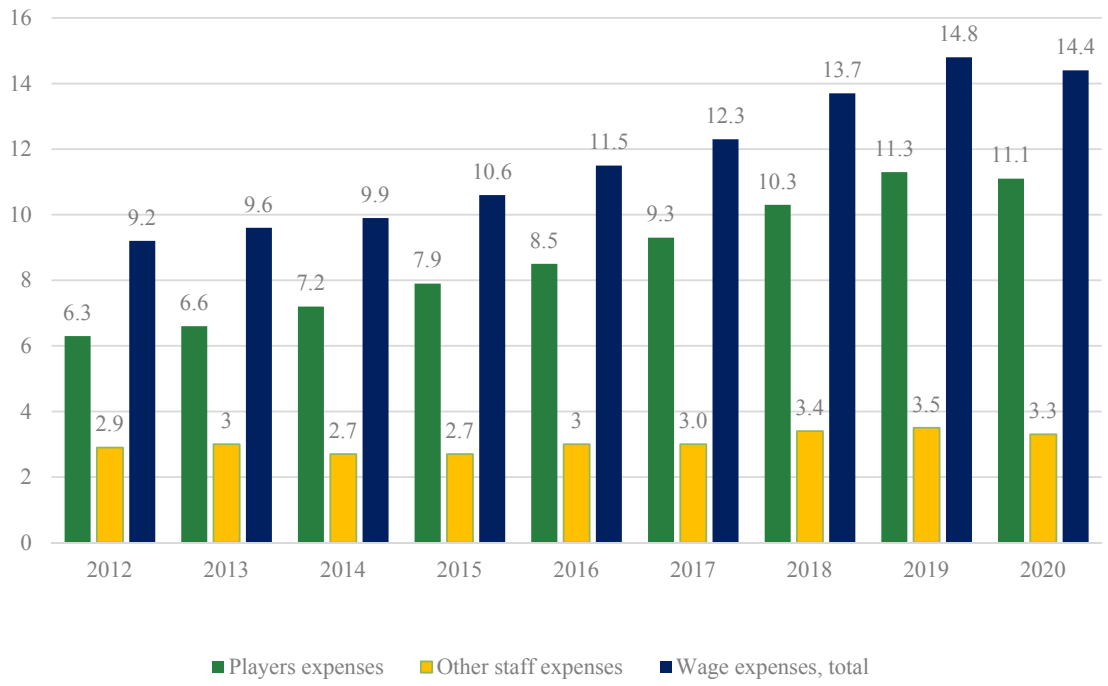

Fig. 5. **Dynamics of Wage Costs of Football Clubs in 2012–2020**

Source: Compiled by the authors.

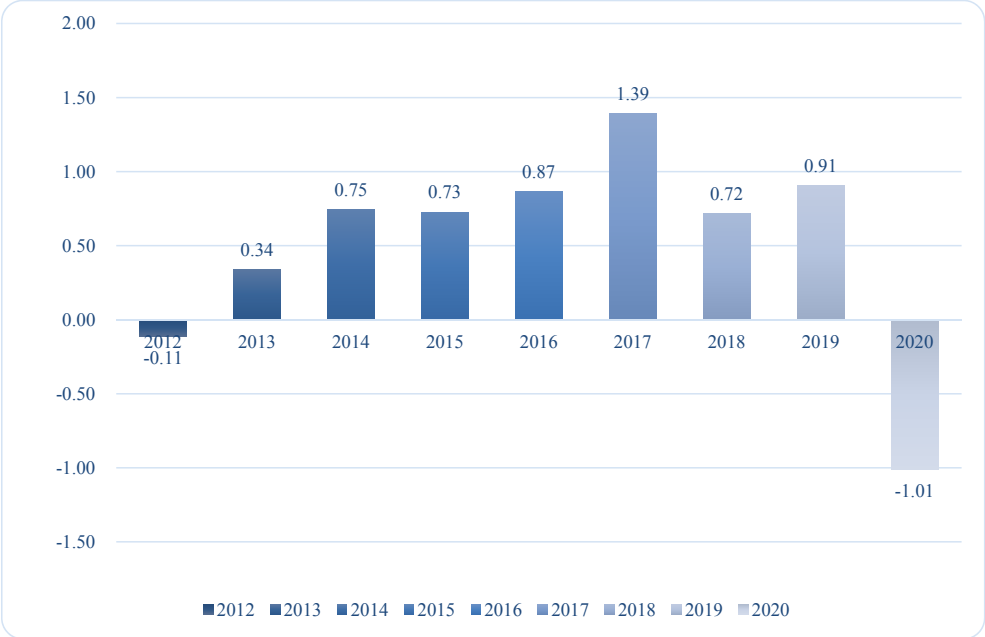

Fig. 6. **Operating Income of European Football Clubs, 2012–2020**

Source: Compiled by the authors.

The main difference from the old FFP rules is that instead of two key requirements for club licensing, there are three new ones: solvency, stability and cost control.

The solvency requirement implies no default credit debt on transfers, wages to all staff and players, social benefits, as well as to UEFA and national federations. In the new chapters, there is a paragraph that controls the absence of current obligations to UEFA (including disciplinary measures). Also, debt is checked more often, namely

3 times a year: July 15, October 15 and January 15.

The stability requirement implies a slightly modified requirement of break-even. The revenue rule of a football club, as it is now called, in the same format estimates the relevant and non-relevant income and expenses of the club (in accordance with the FFP break-even rule), as well as the difference between the respective income and expenses. The permissible "loss" in the new regulation is the same 5 mln euros. The main change is the amount of the possible increase in the loss due to the contributions of the owners: it can be increased not to the usual 30 mln, but already to 60 mln euros.

The last requirement of the updated regulation is cost control. Until 2022, UEFA estimated the club's wage costs. If they exceeded 70% of the total income, additional information was requested from the licensed club. The cost control rule is now a separate criterion for club licensing, non-compliance causes severe penalties. The controlled indicator shall be calculated using the formula and shall not exceed 70%:

$$\frac{\text{wage costs + depreciation of player contract + + agent/broker costs}}{\text{adjusted operating income + net profit (loss) from sales of player registrations.}}$$

The first requirement must be completed by all clubs in competition in UEFA competitions. The second requirements only apply to teams with wage costs of more than EUR 5 million in each of the previous two reporting periods. Finally, the last cost control requirement does not apply only to clubs whose above-mentioned costs amount to less than 30 mln euros for the period that ends in the UEFA club season.

The updated regulations are in effect as of 1 June 2022, already for the 2022/2023 season, but will not be completely implemented for another three years. The cost control requirement will only apply from the 2023/2024 season with a limit of 90% for the first and 80% for the second season. The stability requirement will also not apply in the 2022/2023 season and will be replaced by the usual break-even rules from the previous version of the regulations. The three-year monitoring period will not apply until the 2025/2026 season: just the period ending in 2023 and the 2024/2025 season will be required in the 2023/2024 season. This, according to UEFA, will allow clubs to adapt to the new financial rules, as well as avoid the inclusion in the assessment of periods significantly affected by the COVID-19 pandemic. Finally, the solvency requirement will apply from the moment the regulation enters into legal.

As regards sanctions for violation of financial control rules, in terms of solvency and stability rules, sanctions remained similar to the previous licensing regulations. Since the cost control rule is introduced for the first time, the penalties for its violation are slightly different. For exceeding the allowable wage, transfers, and related payments ratio, UEFA and CFCB shall deduct a share of the income and prize money from participation in European club competitions in proportion to the severity of the violation and the number of such violations in the previous four years.

RECOMMENDATIONS FOR CLUBS

Based on the analysis, recommendations can be formulated for Russian football clubs, which are aimed at increasing income, cost optimization, increasing financial sustainability and compliance with the requirements of the updated UEFA licensing regulations.

1. Planned reduction in wages and transfer reports. Due to constantly rising expense on these items, many clubs will not be able to meet the new cost control requirement even with significant income increases. At the same time, growing demand will not allow these costs to be decreased all at once: the monetary criterion will continue to be important when players

choose a club. Top-clubs always gain from this because they are not restricted by budget. The exit might be a change of the reward system in which basic payouts are transferred to the premium category and paid only when specified indicators, such as wins in individual matches or tournaments, are achieved.

2. Reduction in agency fees, which could significantly reduce not only expense accounts, but also simplify compliance with the cost control rule. At the same time, it should be noted that many Russian clubs have extremely substantial amounts for payments to agents. For example, FC "Spartak–Moscow" in 2021 paid agents 608 mln rubles[7] (*Fig. 7*), and in 2022 the club decided to close the youth team "Spartak-2", the maintenance of which cost 300–400 mln rubles per year.[8] In terms of operational efficiency, the second team may allow for huge savings on legionnaire transfers and wages, making such a decision unusual.

3. The use of innovative technologies. Modern technology requires substantial investment, but in the medium term it reduces the overall cost budget. For example, an artificial intelligence-based TransferRoom service helps clubs in choosing players for problem positions. This reduces transfer costs and agency remuneration. In addition, modern technology can increase the income of the club by improving the comfort of the fans and the spectacularism of the games. In this case, CRM systems and virtual and augmented reality technologies are used, which, by the way, are already used in some American and European clubs. Finally, new technologies are applied in the training process and recovery of players, which allows to improve athletic performance.

4. The use of digital assets. Recently, the release of club NFT-tokens for fans has developed appeal among Western clubs. Tokens, as a high-tech analogue of traditional shares, allow its holders the right to various benefits, including the capacity to participate in decision-making (e.g., to choose music to play during a match break), to enjoy advantages when buying tickets, the chance to choose a location, and much more. You can also change the token rate to make money. For the club, this tool can not only increase the loyalty of fans, but also become a new source of income.

5. Improve fan communication. Active contact and efficient communication with each fan segment are vital not only for attracting fans to stadiums and improving club merchandise sales, but also in the context of working with sponsors. This is especially important in the context of the introduction of Fan ID, which can seriously affect the decrease in income on the day of the games. Communicating with fans through press conferences, social networks, through special events, creating loyalty programs — is an important part of the business model of any club that seeks to work effectively and without losses.

6. Development of infrastructure, youth and women's football. First, the relevant costs are not taken into account in the licensing of clubs, but directly affect the further efficiency of the football club. Infrastructure development can generate additional income from activities and rental of commercial real estate. Investments in the generation of the club academy reduce the gap between the cost of transfer campaigns and incomes from them. And the presence of a women's team from the summer of 2022, under the new regulations, is one of the criteria for club licensing. Furthermore, women's football has the potential to be a promising direction because it is already growing popularity with viewers (for example, on 29 April 2022 more than 91.5 thous. fans watched the game of the female "Barcelona"). Despite the fact that

[7] URL: https://www.championat.com/football/news-4713329-spartak-lider-rpl-po-vyplatam-agentam-v-2021-godu-krasno-belye-otdali-608-mln-rublej.html (accessed on 05.07.2022).

[8] Kuimova П. "Spartak" closed the second team. Has the club enabled the hard saving mode? Championat.com. 2022. URL: https://www.championat.com/football/article-4703811-spartak-obyavil-o-zakrytii-vtoroj-komandy-po-finansovym-prichinam-chto-eto-znachit-dlya-kluba-podrobnosti.html (accessed on 05.07.2022).

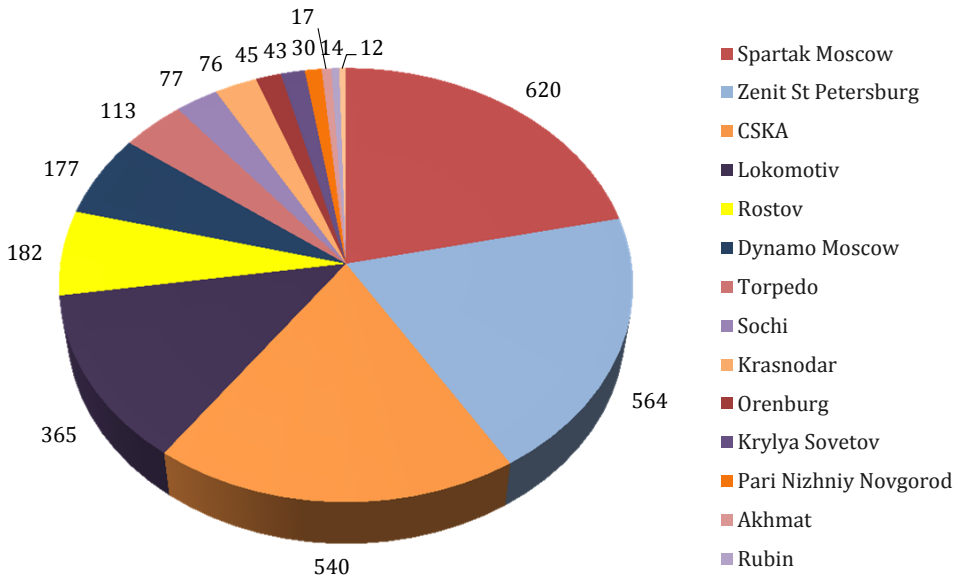

Fig. 7. **Payments to Agents of Russian Premier League Clubs in the 2021/2022 Season, RUB million**

Source: FUR. Published financial information of clubs. 2022 URL: file:///Users/annakudryaeva/Downloads/6297924fdef11%20(3).pdf (accessed on 05.07.2022).

increasing investments in the above directions is one of UEFA's recommendations, many clubs ignore it and strive for results quickly and with significant cash inputs, which rarely repay due to the specificity of the sports business and the uncertainty of the sporting outcome.

7. The use of player rentals to save money on transfers. Leases with the right to reschedule are treated as the player's actual permanent transfer from the date of the contract in the FFP rules (even if the rescheduling is provided only under specified conditions, which is a regular practice in recent years). In this case, clubs can enter into leases with no subsequent obligation to redeem, which lowers the club's expenses because the lease cost is typically substantially cheaper than the acquisition cost. It should also be noted that leasing players allows for a reduction of selection errors and does not require a one-time investment in the purchase of players. This is required in order to achieve the break-even point. Also, under certain conditions, this may have a positive influence on wage statements.

8. Increase the fair value of sponsorship contracts by diversification them. Overpricing sponsorship contracts with corporations connected with the club's shareholders was one of the most common strategies to avoid FFP's rules. "PSG", "Manchester City", and "Dynamo-Moscow" have all used this strategy. With this legal way can be the conclusion of contracts with subsidiaries that are part of the holding (this way, in particular, went the St. Petersburg "Zenit" and Moscow "Spartak", as well as attracting as sponsors small companies to separate categories and the signing of barter agreements with transport companies, water producers, etc. Furthermore, it makes sense to fill sponsorship contracts with a significant number of activations, unique incentives, and bonuses for partners, while integrating activations with the sustainable development objective. All of these could increase the worth of the agreement and bring it closer to the fair evaluation that UEFA monitors. Of course, chances for new sponsorship contracts have been reduced during the current crisis

period. However, due to the need to replace the products of foreign companies, domestic business will need new channels of promotion and advertising, which opens certain opportunities for professional sports clubs.

9. Overdue accounts payable. In order to reduce the amount of outstanding debt, clubs may enter into deferral agreements, which is a reason not to account for these payments as overdue debts. This proposal is largely about debt transfer, which is the most popular article. At the same time, keep in mind that such agreements will necessitate the counterparties' approval and, maybe, an increase in the result payments.

CONCLUSION

Despite the long existence of the system of regulation of club finances, its constant upgrading to the changing external conditions, the requirements of clubs and their shareholders, there are still aspects that need to be refined, including taking into account the particularities of individual countries. Based on substantial information, this paper generates experience and demonstrates the need for an integrated strategy to managing football clubs' financial flows and ensuring their financial sustainability.

The recommendations developed by the authors combine several important areas of work and will contribute to more rational spending, generating additional or new sources of income and, as a consequence, will help Russian clubs to ensure compliance with UEFA and FUR licensing requirements. Unfortunately, due to the global crisis and a number of restrictions, domestic clubs in the next few years will probably not be able to participate in European competitions. However, the FFP rules are aimed at ensuring overall financial stability, and thus the main motivation for Russian clubs in current conditions should be general financial recovery, which, of course, will have a positive impact on the long-term development of domestic football and will ensure not only the development of sport, but also the inflow of private investors, as well as a reduction in public expense. The study is based completely on data from the football industry, but the authors expect that its results will be applicable to other team sports where financial stability is a problem.

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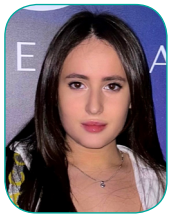

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 26.06.2022; revised on 10.07.2022 and accepted for publication on 26.12.2022.
The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-104-114
JEL G11, G14, G15

The Impact of Market Maker Competition on Price Efficiency Features in the Tunisian Stock Market

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ABSTRACT

The **purpose** of this study — is to determine the relationship between market maker competition and stock price efficiency in TSE (Tunisian Stock Exchange) market. The proxy for competition was determined as the number of market makers and the parameters investigated were transaction costs, information asymmetry and profit. The high positive correlation between competition and stock price efficiency is demonstrated by the negative impact of competition on all the variables studied. In addition, the price efficiency increased considerably after the introduction of new market makers by using the difference-in-difference (DID) model. Also, the competition between market makers has a significant negative impact on price efficiency through transaction costs, asymmetry information and level of experience. Thus, it can be concluded that the stock price efficiency can be improved by increasing the competition of market makers in Tunisia.

Keywords: market maker competition; price efficiency; transaction cost; information asymmetry; TSE

For citation: **Hachicha F. The impact of market maker competition on price efficiency features in the Tunisian stock market. *Finance: Theory and Practice*. 2023;27(5):104-114. DOI: 10.26794/2587-5671-2023-27-5-104-114**

INTRODUCTION

With the digital revolution, financial markets gradually evolved into electronic markets. This development has significantly improved the information dissemination mechanism as well as the transparency of price formation. With this evolution, several investors now have the ability to place their orders via electronic terminals. Despite these advantages, the transition from markets to the electronic world was not without undesirable side effects. In particular, the growing participation of ATMs in financial exchanges has heightened the risks of adverse selection, price manipulation and stock market crashes. In order to cope with these risks, the main world stock exchanges now use specialized agents called market makers. These are intermediate institutions that intervene in the liquidity flow of a given transferable security Ingo [1].

The advantage of these intermediaries as regards direct negotiation in exchange markets is that they allow them to process orders for the profit of their clients and capture the order flow.

Several empirical studies have dealt with the impact of competition between market makers. However, the literature has not thoroughly addressed this issue and its impact on the stock exchange. Only perfect competition or monopoly has been considered in the market microstructure investigation. W.G. Christie and R.D. Huang [2] shed light on the competition between market makers in the Nasdaq stock market.

The impact of competition between market makers on price efficiency is sought in this work through several parameters, notably transaction costs, asymmetric information and profit by providing evidence from the Tunisian market. We wanted to study the impact of market makers competition on price efficiency in a less developed market than the most prominent ones, such as the Nasdaq and China's NEEQ [3].

In Tunisia, the Tunis Stock Exchange (TSE) fully manages the stock market. Established as a private entity, its shareholders are stock market intermediaries. Since 1996, TSE has operated as a purely electronic order-driven market. Investors place orders through market makers. TSE functions as a continuous market for active stocks and a call auction for less liquid ones.

Information asymmetry leads to inefficient economic outcomes, such as investment and finance decisions, and encourages managerial expropriation (T. Chen et al. [4]).

As for transaction costs, the effects of a decline on the structure and performance of organizations and markets have been treated by V. Gurbaxani and S. Whang [5]. A few studies have considered negative effects of reduced transaction costs, especially on intermediaries, but even here the replacement of traditional intermediaries with electronic interaction is socially beneficial, even if it

reduces the profitability of existing intermediaries. Our study extends the prior literature as it links market maker competition with stock price efficiency.

Our starting point was to study the microstructure of the Tunisian financial market through different channels. So far, no researcher has addressed this issue in the Tunisian market. The choice of this market was not arbitrary. The aim was to study the impact of the competition of the market maker on the efficiency of stock market in Tunisia and compare it to developed markets like China's NEEQ and NASDAQ.

The rest of this paper flows as follows: in Section 2, the related literature is surveyed and hypotheses are suggested. Section 3 explains the variables and methods. The data and statistical tools are displayed in Section 4. We present and analyze the obtained results in Section 5. The conclusions are drawn in Section 6.

LITERATURE REVIEW AND HYPOTHESES

Price efficiency is the timely and exact reflection of information about a stock price [6]. The present work investigates the impact of market maker competition on price efficiency through three channels.

Channel 1: Transaction cost

The effects of a decline in transaction costs on the structure and performance of organizations and markets has been a central theme in the information systems literature for many years, as stated in the paper V.A. Belyaev [6].

The effects of a decline in transaction costs on the structure and performance of organizations and markets has been a central theme in the information systems literature for many years [7].

For the most part, research on this topic suggests that lower transaction costs are almost always beneficial. Reductions in transaction costs have been linked to direct cost savings, indirect benefits through improvements in agency costs, monitoring or coordination within existing organizations and markets, and even the creation of new types of market structures that are more efficient [7, 8].

Transaction costs are measured using bid-ask spreads, illiquidity, and trading volume. Market maker competition decreases the transaction costs of stocks, which facilitates the trading of informed orders and a higher efficiency of pricing [9–11].

Hypothesis 1. Market maker competition affects price efficiency through transaction costs. There exists a negative relationship between competition and the transaction costs of a stock.

Channel 2: Information asymmetry

Information asymmetry has been widely reported to affect dealerships. Information-based microstructure models include those by D. Easley and M. O'Hara [12], D.F. Foster and S. Viswanathan [13].

Proxy information asymmetry has been introduced by A. Elbadry et al. [14]. It includes bid-ask spreads, volatility, trading volume and trading value as information asymmetry measurements, market maker competition was found to foster the information asymmetry.

These theoretical models yield two important empirical predictions: the asymmetry is positively related to the bid-ask spread and to the price impact of a trade.

Hypothesis 2. Market maker competition affects price efficiency through asymmetry information. There exists a negative relationship between competition and asymmetry information.

Channel 3: Profit

The trading profits of market makers is affected by competition increase. In our study, we introduce market makers' trading experiences as a key determinant of the competition effect. Our study extends the prior literature as follows. It unprecedentedly investigates the relationship between market maker competition and stock price efficiency. The available literature on this relationship considers market makers in general [15]. The present work however focuses on actual instances of market makers. We consider competition detrimental to price efficiency, as well as other factors indicated in the literature [16]. The relation between market maker competition and price efficiency is herein deemed positive as the former decreases stocks' transaction costs and further incorporates information. In the literature, results are contradictory. Some works claim that competition increases transaction costs [17], while others assert that it decreases costs [11].

Hypothesis 3. Market maker competition affects price efficiency through the channel of trading profit. A stronger negative relationship between competition and total trading profits should be observed in the market maker group with high experience.

REGRESSIONS PARAMETERS AND CALCULATION

Competition

Following R. Winne [18], the level of completion was determined in terms of the evolution of the number of

market makers for a given stock during a definite period. Three variables are considered to calculate the price efficiency as related to completion.

Price Efficiency

The first variable has two proxies: pricing errors and price delay, as they have been proven accurate for this type of investigation in the literature [19]. The first proxy was accounted for in accordance with the work of J. Hasbrouck [20]. The second was determined via the method of K. Hou and T.J. Moskowitz [21].

According to J. Hasbrouck [20]. The estimate of the variance of price errors is:

The standard variance of the transaction price for price efficiency proxy is calculated as follows:

We calculate on each trading day per stock.

On the other hand, K. Hou and T.J. Moskowitz [21] define price delays as the delay in firms' stock return responses to market returns. We compute the price efficiency using the following equation:

This relation suggests that a greater value of refers to a decrease in price efficiency. However, it fails to consider the length of lags or the precision of the estimates. Thus, the following adjustment was also employed:

Trading Cost

Trading costs are estimated in terms of bid-ask spread, illiquidity and volume. The spreads are analyzed as a function of a dealer's cost and market structure, as described in the paper by R. Castellano and R. Cerqueti [22]. We calculate the daily average spread for each sample as a proxy for transaction cost. According to T. Chordia et al. [23], the spread it is determined for sample *i* at transaction time t as follows: where is the bid price and is the ask price at time *t*, and is the average spread for sample i on transaction day *d*.

We follow Y. Amihud [24] in measuring illiquidity (*ILLIQ*) and volume as proxies for market transaction costs. Volume is the average daily volume of a sample during the trading period. *ILLIQ* is calculated using return and volume, as follows:

Where D denotes the trading days of the sample period; denotes sample *i* return on day *d*; is the share volume of sample *i* on day *d*; and the value of *ILLIQ* denotes the illiquidity in the sample and is negatively related to liquidity level, whereas volume is positively related to liquidity level.

Trading Information Asymmetry

Different proxies have been suggested in the literature. K. Kanagaretnam et al. [25] examine other proxies, specifically earnings forecast dispersion and forecast revision volatility. In the present work, we followed A. Elbadry et al. [14] who use four proxies, namely volatility, bid-ask spread, share volume and trade value.

Trading Profits

According to O. Hansch et al. [26], market makers' total trading profit is calculated as: where denotes the trading profit of market makers of sample *i* in transaction time *t*, denotes bid price, denotes ask price, and denotes sell and buy volumes, respectively.

At the methodological level, we tried to test each time the impact of market maker competition on the efficiency of markets through the different channels.

DATA DESCRIPTION AND STATISTICS

In our study, the shares come from the TSM. On 31 December 2018, 80 companies were listed on the Tunisian stock market (TSM), most of which were small and medium-sized enterprises. We will use the daily data relating to listed companies. Data collection is from the TSM and the Data Stream. We use the R software (R studio) to derive the empirical results.

Our final sample contains 12 market makers and 80 companies from different sectors estimated over 2 periods: the first period going between 02.01.2017 and 31.12.2017 and the second period going between 02.01.2018 and 12.31.2018. The market makers are: BIAT Capital, Amen Invest, STB Finance, Attijari intermédiation, BNA Capitaux, BEST Invest, UIB Finance, UBCI Bourse, Compagnie gestion et finance, Maxula Bourse, MENA Capital Partner, Union Financières.

- **Descriptive statistics**

For a better understanding of samples, we provide descriptive statistics in *Table 1* and *Table 2*. We classify samples according to the number of market makers. The statistical variables are sample size, average price, standard variance of price, turnover, share volume, and market capitalization. In *Table 1*, we show the average value of the statistical variables in different market maker groups.

At the start and for the first year, we set a market maker number of around 8 (*Table 1*). Subsequently, we added 4 grades to see their impact on price efficiency (*Table 2*).

Table 1

Summary Statistics of Samples (Period 1)

Market maker	Price	Volatility	Turnover	Volume	Market Cap
1	22.26	2.7	0.50	24.68	10.74
2	31.13	5.28	0.37	51.2	12.56
3	15.93	4.74	0.14	29.2	6.14
4	22.4	1.54	0.21	34.74	8.24
5	7.06	1.11	0.07	10.15	10.72
6	31	3.73	0.3	16.82	11.5
7	59.53	5.68	0.39	31.01	12.68
8	32.33	7.64	0.24	82.13	10.96

Source: Compiled by the author.

Note: Summary statistics of samples provide summary data for 80 samples divided by the number of market makers as different groups. In each group, we calculate the average values of price, volatility, turnover and market capitalization. Market maker represents the number of market makers in the samples for the first period (02.01.2017 until 31.12.2017). The price represents the daily closing price in the samples. Volatility represents the standard deviation of the closing price in the samples. Turnover is calculated as the daily share volume divided by the number of shares outstanding. Market cap (in million Tunisian dinars) represents the market capitalization for the samples.

Table 1 presents descriptive statistics for the first period (02.01.2017 until 31.12.2017) for 8 market makers. We find that the stock price is different between the 8 market makers it varies between 7.06 and 59.53. We also see that volatility is modest globally, ranging between 1.11% and 7.64%, and transaction volume ranges between 10.15 and 82.13.

Table 2 shows that the number of samples decreases as the number of market makers increases. Most samples have no more than six market makers. With the market maker increasing, we find that turnover, share volume, RMB volume, and market capitalization exhibit an increasing trend.

This table provides summary data for 80 samples divided by the number of market makers as different groups. In each group, we calculate the average values of price, volatility, turnover, share volume, and market capitalization. Market maker represents the number of market makers in the samples: period 1 includes 8 market makers (January 2017 — December 2017) and period 2 includes 12 market makers (introduction of 4 new market makers) in January 2018 — December 2018.

We note from this analysis that the Tunisian financial market is well influenced by the entry of new market makers.

Summary Variable Statistics

We also provide summary statistics of the dependent and explanatory variables of the 80 samples in *Table 3*. It provides summary statistics of the variables used in our study. Number represents the number of market makers in the samples. Spread represents the difference between the bid and ask prices. *ILLIQ* represents the inverse liquidity level. Profit (in million Tunisian dinars) represents the total trading profit of market makers in each sample.

It is observed that the mean value and standard deviation are close and at the same level, and they are much smaller than the other three efficiency proxies. Profits are positive in 75% of the samples, indicating that most market makers earn money from trading. The two proxies for market makers' ability show a large difference between the maximum and the minimum, implying that some market makers may have information advantages over the other two efficiency proxies.

The descriptive statistics in *Table 3* show that the number is positive with a high standard deviation. The efficiency proxies are respectively positive with an equal standard deviation.

Also, we provide statistics on the correlation coefficients between the main variables in *Table 4*. The results show that the two price efficiency proxies are highly correlated and range from 0.77 to 0.95. The number of market makers has a negative correlation coefficient with price efficiency (in the range of –0.25 to –0.39), which implies that the number of market makers might increase the price efficiency of the stock.

It calculates the correlation coefficients between variables and proxies for price efficiency (*Table 4*).

Table 2

Summary Statistics of Samples for Totality Period

Market maker	Price	Volatility	Turnover	Volume	Market Cap
1	33.41	4.05	0.76	37.03	16.12
2	46.74	7.93	0.56	76.22	18.85
3	23.96	7.12	0.21	43.85	9.22
4	33.66	2.32	0.32	52.12	12.36
5	10.68	1.67	0.11	15.23	16.09
6	46.56	5.62	0.45	25.23	17.25
7	89.35	8.52	0.59	46.52	19.02
8	48.54	11.46	0.36	123.22	16.45
9	103.93	14.98	0.86	129.81	23.06
10	106.36	15.03	0.95	107.32	23.12
11	104.23	12.04	0.46	113.99	22.51
12	103.25	14.09	0.45	106.23	20.63

Source: Compiled by the author.

Note: Summary statistics of samples provide summary data for 80 samples and we add four market makers as different groups. In each group, we calculate the average values of price, volatility, turnover and market capitalization. Market maker represents the number of market makers in the samples for the second period (January 2018 — December 2018). Price represents the daily closing price in the samples. Volatility represents the standard deviation of the closing price in the samples. Turnover is calculated as the daily share volume divided by the number of shares outstanding. Market cap (in million Tunisian dinars) represents the market capitalization for the samples.

RESULTS AND ANALYSIS

Impact of Market Makers on Price Efficiency

The results of regression (2) are provided in *Table 5*. The independent variables are and, all of which are proxies for price efficiency.

From these results, we find that the number of market makers has a negative relationship with all coefficients are highly significant and have t-values greater than 5. The results imply that stocks with one more market maker, will decrease by 0.003 units. These results reflect the finding that the positive impact of market maker competition on price efficiency is both statistically and economically significant.

We find that the number of market makers has a negative relationship with the two efficiency proxies. All the coefficients are significant and have t-values greater than 5%: (–0.003), (–0.015) and (–0.09). We also notice that the control variables are respectively (the turnover, negative market capitalization and volatility with efficiency proxies.

These results measure the negative impact of competition from Tunisian market makers on price efficiency, which is both statistically and economically significant.

Impact of the New Entry of Market Makers

To provide a robustness test, we use DID to test the impact of the entry of new market makers on price efficiency. The regression is introduced in regression (3), and the details of the test are as follows. We choose stocks that only one market maker joined in during the trading period. A total of 80 qualified stocks constitutes the experimental group. We divide the experimental group stocks into two periods according to the date when the new market makers joined and calculate the price efficiency of each period.

Finally, we have 80 stocks that meet these requirements for the control group. There are 160 pairwise stocks for the DID test. *Table 6* provides statistics on the differences in size and efficiency measurements between pairwise stocks before new market makers entered. Panel A shows the value of the differences, and panel B shows the absolute value of the differences. *Table 6* shows the results of regression (3). The coefficient of After ExpG is negative and highly significant (–6.60) for EH and is negatively significant for the other three efficiency measurements, at least at the 5% level. These results suggest that price efficiency significantly increased after the new market makers entered. The results of the DID test are consistent with the conclusions of regression (2), in which the number of market makers is a proxy for competition.

Table 3

Summary Statistic of Variables

	Mean	Std.dev	Median	Max	Min
Number	9.230	8.223	6.293	66.234	4.256
E^{H}	0.089	0.046	0.063	0.620	0.031
E^{HW1}	0.622	0.456	0.849	0.923	0.009
E^{HW2}	0.982	0.189	0.304	0.123	0.123
Spread	0.012	0.018	0.023	0.089	0.004
ILLIQ	2.985	1.258	3.258	5.486	0.049
Profit	3.286	2.369	1.298	7.236	2.212
Asym	0.236	0.289	0.896	4.223	0.015

Source: Compiled by the author.

Note: Summary statistics of variables provide summary statistics of the variables used in our study. E^{H}, E^{HW1}, E^{HW2} are the proxies for price efficiency. Number represents the number of market makers in the samples. Spread represents the difference between the bid and ask prices. ILLIQ represents the inverse liquidity level. Profit (in million Tunisian dinars) represents the total trading profit of market makers in each sample. Asym represents the average profitability of market makers in each sample.

Table 4

Correlation Statistics Between Variables

	E^{H}	E^{HW1}	E^{HW2}	Nombre	Spread	ILLIQ	Volume	Asym
E^{HW1}	0.46							
E^{HW2}	0.26	0.29	–0.96					
Nombre	–0.56	–0.32	0.32					
Spread	0.28	0.23	0.22	–0.56				
ILLIQ	0.43	0.39	–0.28	–0.48	0.38			
Volume	–0.25	–0.23	0.23	–0.36	0.96	0.48		
Asym	0.89	0.36	0.56	0.23	0.28	0.25	0.87	
Profit	0.06	0.08	0.05	–0.09	0.23	0.18	0.43	0.78

Source: Compiled by the author.

Note: Correlation statistics between variables calculate the correlation coefficients between variables. E^{H}, E^{HW1}, E^{HW2} are the proxies for price efficiency. Number represents the number of market makers in the samples. Spread represents the difference between the bid and ask prices. ILLIQ represents the inverse liquidity level. Volume represents the number of trading shares in the sample. Profit represents the total trading profit of market makers in each sample. Asym represents the share and the trade volume.

Table 6 impact of the entry of new market makers on price efficiency. It provides the results of regression (3). The independent variables are all proxies for price efficiency. The coefficient After ExpG is negative and highly significant (–0.023) for and negatively significant for the other two efficiency measures (–0.105) and (–0.088) at least at the 5% level.

It is observed that the entry of a new market maker in the Tunisian equity market results in a significant negative increase in turnover, market capitalization and volatility.

These results suggest that price efficiency increased considerably after the arrival of new market makers.

Hypothesis 1 is well verified, namely that competition between market makers has a significant negative impact on efficiency. Our results are also consistent with the work of W. Zhang et al [3].

Market Maker Competition and Transaction Cost

To address the question of why market maker competition affects price efficiency, we first test the

Table 5

Impact of Market Maker Competition on Price Efficiency

	E^H	E^{HW1}	E^{HW2}
Intercept	0.022*** (4.27)	0.668*** (6.23)	0.705*** (11.30)
Number	−0.003*** (−6.71)	−0.015*** (−5.88)	−0.09*** (−5.08)
Turnover	−0.010** (−1.01)	−0.089*** (−4.91)	−0.033*** (−3.54)
Market cap	−0.005** (−1.53)	−0.015** (−2.03)	−0.007 *(−1.27)
Volatility	−0.003*** (−3.21)	−0.014*** (−2.01)	−0.006*** (−1.13)
R^2	0.123	0.198	0.39
Observations	80	80	80

Source: Compiled by the author.

Note: Impact of market maker competition on price efficiency. It provides the results of regression (2). The independent variables are E^H, E^{HW1}, E^{HW2}, all of which are proxies for price efficiency. Number represents the number of market makers. Turnover is calculated as daily share volume divided by number of shares outstanding. MarketCap represents the market capitalization for the samples. Volatility is the standard deviation of the closing price in the samples. The t-statistics are reported in parentheses. Single, double, and triple * indicate the 90%, 95%, and 99% levels of significance, respectively, based on the t-values.

possible channel by which market maker competition affects transaction costs. *Table 7* shows the results of regression (4).

We see from *Table 7* that the number of market makers has a significant negative impact on the two different measures of transaction costs: spread and ILLIQ. The coefficient linked to the number is −0.025 for the spread,—0.044 for the ILLIQ and has a positive and significant impact on the volume of 0.205, and all of them are very significant, with a T value greater than 10%.

The result is consistent with Hypothesis 1, i.e. competition between market makers has a significant negative impact on price efficiency through transaction costs (competition lowers transaction costs). Our result is also consistent with studies by R. Winne [18].

Market Maker Competition and Information Asymmetry

We first test the possible channel by which market maker competition affects transaction costs. *Table 8* shows the results of regression (5). We see in *Table 8* that the number has a significant negative impact on the 3 measures of information asymmetry: spread, volatility, trade volume and trade value. We note that market capitalization, price and volatility have a significant negative impact on spread, ILLIQ and volume

The results are consistent with Hypothesis 2. That is, the asymmetry of information has a negative impact on competition from Tunisian market makers.

Market Maker Competition and Trading Profit

The results of regression (6) for each group are shown in *Table 9*. In line with Hypothesis 3, we find that the results of the three groups are very different. In the median and low experience groups, the number of market makers has no significant relationship with trading profits. No obvious learning behavior occurs when market makers compete with the less experienced.

Across different experience groups (high, medium, and low), the number of market makers showed non-significant associations with trading profits, with values of −4.029,—3.067, and −2.062 in the high, medium, and low experience groups, respectively. Conversely, in all three experience groups, there was a notable adverse correlation between yield and trading profits. The strong experience group exhibited a performance coefficient of 23.042, while the medium and weak experience groups displayed coefficients of −31.010 and −61.306, respectively.

Table 6

Impact of the Entry of New Market Makers on Price Efficiency

	E^H	E^{HW1}	E^{HW2}
Intercept	0.072 (0.17)	0.186 (0.45)	0.374 (6.22)
After	0.002 (0.61)	0.038 (1.23)	0.022 (1.02)
Exp	0.006 (0.89)	0.009 (1.16)	0.056 (2.86)
After x Exp	−0.023*** (−4.04)	0.105*** (−2.51)	−0.088*** (−3.67)
Turnover	0.015*** (−2.09)	−0.156*** (−3.10)	−0.068*** (−4.21)
Marketcap	−0.009** (−1.27)	0.056 (0.12)	0.008 (0.08)
Volatility	−0.002** (−1.75)	0.021*** (−3.70)	−0.007*** (−2.13)
Observation	80	80	80
R^2	0.104	0.286	0.207

Source: Compiled by the author.

Note: Impact of the entry of new market makers on price efficiency. It provides the results of regression (3). The independent variables are E^H, E^{HW1}, E^{HW2}, all of which are proxies for price efficiency. After is a dummy variable equal to 1 if the sample period starts after the change in the number of market makers. ExpG is a dummy variable equal to 1 if the sample belongs to the experimental group. Turnover is calculated as daily share volume divided by number of shares outstanding. MarketCap represents the market capitalization for the samples. Volatility represents the standard deviation of the closing price of the samples. The t-statistics are reported in parentheses. Single, double, and triple * indicate the 90%, 95%, and 99% levels of significance, respectively, based on t-values.

We find that competition from market makers has a strong negative impact on trading profits.

The results found in this market are of practical importance and relevance. Through this research, it has been shown that although the microstructure of this market is different compared to developed markets (liquidity, volatility, transaction volume, market capitalization, number of market makers, etc.), the market maker competition has a significant impact on price efficiency.

CONCLUSION

Our study uses data from TSE market to test the relationship between market maker competition and price efficiency.

We further find that the competition among market makers with stronger research abilities increases price efficiency. Our study also discusses the channels of price efficiency that are affected by market maker competition. We tested three channels from the literature: transaction costs, profit and asymmetric information. We use bid-ask spreads, illiquidity, and volume as proxies for transaction costs and show that market maker competition decreases transaction costs. Furthermore, the asymmetry of information has a negative impact on competition from Tunisian market makers. Additionally, the group of market makers with high trading experience has an impact on price efficiency. Also, we find that competition from market makers has a strong negative impact on trading profits.

It is true that the Tunisian market is not considered a developed market like that of NYSE, Nasdaq and China NEEQ, but the results prove that despite the reduced number of companies as well as market makers, there is a relationship between competition's market maker and price efficiency through different channels. Also, the results imply that price efficiency can be improved by enhancing the competition of market makers with high research ability and experience.

Table 7

Impact of Market Maker Competition on Transaction Costs

	Spread	ILLIQ	Volume
Intercept	0.023 (3.25)	1.102 (12.04)	2.134 (6.11)
Number	−0.025*** (−12. 73)	−0.044*** (−13.02)	0.205*** (11.41)
Market cap	−0.004*** (−11.02)	0.098*** (−15.94)	0.757*** (10.98)
Price	−0.005*** (−11.23)	0.004 (0.64)	−0.072*** (−4.13)
Market return	−0.235 (−1.23)	−4.987 (−2.41)	23.25 (5.23)
Observations	80	80	80
R^2	0.325	0.226	0.263

Source: Compiled by the author.

Note: The impact of market maker competition on transaction costs provides the results of regression (4). The independent variables are Spread, ILLIQ, and Volume, all of which are liquidity measurements. Number represents the number of market makers. MarketReturn represents the average return of the market index during the trading days in the sample. The t-statistics are reported in parentheses. Single, double, and triple * indicate the 90%, 95%, and 99% levels of significance, respectively, based on t-values.

Table 8

Impact of Market Maker Competition on Information Asymmetry

	Spread	Trade volume	Trade value	Volatility
Intercept	0.010*** (2.95)	2.47*** (5.46)	1.003*** (7.34)	1.47*** (3.46)
Number	−0.005*** (−4.73)	−0.109*** (−8.11)	−0.004*** (−2.62)	−0.239*** (−5.11)
Market cap	−0.07*** (−3.40)	−0.076*** (−3.28)	−0.08*** (−4.94)	−0.234*** (−1.38)
Price	−0.007*** (−5.73)	−0.0216*** (−2.51)	−0.005*** (−1.09)	−0.0543*** (−3.51)
Market return	−0.591*** (−6.21)	−0.177*** (−5.23)	−0.652*** (−9.62)	−0.2899*** (−3.84)
Observations	80	80	80	80
R^2	0.125	0.369	0.567	0.369

Source: Compiled by the author.

Note: The impact of market maker competition on information asymmetry provides the results of regression (5). The independent variables are Spread, Trade volume, Trade value and Volatility. Number represents the number of market makers. MarketCap represents the market capitalization of the samples. Price represents the average closing price in each sample. MarketReturn represents the average return of the market index during the trading days in the sample. The t-statistics are reported in parentheses. Single, double, and triple * indicate the 90%, 95%, and 99% levels of significance, respectively, based on t-values.

Table 9

Impact of Market Maker Competition on Trading Profit

	High experience	Median experience	Low Experience
Intercept	13.030*** (3.06)	16.310*** (3.14)	24.004*** (3.04)
Number	−4.029 (−3.42)	−3.067 (−1.22)	−2.062 (−0.91)
Stock return	−23.042*** (−3.04)	−31.010*** (−4.12)	−61.306*** (−5.16)
Market cap	0.267*** (2.23)	2.298*** (3.68)	4.621*** (5.15)
Turnover	−11.256 (−0.51)	−14.650 (−0.77)	−15.237 (−0.87)
Observations	27	26	27
R^2	0.226	0.218	0.256

Source: Compiled by the author.

Note: The impact of market maker competition on transaction costs provides the results of regression (6). The independent variables are High experience, Median experience and Low Experience. Number represents the number of market makers. The t-statistics are reported in parentheses. Single, double, and triple * indicate the 90%, 95%, and 99% levels of significance, respectively, based on t-values.

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Conflicts of Interest Statement: The author has no conflicts of interest to declare.

The article was submitted on 18.06.2022; revised on 20.07.2022 and accepted for publication on 26.10.2022. The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-115-127
JEL G11, G12, G15

Data Mining in Indian Equity Markets: Building Low Risk, Market Beating Portfolios

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ABSTRACT

Over the last five decades, business academics have identified over 300 determinants that potentially influence stock returns. However, we still do not know whether all return determinants are equally important, or whether there is a smaller set of determinants that has a disproportionately larger influence on stock returns. Can mining historical data help us find this smaller set of return determinants that has a disproportionately higher influence on stock returns? Using historical data from the Indian market, we build a large database of investments with more than 74,000 investments spread over a period of 132 months. From this database, using "association rule mining" method, we are able to mine a strong set of "association rules" that point to a smaller set of "return determinants" that are seen more frequently in investments that beat index returns. From a pool of thirty-seven return determinants, using "association rule mining", we were able to find out a small set of key return determinants that are seen most frequently in investments that beat index returns in India. Portfolios created from these "association rules" have a portfolio risk lower than the market risk and provide index-beating returns. "Out-of-sample" portfolios created using these association rules have portfolio "Beta" less than one and provide returns that beat the market returns by a significant margin for all holding periods in the Indian market. Through this paper, we demonstrate how portfolio managers can mine "association rules" and build portfolios without any limits on the number of factors that can be included in the screening process.

***Keywords*:** stock returns; mining association rules; return-determinants; portfolio-risk

For citation: **Mitragotri S.R., Patel N. Data mining in Indian equity markets: Building low risk, market beating portfolios. *Finance: Theory and Practice*. 2023;27(5):115-127. DOI: 10.26794/2587-5671-2023-27-5-115-127**

INTRODUCTION

Since 1970, business academics have identified more than 330 firm level return determinants [1]. However, we still have unanswered questions such as: are all these return determinants equally important in predicting stock returns? In this large pile of return determinants, is there a smaller set of return determinants with a stronger ability to predict stock returns? If there indeed is such a smaller set of return determinants — how do we uncover them? Can mining historical data help us answer these questions?

This study places historical data on stock returns and 37 highly prevalent return determinants in a single frame, and, with the help of "association rule mining" successfully, identifies return determinants that are seen more frequently in index-beating investments. Portfolios built from the mined association rules have a lower risk than the market, and yield returns that are significantly above market returns and perform equally well in an out-of-sample data set.

The remainder of this paper is organized as follows: in Section 2, we look at past research on factors influencing stock returns and try to understand the reasons for some of the contradicting inferences about factors influencing stock returns. We also examine recent methodologies used in empirical asset pricing research including the application of analytics and machine learning techniques. Section 3 briefly explains the association mining technique and analyzes the association rules mined between stock returns and return determinants. Section 4 tests the mined association rules and Section 5 concludes the paper.

LITERATURE REVIEW

In this section, we highlight how factors proven to be strong return determinants in one study are challenged, and proven to be insignificant in a subsequent one. The objective is to uncover the possible reasons for such contradicting inferences about the factors that influence stock returns.

Numerous studies have been carried out to identify factors that influence stock returns. One of the highly studied return determinants is the P/E ratio [2–4]. The predominant observation from these studies is that portfolios with low P/E stocks have lower systematic

risk and earn significantly higher returns compared to portfolios with higher P/E stocks. Another factor that has been closely studied for its impact on stock returns has been the "debt/equity" ratio (D/E) [5–7]. The D/E ratio of a company is a useful proxy for risk and a higher D/E ratio indicates a higher degree of risk for equity holders, which is seen in higher expected stock returns. However, another study [8] finds that the impact of these two factors, P/E and D/E, is subsumed by two other factors: size and BV/P (book value/price). A study by W.C. Barbee et al. [6] challenged the role of BV/P and size in predicting stock returns. Instead, they find that sales-price ratio and D/E ratio explain stock returns better than BV/P or size. This study reports that the sales-price ratio also captures the role of the D/E ratio in explaining stock returns, thus making the sales-price ratio a more reliable return determinant.

This cycle of published return determinants being challenged and new return determinants being proposed continues even today. For example, R. Alquist et al. [9] challenged the impact of size on stock returns. They report that while the "size effect" is seen in the market, returns to size are neither persistent nor stable; hence it is not a key factor for constructing portfolios. More recently, R. Ball et al. [10] argue that P/BV is a good predictor of stock returns because the retained earnings part of book value aggregates past earnings, which is a strong indicator of a firm's earnings history. They further report that retained earnings/price is a good predictor of returns and that contributed capital has no ability to predict stock returns.

Asset pricing research is now at a stage, where approximately 18 new factors are discovered annually [11] creating what J.H. Cochrane [12] calls a "zoo" of factors. For example, new factors being studied for their impact on asset returns relate to the environmental impact, social impact and governance (ESG) of the organization [13–15]. C.R. Harvey et al. [11] have identified 316 factors from top journals and believe that this probably underrepresents the factor population.

One reason for this tussle between different return determinants in different studies can be attributed to the choice of linear regression as a method used in these studies. When linear regression is applied to understand the relationship between stock returns and return determinants, it is very difficult to include more than four return determinants in a single study [16]. This leads to a situation where a researcher selects four factors and identifies a couple of strong factors as "key return determinants". The next research considers these "key return determinants" along with a few other factors and proves that the first two return determinants do not influence as much as the new set of factors in a different period of study. We see this happening repeatedly in a large part of asset pricing research over the last five decades. Given the fact that we have more than 300 documented return determinants, we need to use a method that will allow us to include as many potential return determinants as possible in the same study and understand the strength of each one's influence on stock returns.

Towards that objective, we see a lot of interesting studies that use different methodologies to understand the influence of factors on stock returns. E.H. Sorensen [17] traces the evolution of quantitative methods in investing and portfolio management including recent machine learning techniques. X. Wu et al. [18] have used both multivariate regression and a novel machine learning models to examine the effect of expert analysts' recommendations on stock prices. Y. Li and Y. Pan [19] have developed an ensemble of deep learning model to predict future stock prices. K.C. Rasekhschaffe and R.C. Jones [20] provide a very good introduction to machine learning algorithms. Multiple literature reviews focus on prior work that applied machine learning to empirical asset pricing and portfolio management [21, 22].

In this paper, we use a data-mining technique called "mining association rules" to explore the relationship between stock returns and return determinants. In the next section, we examine the framework for mining association rules between stock returns and a large pool of return determinants.

MINING ASSOCIATION RULES BETWEEN STOCK RETURNS AND RETURN DETERMINANTS

Mining for association rules between different variables in a large database is widely adopted in industries that generate multidimensional data. We briefly look at what "association rule mining" is and how it can be used to mine association insights between stock returns and return determinants.

Mining "association rules" involves identifying item clusters in a database. For example, in the retail industry, this technique is used to discover groups of products that tend to be purchased together. In our study, the item cluster we are looking for is a "set of return determinants" regularly observed in index-beating investments.

Information about the associations mined is expressed in form of "if-then" statements that are probabilistic in nature. For example, an association rule mined from the transaction database of a retail store could be: "If a buyer has purchased milk and butter, then there is 80% probability that she/he will also buy bread". This is inferred from the actual number of transactions recorded in the database. This means that of the 100 customers who had purchased milk and butter, 80 of them had also purchased bread. This is how the "if-then" association rules are formed based on historical transactional data. A. Rai [23] provides a very good overview of mining association rules.

To build a database to mine association rules, we would need data on different return determinants at the time of investment and data about stock returns and index returns for different holding periods after the investment is made. Imagine an investor who invests in a large set of stocks on the 1st May 2002 and continues to invest every month on the same date in the same set of stocks for the next ten years. Every month, at the time of investment, for each of his investments, he has data of company-reported information about different return determinants like sales, earnings, P/BV, etc. This information about different return determinants at the time of investing is the first part of the database. For investments made at different points in time, we obtain data about actual returns relative to the index returns for different holding periods. Such a database will enable us to mine the association rules between return determinants at the time of investing and stock returns for different holding periods.

Building the Database to Mine Association Rules

The first task in building the database for mining association rules was to identify the return determinants. Researchers have identified over 300 factors that impact stock returns. Although association rule mining does not limit the number of return determinants that can be included in the study, we considered thirty-seven return determinants that are considered important in fundamental analysis i.e., accounting data, which are considered strong predictors of stock prices. We did not consider technical indicators because our primary intent was to mine associations between factors and returns for longer holding periods.

Data

For this study, we have taken data from companies listed on the National Stock Exchange of India (NSE) and Bombay Stock Exchange (BSE). The data source was "Refinitiv Datastream". The thirty-seven return determinants considered for this study are listed in Appendix (*Table 1*).

We considered monthly investments from January 2002 to December 2012, with investments made on the first of every month. This created a pool of 74,869 investments spread over 132 months. We mined association rules between return determinants and stock returns for holding periods of one, three and five years.

The market index considered for computing market returns is NSE Nifty 50.

Based on the above information, a comprehensive database was created to mine associations rules.

Associations Mined

We used libraries available in R-programming language to mine the association rules. From the large set of association rules mined, we considered ten strong association rules for analysis and they are listed in Appendix (*Table 2*).

Interpreting the Association Rules

Consider association rule No. 2 for 3 year holding period shown in *Table 1* below.

'LHS' (Left Hand Side) in the above table is the 'If' part of the 'If-Then' statement of the association rule.

'RHS' (Right Hand Side) in the above table is the 'Then' part of the 'If-Then' statement of the association rule.

The confidence column is the confidence of the association rule.

Let us interpret this association rule — it says:

"*If, for a stock:*

- The "price divided by the sales-per-share is less than 1", AND "Debt by Working capital is less than 2", AND 'Return on Invested Capital has consistently been above 12% in the last 5 years' AND it has very high "Cash Flow by Assets" (in top 33 percentile)

Then

There is an 75.2% chance that the "3 years returns" from investing in that stock will be greater than the "3 years index returns" for the same holding period.

The above "If-then" statement is based on the first three columns of the association rule.

We can also see that this association rule is based on performance of 848 investments in the investment database created for this study. The lift value greater than

Table 1

Example of Association Mined

LHS (Antecedent)	Confidence	RHS (Consequent)	Support	Count	Lift
PriceBySalesPerShareLT1, TTMDbyWCLT2, T5RoICGT12, T33CFbyAssets	75.2%	n3YrRtn_GTNSE 50	1.1%	848	1.81

Source: Compiled by the authors.

one (1.81) confirms that this is a strong association rule and not a chance occurrence.

Based on the rules considered for analysis in this study, we can make the following observations:

- Index-beating returns can be achieved by picking stocks based on different return determinants in different combinations. For example, in association rule number 1, we see that investment in stocks with certain return determinants (mentioned in the "If" part of the rule) have a high probability of yielding market-beating returns. Association rule No. 2 has a completely different combination of return determinants with a high probability of index-beating returns. This implies that there are multiple ways to achieve market-beating returns and raises questions about the validity of the quest for a single asset pricing model based on a fixed set of factors.
- There are no strong association rules for a 1-year holding period (confidence lower than 70%).
- In almost all cases, we see that the confidence of the association is comparatively higher for a 5-year holding period. This implies that for smaller holding periods, it is difficult to find strong associations between return determinants and market-beating returns. However, for longer holding periods (three to five years), we find strong association rules between return determinants and market-beating returns.

Key Return Determinants

From all the strong associations mined and tabulated in *Appendix* (*Table 2*), we listed return determinants that appear most frequently in these association rules. We consider these factors as key return determinants — factors key for predicting index-beating stock returns. The key return determinants are listed below:

1) T33_T5AvgSalesByT5AvgAssets: "Average of past five-years of sales by average of past five-years of assets" is in top 33 percentile among all the investment opportunities considered.

2) T5RoICGT12: For every year in the last 5 years, the Return on Invested Capital was greater than 12%.

3) T33CFbyAssets: Cash flow by assets is in the top 33 percentile among all investment opportunities considered. (Cash flow = earnings + depreciation).

4) T5SalesGrowthGT1.05: Last five-years year-on-year sales growth is more than 5%.

5) T5BVGrowthGT1: Each year in the last 5 years, year-on-year growth in Book Value is greater than 1.

6) TTMDbyWCLT2: Debt by Working Capital is less than 2.

7) TTMDERatioLE 1: D/E Ratio is less than or equal to 1.

8) T33SalesByRcvbl: Sales by Accounts Receivables is in the top 33 percentile among all the investment opportunities considered.

The above factors and their strong association with market-beating returns convey that if the stock you are investing in has a certain combination of the above factors, then there is a very good probability that such an investment will yield market-beating returns for holding periods ranging between one and five years. The right combination of the above factors for market-beating returns can be seen in the LHS of the association rules listed in *Appendix* (*Table 2*).

The above key return determinants give some interesting insights:

- The first 3 metrics emphasize the importance of capital efficiency. Firms that deploy capital more efficiently than their peers show better results, which is reflected in the index-beating returns from investment in those stocks.
- The next 2 metrics emphasize growth and this is important for a growing economy like India.
- The next 2 metrics underscore the need for limiting the "debt" of the company to reasonable levels.

VALIDATING THE ASSOCIATIONS MINED

We have tested the associations mined in two different ways as described below:

1. Using an out-of-sample data set, we compute the risk of "association rule portfolios" and compare the risk-return of these portfolios with the market returns.
2. The second validation of the association rules was to check the performance of these association rules when linear regression methods were applied to them.

Risk Adjusted Returns

First, we compute the portfolio risk of association rule portfolios. For that, we created "association rule portfolio" for all ten association rules analyzed in this study. The "association rule portfolio" comprises stocks that meet the LHS criteria ("If" part) of the association rule.

For constructing association rule portfolios and computing the portfolio betas, we collected the below data from "Refinitiv Datastream":

Data on monthly stock price and return determinants from Jan-2013 to Dec-2014 for 832 companies listed on NSE-India and BSE-India. The data set required to compute the 5-year returns of an investment made in Dec-14 extends up to Dec-19. So, the period covered in this study extends up to Dec-19. We did not consider the period beyond 2019 to ensure that our findings were not influenced by the uncertain economic period of the 2020 global pandemic.

NSE Nifty-50 (Index) data for the above period to compute the market returns.

To compute risk-free returns, we consider the 91-day government treasury bill yield as the risk-free rate.

To compute portfolio beta, we use the following equation provided by CAPM:

$$R_p - R_f = \beta(R_m - R_f).$$

We ran OLS regression with dependent variable as "$R_p - R_f$" and independent variable as "$R_m - R_f$" to estimate portfolio β. The value of the portfolio beta for the portfolios of each association rule is shown below in *Table 2*.

As seen in *Table 2*, portfolio β for every association rule considered in this study is less than 1, which means that the association rule portfolios have a lower risk level than the market risk.

For all ten association rules analyzed here, we constructed price-weighted portfolios every month between Jan-13 and Dec-14. This gave 24 portfolios for each association rule. We compared the portfolio returns of these 24 portfolios for each association rule with the index returns for the corresponding holding period.

The performance of these portfolios for different association rules created at different points in time is tabulated in *Appendix* (*Table 3*). Below are some important observations:

- For 3-year holding period, for all 10 association rules and all 24 monthly portfolios, the portfolio returns are greater than the index returns — at lower risk than the market.
- For 5-year holding period, in 9 of the 10 association rules, the portfolio returns for all 24 monthly portfolios were greater than the index returns. For one association rule (association rule No. 2), returns of one of the 24 portfolios is lower than the index returns — which is a very small percentage of failure of the association rule.
- The association rules considered here are not strong for 1-year holding period. However, we analyzed portfolio returns for 1-year holding period for all ten association rule portfolios. We find that in this case as well, in 67% or more cases, portfolio returns are higher than index returns. Therefore, the association rules performed reasonably well even when they were not very strong.

Association Rules and Regression

To verify performance of association rules in the regression model, we used the LOGIT model because both the antecedent and consequent of the association rules are binary in nature. For the LOGIT regression, we consider the antecedent(s) of the association rule as the independent variables and the consequent part of the association rule as the dependent variable.

We find that the parameters are statistically significant for eight of the ten rules being analyzed. These rules also passed the following model consistency tests:

- Likelihood ratio test
- Wald Test
- Variance Inflation Factor Test

This outcome of the logit regression when applied to the association rules raises an interesting question. Does the real value of a return determinant matter in driving the performance of stock returns relative to the index? Or is the value of the return determinant above or below a certain threshold more important in determining the

Table 2

Portfolio Beta for Different Association Rule Portfolios

Association Rule Portfolio ↓	Portfolio Beta
Rule 1	0.94
Rule 2	0.89
Rule 3	0.888
Rule 4	0.91
Rule 5	0.93
Rule 6	0.89
Rule 7	0.92
Rule 8	0.97
Rule 9	0.81
Rule 10	0.85

Source: Compiled by the author.

stock performance? For e.g.— does the actual value of Price / Sales matter, or is its value above or below the threshold of 1 more important in determining the stock's relative performance?

CONCLUSION

We began this research by looking for answers to a few questions related to asset pricing: In a pile of over 300 potential return determinants, is there a smaller set of return determinants that can be a stronger predictor of stock returns? Is there a way to uncover that set of key return determinants?

This study has largely been able to answer these questions. Takeaways from this study are as follows:

1. Using association mining method, from a pool of 37 return determinants, we were able to extract a smaller set of 8 return determinants that are seen most frequently in investments with market-beating returns. These return determinants are:
   a. Past 5 years Y-O-Y sales growth greater than 5%;
   b. High value of Sales/Account Receivables;
   c. High value of '5 years average of sales/5 years average of assets';
   d. Debt / Working Capital less than 2;
   e. Debt/Equity less than 1;
   f. Past 5 years RoIC greater than 12%;
   g. Year-on-year positive increase in book value;
   h. High value of ratio "Cash Flow / Assets".
2. In an out-of-sample data set, portfolios created from these association rules have portfolio "beta" less than one and provide returns that beat the market returns by a significant margin for all holding periods.
3. Portfolio managers can use the association mining process to identify strong associations between the factors of their choice and index-beating returns.
4. Finally, when we applied the LOGIT model to the association rules, we found that the coefficients were statistically significant for eight out of the ten association rules analyzed.

Data Availability

The data supporting the findings of this study are available in the general public repository "Figshare" at DOI: https://doi.org/10.6084/m9.figshare.21399549

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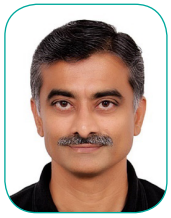
ABOUT THE AUTHORS



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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 07.01.2023; revised on 07.03.2023 and accepted for publication on 26.03.2023. The authors read and approved the final version of the manuscript.

APPENDIX

Table 1

List of Return Determinants Considered in this Study

No.	Return Determinant	Variable name used in this paper	Brief Explanation of variable-all variables are binary (Y/N)
1	PAT Margins > 8%	T5PATMarginsGT8	Is the "Profit After Tax" margin > 8% in each of the last 5 years?
2	PAT Margins > 10%	T5PATMarginsGT10	Is the "Profit After Tax" margin > 10% in each of the last 5 years?
3	EPS Growth	T5EPSGrowthGT1	In each of the last 5 Years, is EPS in year 'N' > EPS in year 'N – 1'?
4	Sales Growth	T5SalesGrowthGT1	In each of the last 5 Years, is Sales in year N > sales in year ''N – 1'?
5	Sales Growth	T5SalesGrowthGT1.05	In each of the last 5 Years, is Sales of year N divided by Sales of year 'N – 1' > 1.05?
6	P/Sales	PriceBySalesPerShareLT1	Is Price divided by latest Sales per Share < 1?
7	FCFF	T5FCFF_Positive	Is Free Cash flow to the firm > 0 each year in last 5 Years?
8	Book Value Growth	T5BVGrowthGT1	In each of the last 5 Years, Book Value in year N been > Book Value in year N – 1?
9	P/BV	PriceByTTMBVLE 1	Is Price/ Book Value per Share <= 1?
10	Debt/Working-Capital	TTMDbyWCLT2	Is Debt/Working Capital < 2?
11	D/E Ratio	TTMDERatioLE 1	Is Debt/Equity <= 1?
12	P/E Ratio	PERatioLE 10	Is Price/EPS <= 10?
13	PE Ratio/EPS Growth	TTMPEGLE 1	Is Price/EPS ratio divided by EPS growth in Percent <= 1?
14	Return on Invested Capital (ROIC)	T5RoICGT12	In each of the last 5 Years, is RoIC > 12%?
15	Return on Invested Capital	T5RoICGT15	In each of the last 5 Years, is RoIC > 15%?
16	EPS/P + DPS/P + (EPS-DPS)/BVPS	ThumbRuleGE 0.25	Is ThumbRule value >= than 0.25? ThumbRule = (EPS/Price) + (Div. per Share / Price) + ((EPS – Div. per Share) / Book Value per Share)
17	Dividend Yield	T33AvgT3DY	Is Dividend yield in the top 33 percentile amongst all investment opportunities considered?
18	EBIT / EV	T33TTMEBITbyEV	Is EBIT/EV in the top 33 percentile amongst all investment opportunities considered?
19	Gross Profit/Assets	T33TTM_GrProfitByAssets	Is Gross Profit divided by Total Assets in top 33 percentile amongst all the investment opportunities considered?
20	EBIT / Assets	T33TTM_EBITByAssets	Is EBIT by Total Assets in the top 33 percentile amongst all the investment opportunities considered?
21	CF / Price	T33TTM_CFperShareByPrice	Is Cash Flow/Price in the top 33 percentile amongst all the investment opportunities considered? (Cash Flow = Earnings + Depreciation)

Table 1 (continued)

No.	Return Determinant	Variable name used in this paper	Brief Explanation of variable-all variables are binary (Y/N)
22	CF / Assets	T33CFbyAssets	Is Cash Flow/Assets in the top 33 percentile amongst all the investment opportunities considered?
23	FCFF / Assets	T33FCFFbyAssets	Is Free Cash Flow to the Firm / Assets in the top 33 percentile amongst all the investment opportunities considered?
24	Sales / Cash	T33SalesByCash	Is Sales / Cash in the top 33 percentile amongst all the investment opportunities considered?
25	Sales / Ac-Receivables	T33SalesByRcvbl	Is Sales / Accounts Receivables in the top 33 percentile amongst all the investment opportunities considered?
26	Sales / Inventory	T33SalesByInventory	Is Sales / Total Inventory in the top 33 percentile amongst all the investment opportunities considered?
27	Debt / CashFlow	B 33TTM_DebtByCF	Is Debt / Cash Flow in the Bottom 33 percentile amongst all the investment opportunities considered?
28	Working-Capital / Sales	B 33TTM_WCbySales	Is Working Capital/Sales in the Bottom 33 percentile amongst all the investment opportunities considered?
29	% Change in Sales > % Change in Inventory	pcChgInSalesGTpcChgInInvtry	Is percent change in sales over previous year > percent change in inventory over previous year?
30	% Change in Sales > % Change in Receivables	TF_ChgInSalesGTRcvbls	Is percent change in sales over previous year > percent change in receivables over previous year?
31	Year-on-Year Asset Growth	B 33_AssetGrowthYoY	Is year on year asset growth in the bottom 33 percentile amongst all the investment opportunities considered?
32	Return on Assets	T33_T5AvgRoA	Is average of past 5 years of return on assets in the top 33 percentile amongst all the investment opportunities considered?
33	Sales / Assets	T33_ T5AvgSalesByT5AvgAssets	Is average of past 5 years of sales divided by average of past 5 years of assets in the top 33 percentile amongst all the investment opportunities considered?
34	Return on Equity	T33_T5AvgRoE	Is average of past 5 years of RoE in the top 33 percentile amongst all the investment opportunities considered?
35	PAT Margins	T33_T5AvgPATMargins	Is average of past 5 years of PAT margins in the top 33 percentile amongst all the investment opportunities considered?
36	E / P Ratio	T33TTM_EPRatio	Is EPS / Price in the top 33 percentile amongst all the investment opportunities considered?
37	Return on Invested Capital	T33_T5AvgRoIC	Is average of past 5 years of RoIC in the top 33 percentile amongst all the investment opportunities considered?

Source: Compiled by the author.

Table 2

List of Strong Association Rules Mined in India & Analyzed

Antecedent ('If' part of the association rule — LHS)	Consequent ("Then" part of the association rule — RHS)	Support	Confidence	Lift	Count
Rule 1					
T5SalesGrowthGT1.05, T5RoICGT12, T33SalesByRcvbl	5YearReturns > NSE 50	0.012	0.78	1.8	933
	3YearReturns > NSE 50	0.012	0.75	1.8	895
Rule 2					
PriceBySalesPerShareLT1, TTMDbyWCLT2, T5RoICGT12, T33CFbyAssets	3YearReturns > NSE 50	0.011	0.75	1.8	848
	5YearReturns NSE 50	0.011	0.72	1.6	807
Rule 3					
T5SalesGrowthGT1.05, TTMDbyWCLT2, T33SalesByRcvbl, T33_T5AvgSalesByT5AvgAssets	5YearReturns > NSE 50	0.013	0.77	1.8	1001
	3YearReturns > NSE 50	0.012	0.7	1.7	913
Rule 4					
T5SalesGrowthGT1.05, T3BVGrowthGT1, T33SalesByRcvbl, T33_T5AvgRoA, T33_ T5AvgSalesByT5AvgAssets	5YearReturns > NSE 50	0.011	0.78	1.8	852
	3YearReturns > NSE 50	0.011	0.73	1.8	796
Rule 5					
T5SalesGrowthGT1.05, T3BVGrowthGT1, TTMDERatioLE 1, T33SalesByRcvbl, T33_ T5AvgSalesByT5AvgAssets	5YearReturns > NSE 50	0.014	0.78	1.8	1051
	3YearReturns > NSE 50	0.013	0.73	1.8	976
Rule 6					
PriceBySalesPerShareLT1, TTMDbyWCLT2, TTMDERatioLE 1, T5RoICGT12, T33CFbyAssets	3YearReturns > NSE 50	0.011	0.76	1.8	847
	5YearReturns > NSE 50	0.011	0.72	1.7	806
Rule 7					
T5SalesGrowthGT1.05, T3BVGrowthGT1, TTMDbyWCLT2, T33TTM_GrProfitByAssets, T33SalesByRcvbl	5YearReturns > NSE 50	0.011	0.78	1.8	850
	3YearReturns > NSE 50	0.011	0.72	1.7	784

Table 2 (continued)

Antecedent ('If' part of the association rule — LHS)	Consequent ("Then" part of the association rule — RHS)	Support	Confidence	Lift	Count
Rule 8					
T5SalesGrowthGT1.05, T33CFbyAssets, T33SalesByRcvbl, TF_ChgInSalesGTRcvbls, T33_T5AvgSalesByT5AvgAssets	5YearReturns > NSE 50	0.013	0.77	1.8	944
	3YearReturns > NSE 50	0.012	0.7	1.7	863
Rule 9					
T5SalesGrowthGT1.05, TTMDbyWCLT2, T33SalesByRcvbl, T33_T5AvgRoE, T33_T5AvgRoIC	5YearReturns > NSE 50	0.013	0.77	1.8	978
	3YearReturns > NSE 50	0.012	0.7	1.7	897
Rule 10					
T5PATMarginsGT8, T5SalesGrowthGT1, TTMDERatioLE 1, T33TTM_EBITByAssets, T33_T5AvgSalesByT5AvgAssets	5YearReturns > NSE 50	0.012	0.7	1.7	874
	3YearReturns > NSE 50	0.012	0.7	1.8	859

Source: Compiled by the author.

Table 3

Comparison of 'Association-Rule-Portfolio Returns' and 'Index Returns' for the Corresponding Holding Period (Out-of-Sample Data Set)

Performance of 'Rule-1 Portfolio'			
	Holding Period		
	1 Year	3 Years	5 Years
Np = Number of association rule Portfolios created at different point in time	24	24	24
Number: *Rp* > *Rm* = Number of portfolios with returns > index returns	18	24	24
% *Rp* > *Rm* = Percent of association rule portfolios with returns > index returns	75%	100%	100%
Avg. *Rp*	24.7%	14.8%	16.1%
Avg Mkt Rtn: *Rm*	17.3%	9.9%	10.6%
Performance of 'Rule-2 Portfolio'			
	Holding Period		
	1 Year	3 Years	5 Years
Np	24	24	24
Number: *Rp* > *Rm*	21	24	23
% *Rp* > *Rm*	88%	100%	96%

Table 3 (continued)

Avg *Rp*	47.7%	34.6%	24.1%
Avg Mkt Rtn: *Rm*	17.3%	9.9%	10.6%
Performance of 'Rule-3 Portfolio'			
	Holding Period		
	1 Year	**3 Years**	**5 Years**
Np	24	24	24
Number: *Rp* > *Rm*	17	24	24
% *Rp* > *Rm*	71%	100%	100%
Avg *Rp*	34.5%	21.2%	19.7%
Avg Mkt Rtn: *Rm*	17.3%	9.9%	10.6%
Performance of 'Rule-4 Portfolio'			
	Holding Period		
	1 Year	**3 Years**	**5 Years**
Np	24	24	24
Number: *Rp* > *Rm*	18	24	24
% *Rp* > *Rm*	75%	100%	100%
Avg *Rp*	34.8%	20.6%	19.9%
Avg Mkt Rtn: *Rm*	17.3%	9.9%	10.6%
Performance of 'Rule-5 Portfolio'			
	Holding Period		
	1 Year	**3 Years**	**5 Years**
Np	24	24	24
Number: *Rp* > *Rm*	19	24	24
% *Rp* > *Rm*	79%	100%	100%
Avg *Rp*	36.6%	22.6%	20.4%
Avg Mkt Rtn: *Rm*	17.3%	9.9%	10.6%
Performance of 'Rule-6 Portfolio'			
	Holding Period		
	1 Year	**3 Years**	**5 Years**
Np	24	24	24
Number: *Rp* > *Rm*	21	24	24
% *Rp* > *Rm*	88%	100%	100%
Avg *Rp*	47.7%	34.6%	24.1%
Avg Mkt Rtn: *Rm*	17.3%	9.9%	10.6%

Table 3 (continued)

Performance of 'Rule-7 Portfolio'			
	Holding Period		
	1 Year	3 Years	5 Years
Np	24	24	24
Number: *Rp* > *Rm*	17	24	24
% *Rp* > *Rm*	71%	100%	100%
Avg *Rp*	30.1%	17.8%	17.3%
Avg Mkt Rtn: *Rm*	17.3%	9.9%	10.6%
Performance of 'Rule-8 Portfolio'			
	Holding Period		
	1 Year	3 Years	5 Years
Np	24	24	24
Number: *Rp* > *Rm*	23	24	24
% *Rp* > *Rm*	96%	100%	100%
Avg *Rp*	40.1%	25.4%	21.3%
Avg Mkt Rtn: *Rm*	17.3%	9.9%	10.6%
Performance of 'Rule-9 Portfolio'			
	Holding Period		
	1 Year	3 Years	5 Years
Np	24	24	24
Number: *Rp* > *Rm*	16	24	24
% Rp > *Rm*	67%	100%	100%
Avg *Rp*	27.4%	17.2%	17.1%
Avg Mkt Rtn: *Rm*	17.3%	9.9%	10.6%
Performance of 'Rule-10 Portfolio'			
	Holding Period		
	1 Year	3 Years	5 Years
Np	24	24	24
Number: *Rp* > *Rm*	17	24	24
% *Rp* > *Rm*	71%	100%	100%
Avg *Rp*	23.2%	13.9%	14.2%
Avg Mkt Rtn: *Rm*	17.3%	9.9%	10.6%

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-128-139
UDC 339.7(045)
JEL G02, G4, G41

Impact of Social Media and Google on Stock Markets During a Pandemic: The Case of an Airline

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ABSTRACT

The outbreak of the pandemic has dealt a tangible blow to the global economy, in particular by causing the collapse of stock markets. Most countries have taken measures to contain the coronavirus related to the restriction of human mobility. One of the main victims of such actions were airlines. In order to examine the direct and indirect effects of the pandemic, we investigated the long- and short-term effects on airline stock price volatility of the spread of coronavirus, social media attention to it, the vaccines against coronavirus and restrictive measures in relation to the pandemic. The ARDL model with MG and PMG estimates was applied after the preliminary stability tests for airlines in developed and developing countries. We analyzed the period of the greatest anti-COVID restrictions from 23 March 2020 to 23 March 2021. We reached the following **conclusions**. Firstly, the increase in the number of cases and deaths from COVID-19 was accompanied by a short-term increase in the volatility of airline stock prices. Secondly, Twitter's increased focus on COVID-19-related restrictive measures and vaccines against it was accompanied by a short-term increase in airline stock price volatility. Thirdly, the increasing attention at Google on airline restrictions has been accompanied by the long-term effects of rising stock volatility. Our results demonstrate that with the spread of the Internet and social media, the impact of the pandemic on stock markets occurs not only through direct effects on the determinants of Solow's economic growth model, but also through indirect effects of social media and the Internet on investor behavior through the formation of fear and hysteria in them.

Keywords: COVID-19; vaccines; restrictions; attention to COVID-19; attention to vaccines; attention to restrictions; Twitter; Google Trends; stock volatility; airlines; ARDL; MG; PMG

For citation: **Nepp A.N., Dzhuraeva Z.F. Impact of social media and Google on stock markets during a pandemic: The case of an airline. *Finance: Theory and Practice*. 2023;27(5):128-139. DOI: 10.26794/2587-5671-2023-27-5-128-139**

INTRODUCTION

Globalization and interdependence of economies contributed to increased negative effects of COVID-19. Growing numbers of cases forced governments to impose restrictions on individual rights of movement, upsetting supply networks, increasing unemployment and inflation [1], and decreasing GDP and trade [2]. Coronavirus has had a strong negative impact on financial markets, increasing volatility in stock markets [3] and foreign exchange markets [4].

Measures to close borders and restrict the mobility of people have affected the tourism industry and people's desire to travel, provoked a decrease in the passenger traffic of airlines, making it one of the main affected [5, 6]. In 2020, airline stock prices fell with a significant increase in volatility [7]. Volatility increases did not always correspond to the peak COVID-19 incidence while also related to the peak Covid-19 social media attention (*Fig. 1–4*), and this has led us to assume the existence of a mechanism for the indirect influence of the pandemic on the market through panic and hype around the coronavirus. This assumption was the motivation for our article.

In the context of the development of the Internet, the functioning of social networks is increasingly consistent with the laws of the crowd [8, 9], which is characterized by the effects of hype in external shocks [10]. The risk associated with so-called effects stems, first, from the potential for mass panic to appear [11], whereby market participants act

irrationally [12]. On the other hand, the effects of hype and panic can be artificially prompted in the interests of a narrow group of market participants. As an illustration, consider Tesla's stock, whose value and volatility are greatly impacted by Elon Musk's Tweeter [13].

In order to identify the mechanisms of direct and indirect effects, we investigated the impact on airline stocks of COVID-19 cases and deaths, social media attention to the coronavirus, vaccines against Covid-19 and restrictive measures in connection with the pandemic during the period of the high anti-Covid restrictions from 23.03.2020 to 23.03.2021. We also examined how airline restrictions are affected by Google searches. The stocks of 16 airlines in developed and developing countries were analyzed.

We are based on the theories of crowd psychology [8] and behavioral finance [12], namely on the change in the rationality of behavior of market participants under the influence of the spread of fear and hysteria in an environment of external shock [11]. We apply the ARDL model with MG and PMG estimates after the preliminary stability tests.

The novelty of our research is due to the fact that we have identified the indirect effects of the coronavirus pandemic when studying corporate data on the value of stocks on the example of airlines. The main contribution of our work is that we have demonstrated the importance of the mechanism in the context of the spread of the Internet and social networks of the indirect impact of the pandemic on the shares of companies by influencing the behavior of investors through the formation of fear and hysteria in them.

The effects of new media, which we will demonstrate in our study, open up the possibility of influencing markets for the benefit of a narrow group of market participants. In such circumstances, there is a need for monitoring by financial regulators in order to minimize possible adverse effects. The paper is structured as follows. Section 2 provides theoretical and methodological justification for COVID-19's indirect impact on financial markets. Section 3 summarizes the study's data and methods. Section 4 discusses the results of empirical research. Conclusions are provided at the end.

REVIEW OF THE LITERATURE

Direct Effects of Disease on Markets

One theoretical basis for explaining the impact of health and, consequently, diseases on financial markets is the model of economic growth [14], according to which the direct impact of diseases is attributed to the impact on demand, output, savings and investment.

In the scientific literature, there are a large number of empirical studies justifying the direct influence of diseases [15].[1] Diseases are not only a health problem but also have an impact on economic growth [16, 17]. Public health is one of the main determinants of economic development; it affects the formation of human capital, life expectancy, and consequently consumption and GDP levels. Modern research on the effects of coronavirus confirms the results on the impact of diseases.

The COVID-19 pandemic has resulted in increased unemployment, closed more than tens of millions of enterprises [18], and reduced the countries' economic growth rates.

The restrictions, as well as the sickness itself, have resulted in a decrease in production, demaged of supply chains and increased inflation. Restrictive measures have provoked instability and increased trade costs, as well as rising interest rates and unemployment, and negatively effected sectoral trade and foreign direct investment [19]. Restrictions have led to a decline in demand for all types of travel, costing the world tourism industry more than 200 bln

[1] World Bank. The economic impact of the 2014 Ebola epidemic: short-and medium-term estimates for West Africa. 2014. URL: https://www.worldbank.org/en/region/afr/publication/the-economic-impact-of-the-2014-ebola-epidemic-short-and-medium-term-estimates-for-west-africa (accessed on 22.09.2023).

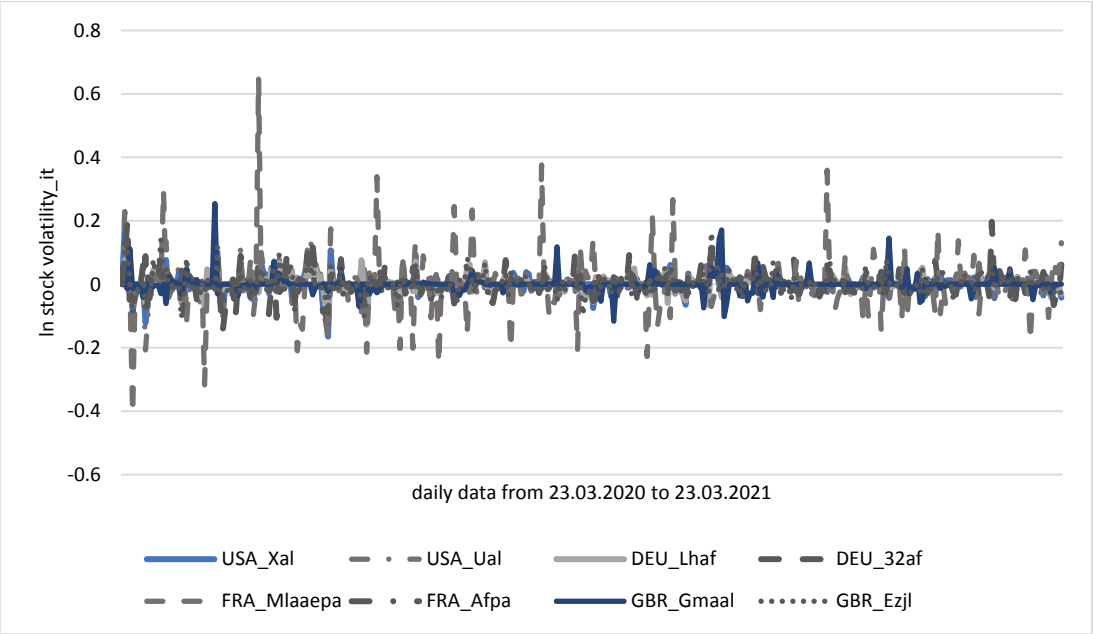

Fig. 1. **Volatility of Airline Stocks in Developed Countries**

Source: Compiled by the authors.

Note: $ln\ stock\ volatility_{it}$ – the logarithmic returns calculated based on the closing prices of the stock at time *t* and *t* – 1; USA_Xal, USA_UAL – USA airline; GBR_Ezjl, GBR_Gmaal – UK airline; DEU_LHA, DEU_32af – Germany airline; FRA_Afpa, FRA_Mlaaepa – France airline.

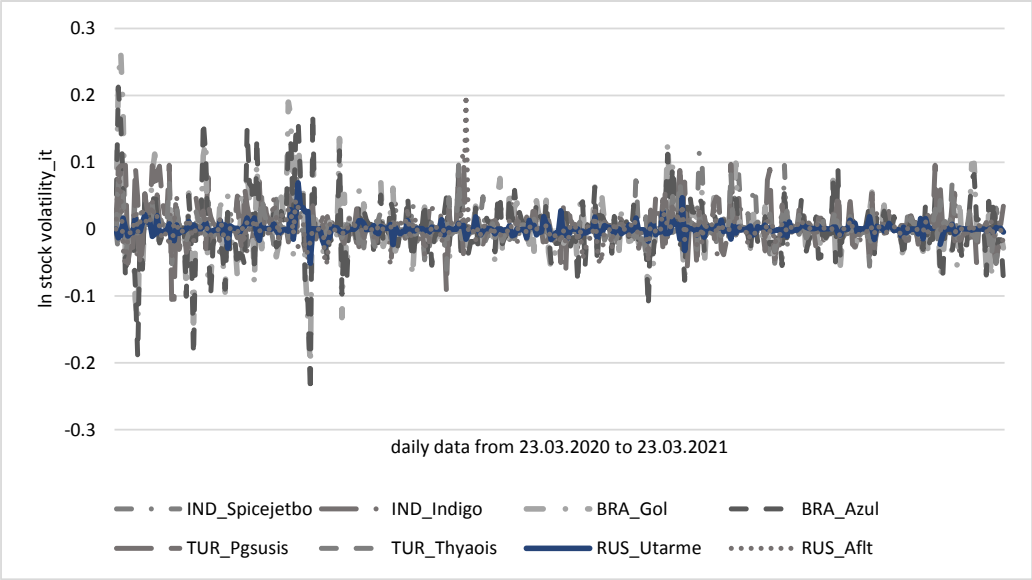

Fig. 2. **Volatility of Airline Stocks in Developing Countries**

Source: Compiled by the author.

Note: $ln\ stock\ volatility_{it}$ – the logarithmic returns calculated based on the closing prices of the stock at time *t* and *t* – 1; IND_Indigo, IND_Spicejetbo – India's airline; BRA_Azul, BRA_Gol – Brazilian airline; TUR_Pgsusis. TUR_Thyaois – Turkey airline; RUS_Aflt – Aeroflot, RUS_Utarme – Russian airline.

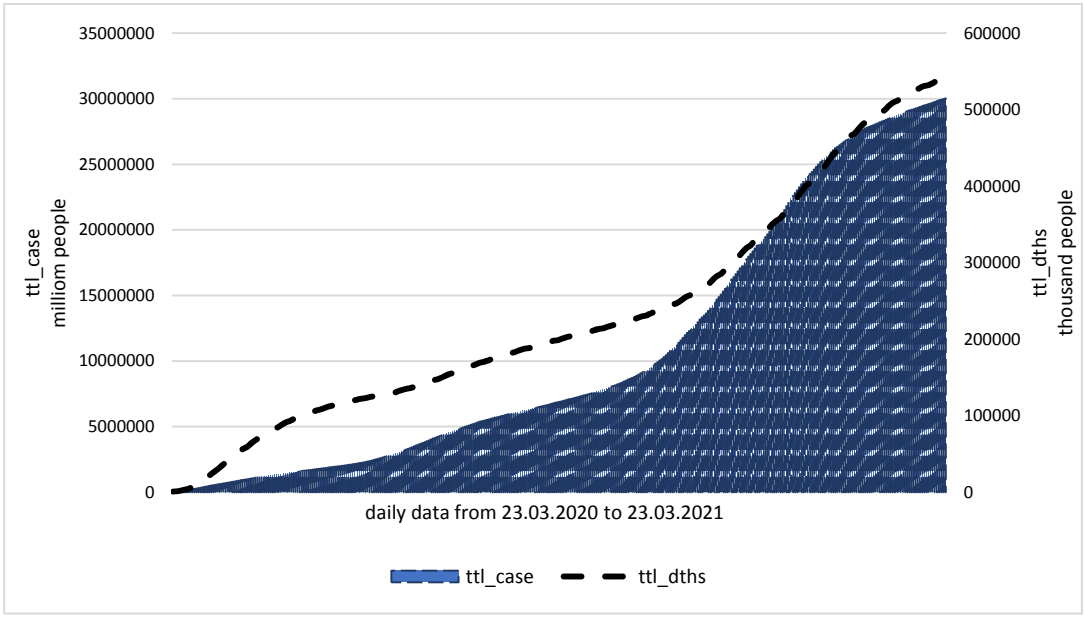

Fig. 3. **The Number of Confirmed Coronavirus Cases and Deaths**

Source: Compiled by the authors.

Note: ttl_case – number of confirmed coronavirus cases (cumulative total), million people/per day; ttl_dths – number of confirmed coronavirus deaths (cumulative total), thousand people/per day.

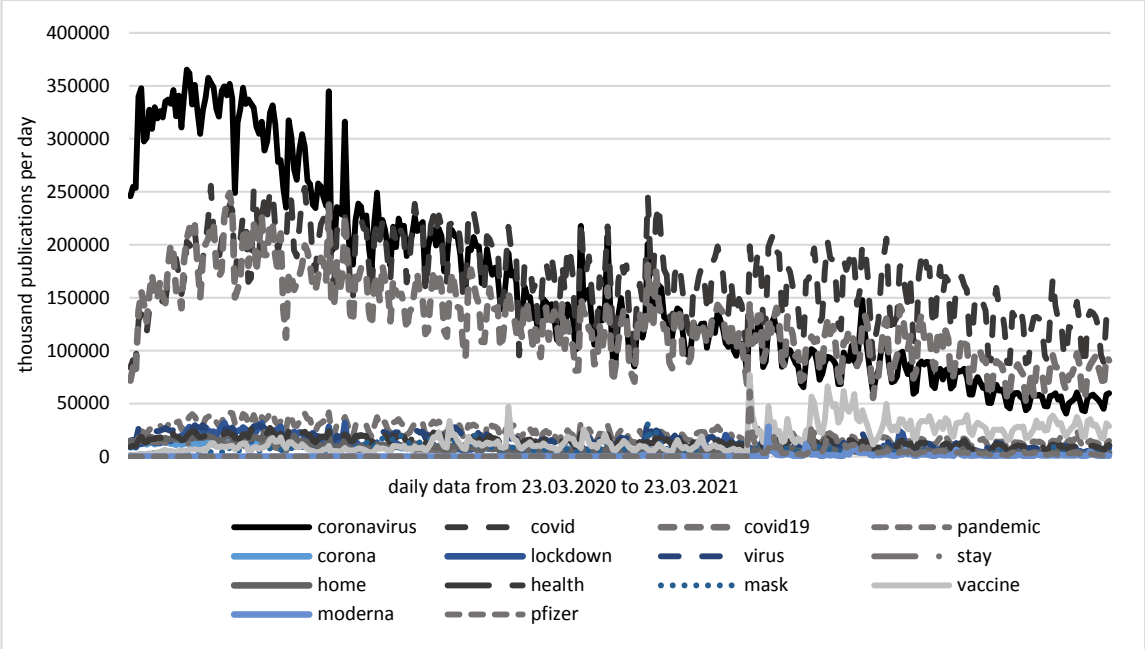

Fig. 4. **Attention on Twitter to the Spread of Coronavirus, to Vaccines Against COVID-19 and Pandemic Restrictions***

Source: Compiled by the author.

Note: * the number of times the term is used daily on Twitter in the research countries: "coronavirus", "Covid", "Covid19", "pandemic", "corona", "virus", "lockdown", "stay", "home", "mask", "health", "vaccine", "moderna", "pfizer".

dollars in losses [20]. Overall, the pandemic contributed to the economic collapse.

The scientific literature we have reviewed provides numerous evidence of the direct effects of the pandemic. However, the analysis of stock market dynamics (see *Fig. 1, 2*) demonstrates the inability to fully explain the increased volatility in the stock market by direct-impact mechanisms: the peaks of volatility do not coincide with the peaks of coronavirus cases and deaths from it. At the same time, comparing peak volatility in airline stock prices with social media attention to the pandemic, vaccines against COVID-19 and restrictive measures related to it (see *Fig. 1–4*) gives us reason to assume that there is a mechanism for the indirect impact of the pandemic on the markets.

Indirect Effects of the Pandemic: The Role of the Internet and Social Media

Through the indirect impact of the pandemic on the markets, we understand the influence of the coronavirus on the mood of investors and ordinary citizens through the media, the Internet, and social networks, whose role in modern society is increasing.

The media influences markets through news and television programs, affecting the psychological state of its participants. Increased pessimism in the media is causing market prices to fall. The news media predict a subsequent decline in stock market volatility, while social media — predicts a rise in stock volatility [21].

Internet technologies have reached into people's lives and are frequently used to define and shape market participants' behavior. The mood of investors is influenced by news on the Internet. When considering the role of the Internet for markets, we will separate social networks, which serve not only as a channel through which investors receive information that shapes their rational expectations but also as a channel that affects their behavior. By researching social networks, it is possible to analyze the trust of market participants in the asset as well as its popularity among investors [10]. Social networks can act as a tool for forecasting the stock market [5]. A high level of positive social media posts predicts short-term stock growth, while negative sentiment has a long-term negative impact [22]. Based on concern indicators on different topics on Twitter and Google, it is possible to predict stock price movements [5].

S.V. Egorova and A.N. Nepp [23] defend the probability of indirect effects on markets by summarizing the work on crowd psychology and behavioural finance. The appearance of the shock event causes the rise of fear and hysteria in market participants, which, according to the Le Bon crowd theory [8] in online communities [9], creates conditions for irrational decision-making [12]. In the context of our research, we examine the probability of indirect effects on the stock market based on microdata, with a focus on airline stocks as one of the main victims of the epidemic and the restrictive measures implemented.

METHODOLOGY OF RESEARCH

Hypothesis

Despite the growing number of publications on the impact of the coronavirus on the stock markets [5, 6, 11], we have not found any papers that investigate the stocks of individual companies, especially airlines. We developed our initial hypothesis to fill this gap:

Hypothesis 1. The rise in COVID-19 cases and deaths has led to increased volatility in airline stock prices in developed and developing countries.

Investors' sentiment plays an important role in market decisions. The behavior of market participants can be studied by analyzing posts and reposts on social media. Sentiment analysis on Twitter can be useful to forecast stock market movements [24]. To study the impact of social network users' feelings on airline stocks, we formulate the second hypothesis:

Hypothesis 2. Increased attention to the coronavirus, the vaccine against it and the

pandemic restrictive measures among Twitter users is accompanied by rising volatility of the airline's stock price.

Another tool for analyzing the attention of market participants is Google search queries as determinants in the forecasting models of the stock, oil [25] and foreign exchange markets [26].

In order to address the impact of Google search queries on coronavirus restrictions on the volatility of individual companies' stocks, we have formulated our third hypothesis.

Hypothesis 3. Increased Google searches about coronavirus restrictions are accompanied by rising volatility in airline stock prices.

The proposed hypotheses will be verified with the database presented in the following subsection.

Data

We are reviewing the stocks of 16 airlines from developed[2] and developing[3] countries during the period of pandemic peak and restrictive measures from 23.03.2020 to 23.03.2021.

When examining stock volatility as a dependent variable [27], we use logarithmic returns $ln\left(\frac{P_t^{close}}{P_{t-1}^{close}}\right)$ $\left(ln\, stock\ volatility_{it}\right)$ based on the Yahoo finance.

In order to verify the hypotheses in the model integrated the vector of the control variables $control_{it}$. The vector includes the price of Brent oil ($brent_{it}$) as an indicator of the cost of fuel, which is of great significance for the financial performance of airlines [28].

In the context of the pandemic, restrictive measures [29] have had a significant impact on the development of tourism and the transport sector, for which we have considered the Strigency Index of the University of Oxford on the Strength of Governmental Restrictive Measures against COVID-19 as a control determinant [30] (str_{it}).

The intensity of deterrent measures has declined following the development of vaccination programmes, which have ultimately had a positive impact on air transport [31], which has led to the inclusion of the share of citizens vaccinated against COVID-19 $control_{it}$ in the vector (vac_{it}) according to Our World in Data.

When we test the H1 hypothesis, we analyze the vector variable characterizing the spread of the coronavirus ($spread\_covid_{it}$, which includes the number of cases by (ttl_case_{it}) and deaths (ttl_dths_{it}) by the coronavirus (increasing) in the analysed countries. To verify the hypotheses of H2 as the variables being studied, we consider the vectors of variables characterizing: a) social network attention to COVID-19 ($attention\_covid_{it}$); b) attention to restrictive measures ($attention\_restriction_{it}$); c) attention to the vaccine against COVID-19 ($attention\_vaccine_{it}$). To investigate the H3 hypothesis, we analyze the vector of variables characterizing attention in Google to restrictions in airlines (ggl_search_{it}) based on Google Trends. To fill in the vector variables formulated for the second hypothesis, we analyzed Twitter, which has proven itself well in the study of users' attention to the coronavirus [11]. Guided by the paper [32], 14 most frequently occurring terms in English have been identified in posts about:

- coronavirus (vector $attention\_covid_{it}$): coronavirus ($cvrs_{it}$), covid (cov_{it}), covid19 ($cov19_{it}$), pandemic (pdc_{it}), corona (crn_{it}), virus (vrs_{it});
- restrictive measures (vector $attention\_restriction_{it}$): lockdown ($ldwn_{it}$), stay ($sty_{it}$), home ($hme_{it}$), health ($hlth_{it}$), mask ($msk_{it}$);
- coronavirus vaccines (vector $attention\_vaccine_{it}$): vaccine ($vcne_{it}$), moderna ($mdrn_{it}$), pfizer ($pfzr_{it}$).

For the formation of the vector ggl_search_{it} [5] the most frequent queries related to

[2] USA — NYSE ARCA Airline index (USA_Xal), United Airlines Holdings, Inc. (USA_UAL); UK — easyJet plc (GBR_Ezjl), Gama Aviation Plc (GBR_Gmaal); Germany — Deutsche Lufthansa AG (DEU_LHA), Aegean Airlines S.A. (DEU_32af); France — Air France-KLM SA (FRA_Afpa), Caire (FRA_Mlaaepa).

[3] India — InterGlobe Aviation Limited (IND_Indigo), SpiceJet Limited (IND_Spicejetbo); Brazil — Azul S.A. (BRA_Azul), Gol Linhas Aéreas Inteligentes S.A. (BRA_Gol); Turkey — Pegasus Hava Tasimaciligi Anonim Sirketi (TUR_Pgsusis), Türk Hava Yollari Anonim Ortakligi (TUR_Thyaois); Russia — Aeroflot — Russian Airlines (RUS_Aflt), UTair Aviation (RUS_Utarme).

restrictions in the airline during the period under investigation such as "flight status" (ggl_fsts_{it}), "flight cancellation" (ggl_fcanl_{it}), "booking a flight" (ggl_fbkg_{it}) and "flight reservation" (ggl_fres_{it}) have been identified.

Selection of Method and Modelling Methodology

For our study, we have focused on the ARDL model with MG and PMG [33], because the MG-PMG designation enables long-term and short-term relationships to be evaluated, which appears to be important in the study of the effects of fear, hysteria, and hype, which can be of a short, impulsive nature.

A single root test was carried out for the stability of the variables. Based on the selected method and the variables being analyzed, the vector model takes the form:

$$\begin{aligned}\ln stock\ volatility_{it} = \\ \sum_{j=1}^{p}\alpha_i \ln stock\ volatility_{i,t-j} + \sum_{j=0}^{q}\delta_{ij} spread\_\mathrm{cov}id_{i,t-j} + \\ + \sum_{j=0}^{q}\delta_{ij} attention\_\mathrm{cov}id_{i,t-j} + \sum_{j=0}^{q}\delta_{ij} attention\_restriction_{i,t-j} + \\ + \sum_{j=0}^{q}\delta_{ij} attention\_vaccine_{i,t-j} + \sum_{j=0}^{q}\delta_{ij} ggl\_search_{i,t-j} + \mu_i + \varepsilon_{it},\end{aligned} \quad (1)$$

where α_i — the coefficient of the dependent variable with the lag; δ_{ij} — coefficient vectors $k \times 1$; μ_i — fixed effects for a specific unit (company); ε_{it} — member error, $i = 1,\ldots N$; $t = 1,\ldots T$; p and q — optimal number of lag.

To analyse the potential impact between developed and developing countries, the database is divided into two panels. Panel *a* includes companies from developed countries, Panel *b* — from developing countries. Assuming the possibility of a hidden multicollinearity between the variables under investigation, a model containing the vector of the control variables $control_{it}$, is successively integrated with one variable of the vectors of the variable under examination. For example, for ttl_case_{it} the model takes the form:

$$\begin{aligned}\ln stock\ volatility_{it} = \alpha_0 + \alpha_1 ttl\_case_{it} + \alpha_2 ttl\_case_{it-1} + \\ + \alpha_3 ttl\_case_{it-2} + \gamma_4 vac_{it} + \gamma_5 vac_{it-1} + \gamma_6 vac_{it-2} + \\ + \gamma_7 str_{it} + \gamma_8 str_{it-1} + \gamma_9 str_{it-2} + \gamma_{10} brent_{it} + \\ + \gamma_{11} brent_{it-1} + \gamma_{12} brent_{it-2} + \varepsilon_{it}.\end{aligned} \quad (2)$$

RESULTS AND DISCUSSION

In all models, $brent_{it}$ has demonstrated importance for both developed and developing countries. Growth $brent_{it}$ in the short-term effects study was accompanied by an increase $ln\ stock\ volatility_{it}$, which corresponds to the [28] results on the impact of oil prices on the financial performance of airlines. At the same time, in the analysis of long-term effects, we observed a decrease in the volatility of airline stock prices, which did not meet our expectations. Such results could have been caused by the stronger influence of social media and Internet attention to COVID-19 and coronavirus-induced restrictions.

When the index str_{it} increases, we find a rise $ln\ stock\ volatility_{it}$, which was observed in both short- and long-term models and consistent with our expectations of a deterioration in the financial performance of airlines due to restrictive measures and, as a result, increased volatilities in the price of shares, the results correspond to the result [29]. The results of the study of the index vac_{it} were unstable in the analysis of long-term effects, such results may be due to the existence of a mechanism of indirect influence of the coronavirus through influence on the psychological state of market participants.

The Results of Hypothesis H1

In formulating the first hypothesis of our study, we assumed that the rise in COVID-19 cases and deaths would be accompanied by an increase in airline stock volatility. During the verification of the hypothesis, we revealed that the increase in the share volatility in the analysis of short-term effects for developing countries was accompanied by the growth in the growth of the ttl_case_{it} and ttl_dths_{it} which corresponds to the results [11]. At the same time, an adverse relationship was found in the investigation of long-term consequences. We justify the results obtained,

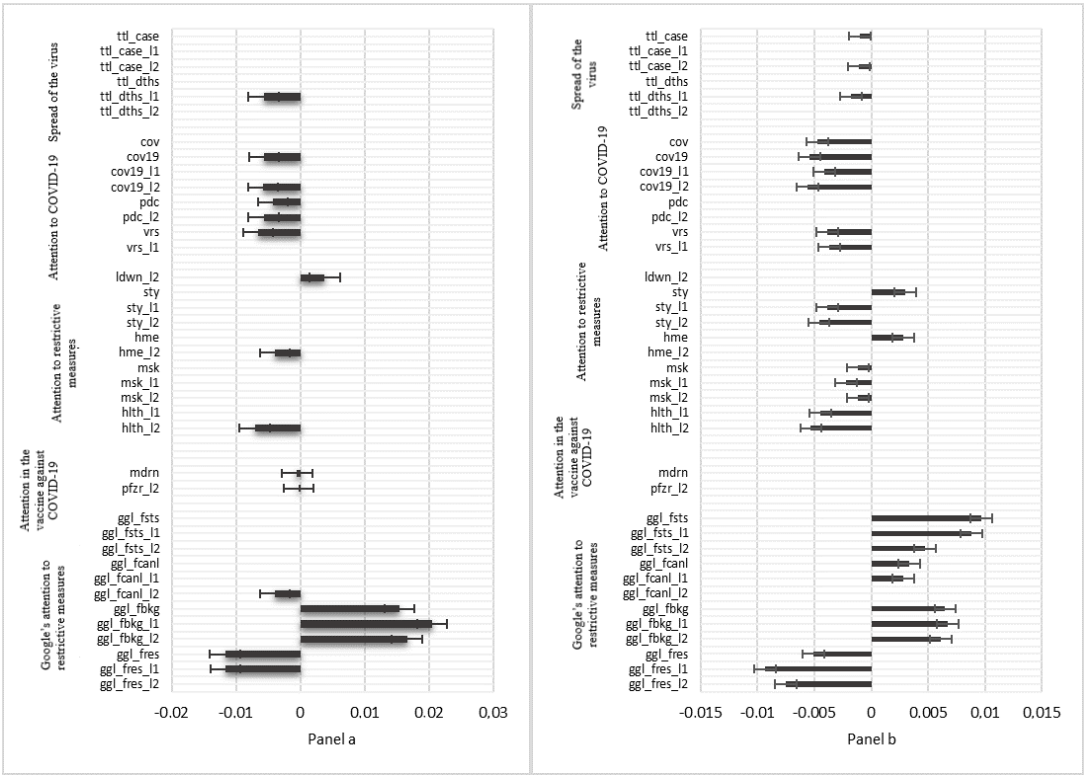

Fig. 5. **Long-term Effects on Airline Stock Volatility from Coronavirus Spread, Twitter Attention to COVID-19, Vaccines Against Coronavirus, Restrictive Measures, and Google Attention to Airline Restrictive Measures**

Source: Compiled by the author.

first, by the impulsive nature of the effects studied, and second, by a distortion resulting from the existence of a mechanism of indirect influence of the coronavirus on the volatility of the shares studied by influencing investor sentiment via the Internet and social networks.

The Results of Hypothesis H2

The main results are presented in *Fig. 5*, *6*.

The vector of variables $attention\_covid_{it}$, characterizing attention to COVID-19, in the analysis of long-term effects showed a negative correlation with the volatility of airline shares in both developed and developing countries. The discovered association was unstable in the study of short-term impacts: the effects changed signs in the models. The model results were opposite to expectations in the H2 hypothesis, which we attribute to market participants being terrified not so much of the coronavirus itself, but of the prospect of restrictive measures imposed by it. In the study of the vector $attention\_restriction_{it}$, which characterizes attention to restrictive measures, we find confirmation of the H2 hypothesis in almost all models. In models for both developed and developing countries, increased attention to coronavirus-related restrictions was accompanied by a short-term increase in volatility, confirming the negative impact of COVID-19 restrictive measures on tourism [20] and, in particular, on traffic volumes. Considering the long-term impacts, we discover a negative relationship between the volatility of airline stocks and compliance of regulations. These results confirm our hypothesis that behavioral elements, particularly the attention to restriction measures against COVID-19, have an impulsive and temporary effect, as shown, for instance, in the paper [11]. On the other hand, we associate this result with the fact that society has eventually realized the positive role of restrictions in the fight against the pandemic. Similar effects we encounter in vector $attention\_vaccine_{it}$. analysis. The H2 hypothesis was supported by the short-term increase in share value volatility that corresponded

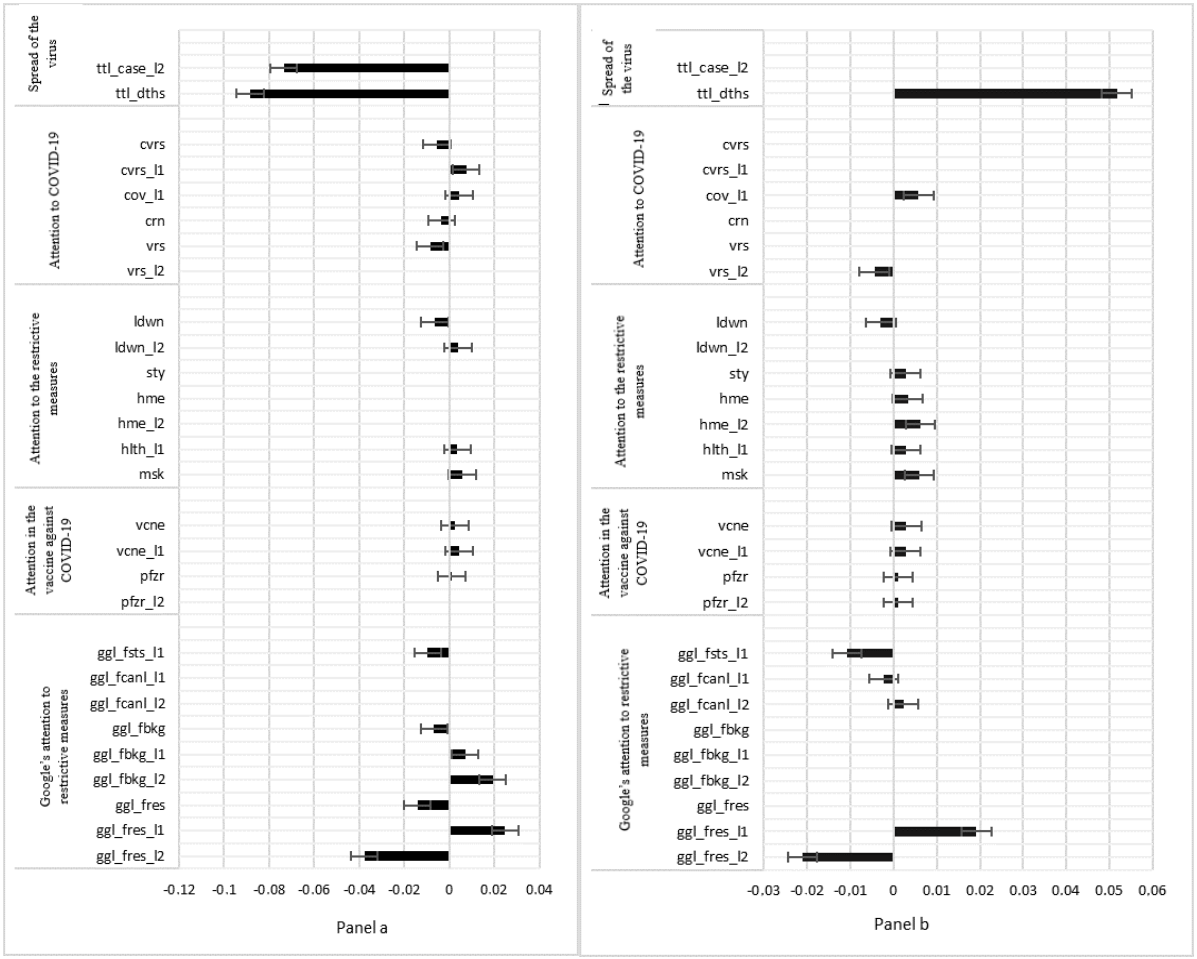

Fig. 6. **Short-term Effects on Airline Stock Volatility from Coronavirus Spread, Twitter Attention to COVID-19, Vaccines Against Coronavirus, Restrictive Measures, and Google Attention to Airline Restrictive Measures**

Source: Compiled by the authors.

with the focus on vaccines. Restrictive measures to stop the epidemic included airline rules that only vaccinated passengers could board aircraft. Therefore, it seems quite logical that the results of models with the vector $attention\_vaccine_{it}$ were very similar to the result of the vector $attention\_restriction_{it}$. A negative correlation between stock volatility and attention to vaccines was found in the analysis of long-term effects, which confirmed the results of models for the COVID-19 $attention\_covid_{it}$ vector and $attention\_restriction_{it}$. vector. Such results can be attributed to the long-term positive role of vaccines, as well as restrictive measures in pandemic deterrence, which have had a "calming" effect on stock price volatility. Our results are consistent with the findings [31] on the long-term positive impact of vaccination on air transport.

Following a summary of the H2 hypothesis test results, we are able to report that there has been a short-term increase in airline stock price volatility, which is consistent with our expectations under H2 and the conclusions [20] on the pandemic's effects on travel and tourism. This increase was associated with a rise in Twitter attention to restrictive measures related to COVID-19 and vaccines against it. At the same time, we note that the H2 hypothesis was not confirmed in the analysis of long-term effects. Such results are explained by the impulsive short-term nature of the effects studied, which confirms the results [11].

The Results of Hypothesis H3

In a study of the short-term relationship between airline stock volatility and Google searches

ggl_fcanl_{it}, ggl_fres_{it}. and ggl_fbkg_{it} for flights, we did not observe sustainable effects. The factors studied and their lies changed signs in different models. Such results were quite expected, against the background of the volatility of regular flights any positive, however, as well as negative, information about the status, booking, reservation and cancellation of the flight caused a quick response (impulsion) for the volatility of the stocks. Results from long-term effects analysis are more unambiguous. We have observed an increase in airline stocks volatility for developing countries in addition to an increase in Google queries on flight status, cancellations, and flight bookings. In developed countries, increased volatility was attributed to flight bookings. The decline in stock volatility against the backdrop of increased attention in Google to ggl_fres_{it} in the countries we associate with the fact that during the pandemic the stock market needed some positive news, for example, the growth of reservations in airlines against the background of negative news about the cancellation and status of flights. Most results confirm the H3 hypothesis: an increase attention in Google to status, cancellation, and flight reservations was accompanied by a long-term rise in stock volatility. These results confirm our findings during the testing of the effects of Twitter attention to COVID-19-related restrictive measures under the H2 hypothesis and are consistent with the results [20] on the impact of restrictions on traffic volumes and tourism.

CONCLUSION

We reached at the following conclusions after studying the factors behind the pandemic's direct and indirect effects on airline stocks:

- firstly, the increase in COVID-19 cases and deaths was accompanied by a short-term rise in airline stock volatility;
- secondly, Twitter's attention to COVID-19 restrictions and vaccines was accompanied by a short-term rise in airline stock volatility. The results of hypothesis 2 confirmed the impact of social media on stock indices;
- thirdly, an increase attention in Google to status, cancellation, and flight bookings was accompanied by the long-term effects of increased stock volatility.

The obtained results demonstrate that in conditions of spread of Internet and social media, the impact of the pandemic on stock markets occurs not only in the form of direct impact on the determinants of economic growth model, but also indirectly through social media and Internet on investor behaviour by creating fear and hysteria among them.

Our results can be of practical interest to stock market participants and its regulators to forecast and minimize the possible negative impact of social media on stock markets.

ACKNOWLEDGEMENTS

The reported study was funded by the Russian Foundation for Basic Research under the scientific project No. 20–04–60158. Ural Federal University named after the first President of Russia B.N. Yeltsin, Ekaterinburg, Russia.

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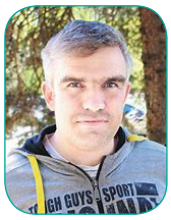

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 14.03.2023; revised on 19.04.2023 and accepted for publication on 26.04.2023. The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-140-149
UDC 336.226.111(045)
JEL H24

An Old Song in a New Way: About the Progression in the Personal Income Tax

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ABSTRACT

The issues of choosing between proportional and progressive taxation of personal income and assessment of the principle of fair taxation in relation to these methods accompany the centuries-old history of world tax policy, which is the **relevance** of the research, being the **subject** of discussions of Russian and foreign scientists. The **purpose** of the study is to develop the idea of taxation of income of the population in Russia, taking into account the principle of fair taxation. The **theoretical objectives** of the study include an analysis of the validity of the method of taxation chosen, as well as an analysis of the progressive method of taxation, which allows for a fair redistribution of income through the progression of rates and an adequate system of tax deductions. The **practical objectives** of the study are to study the influence of income taxation methods on the formation of budget revenues and incomes of the population, to assess the "shadow" fiscal potential of income, to determine the level of demand and significance of tax deductions. As a **result** of the research, it has been scientifically proven that proportional taxation and weak progression discredit the principle of vertical equity, lead to a hidden progression in the withdrawal of income, have no obvious positive effect on capital outflow and, in combination with insurance premiums, affect the size of the potential tax base. The practical **significance** of the study is to develop concrete proposals for the methodological development of personal income tax through differentiated tax deductions, tax mechanisms for strengthening the institution of family and marriage, and the expansion of the tax base.

Keywords: PIT; personal income tax; social deductions; standard deductions; progressive taxation; the principle of equity; concealment of income; withdrawal of capital; tax control; insurance payments; family taxation

For citation: **Yumaev M.M. An old song in a new way: About the progression in the personal income tax.** ***Finance: Theory and Practice*****. 2023;27(5):140-149. DOI: 10.26794/2587-5671-2023-27-5-140-149**

INTRODUCTION

Various levels of progressive taxation were an important characteristic of the taxation of individual income through the history of pre-revolutionary Russia, the USSR, and the period during which the tax system of the new Russia was developing. Chapter 23 of the Russian Federation's Tax Code officially took effect from 1 January 2001, and as a result, income was taxed using the proportionate method, which applied an ad valorem rate of 13% to the majority of income received by people. This is linked to the liberalization of tax legislation in the history of the tax system of the Russian Federation — the reduction of rates on most taxes and the mitigation of responsibility for violations of tax laws.

From 2021 in the personal income tax (further — PIT) appeared the second stage of the scale of tax rates — 15% for income over 5 mln rubles, such a weak progression increased budget revenues from PIT by only 2% (according to data for 11 months 2022).[1]

The state's attitude to progression in income taxation is expressed in the letter of the Ministry of Finance of Russia dated 30.12.2019 No. 03–04–05/103357, it is recognized that the application of progressive income tax in the 1990s led to a decrease in legal income. The Ministry of Finance considers the introduction of an extensive list of deductions, reducing taxpayers' tax burdens, increasing the State's attraction to investors, and improving tax administration as benefits of PIT.

The targeting of such preferences is, however, somewhat undermined by the unclaimedness of individual deductions, the imperfection of their receipt, and the insignificant amount.

[1] Report No. 1-NM for 2021. Official website of the Federal Tax Service. URL: https://www.nalog.gov.ru/rn77/related_activities/statistics_and_analytics/forms/10973378/ (accessed on 20.02.2023).

PROGRESSIVE TAXATION: THE PRINCIPLE OF EQUITY AND EVOLUTION

The principle of equity put forward by A. Smith [1] for the present time can be expressed as follows: the State guarantees a person the right to carry out any legal activity in exchange for imposing on the recipient of income an obligation to pay tax on that income. The tax in this case is a fee for the granted right and the opportunity to receive income in such amounts and to have guarantees of protection of their right to such income.

Equity in income taxation is expressed in two approaches: proportional taxation without change of tax rate with rising income — horizontal equity and progressive taxation — vertical equity [2]. The preservation of two approaches to income taxation demonstrates world experience: in Europe, Asian countries, and the US, progressive taxation with high rates is predominantly prevalent, in the countries of the Eurasian Economic Union — proportional taxation is very low rates. According to V.N. Edronova and A.V. Telegus, proportional taxation is common in the EAEU, often at a rate below the Russian rate of 10% (Republic of Kazakhstan and Kyrgyzstan), with the exception of the Republic of Armenia, where the progressive scale of rates with a weak progression of 24.4% and 26% is used [3].

Progressive taxation as an equity form of exemption of differentiated income was formed long before it was defined by A. Smith. According to the results of a study by E.A. Smorodina and E.V. Rudenok [4], progression in income taxation began in ancient Greece. It had a personal development in medieval Europe, characteristic of both the two-hundred-year history of Russia before the revolution of 1917 and the Soviet and new Russian stages of development, and is popular now and abroad.

In the USSR, weak progression was applied with a maximum rate of 13%. In transitional 1991, on the territory of the RSFSR were

simultaneously in force the laws of the USSR and the RSFSR on income tax, which established different values of the progressive scale of rates: in the Law of the Soviet Union[2] — from 0.3 to 60%, according to the law of the RSFSR[3] rates varied from 0.3% to 50%.

Since 1992, the Law of the Russian Federation of 07.12.1991 No. 1998–1 "On income tax on individuals" has established a three-stage scale of rates in the range from 12 to 30%. The scale was subsequently modified to a maximum rate of 42%.

The PIT base rate was raised to 13%, progression and required individual declarations were eliminated, and other liberal tax reforms were put in effect at the beginning of the 20th and 21st centuries. Despite popular belief, these changes did not result in a significant rise in incomes: since 2000, PIT increased by 24% in nominal terms in 2001, but income tax revenues in 2000 increased in the same amount compared to 1999 (author's data). Furthermore, due to the non-payment crisis, two-thirds of funds in 2000 were deducted from taxpayers' accounts, but came to the budget later. The growth of PIT revenues in subsequent years was roughly the same as the growth of aggregate tax revenues. In other words, the impact of proportional taxation on income growth with the introduction of PIT is unclear. This conclusion is confirmed by V. G. Panskov, pointing out that the reasons for the increase in incomes with the introduction of PIT were, among other things, the cancellation of benefits for the employees of the security agencies and the establishment of a single social tax with a regressive scale of rates [5], aimed at the legalization of incomes.

The introduction in Russia of a complex, but weak progression from 2021 was an attempt by the state to solve the goal: the second stage of taxation for income over 5 mln rubles at a rate of 15% was introduced to finance the costs of treatment of children and the purchase of medical equipment, primarily within the framework of the functioning of the "Circle of Kindness" fund, which finances the treatment of severe childhood diseases. The actual budget postponements in 2021 amounted to 0.6 trn rubles,[4] exceeding the expected revenue by 10 times; nevertheless, the increase in PIT due solely to the application of the increased rate to "surplus income" was only 2%.[5] Moreover, to date, the "Circle of Kindness" fund has concluded contracts for only 103 bln rubles.[6]

CRITICISM OF PROPORTIONAL INCOME TAXATION

The low PIT rate of 13% introduced in 2001 gives the population a subjective signal of its insignificant contribution to budget revenue formation. This, in our opinion, has contributed to a high level of the aggregate rate of insurance premiums and a desire to avoid both PIT and insurance contributions, along with the lack of development in PIT over a prolonged period of time.

According to expert estimates, "grey salary" in Russia reaches 10 trn rubles a year, and approximately 30–40% of the population receives wages without taxation. This conclusion discredits the proportional taxation of incomes, which has not been able to take such income out of the shadow [4], although to verify actual income in an age of excess information online can carried out through analysis of HR resources (such as

[2] USSR Law from 23.04.1990 No. 1443–1 "On income tax from USSR citizens, foreign citizens and stateless persons".

[3] The Law of the RSFSR from 02.12.1990 "On the Procedure of Application in the Territory of the RSFSR in 1991 of the Law of the USSR "On Income Tax from Citizens of the USSR, Foreign Citizens and Stateless Persons".

[4] Report No. 1-NM for 2021. Official website of the Federal Tax Service. URL: https://www.nalog.gov.ru/rn77/related_activities/statistics_and_analytics/forms/10973378/ (accessed on 22.03.3023).

[5] See ibid.

[6] Official website of the Foundation "Circle of Kindness". URL: https://xn-80abfdb8athfre5ah.xn — p1ai/ (accessed on 22.03.2023).

Headhunter and others) and comparison of data with real wages in specific companies.

In this case, one can agree with the opinion of A.V. Tikhonova that the high tax burden (maximum aggregate amount of insurance premiums and PIT is 43–45%) is a key factor that forms the desire for tax evasion of individuals and employers along with possible insufficient "tax morality" [6].

Employees and the budget suffer as a result: the Russian Federation's Pension Fund deficit prompted the unpopular decision to raise the retirement age rather than look for ways to increase the base of insurance contributions, such as by liquidating envelope schemes or searching for other ways to replace the insurance funds' decreasing income, such as a higher level of resource rent withdrawal.

The potential of PIT to solve the problem of insurance taxation is confirmed by the application of the 15% PIT rate. According to Rosstat, 10% of the population accounts for 30% of income,[7] it can be assumed that from the total tax base of PIT (taxed at the rate of 13%) to 32 trn rubles[8] approximately 11 trn rubles are income of the highest-income group of individuals, and the establishment of the PIT rate at least in the amount of 30% would have allowed to mobilize additional income in the sum of more than about 2.8 bln rubles, while, according to the Federal Tax Service of Russia (further — FTS), from the incomes of persons taxed at 15%, additional received PIT in the total amount of 0.6 bln ruble.[9]

A significant problem affecting the search for non-popular measures in taxation, in our view, remains the criminal distribution of part of the income entering the budget system. According to the results of the investigation of the Higher School of Economics on the losses of the state from corruption in procurement in 2021, out of 29.1 trn rubles of funds allocated to state and corporate procurements, the amount of "disbursements" amounted to 6.6 trn rubles, or approximately 6% of Russia's GDP.[10]

It is known that reducing corruption should also result in less tax evasion, which raises budgetary income directly [7]. In the event of the elimination of the possibility of corruption gaps, the question of the feasibility of introducing a progressive rate scale would be less acute, as would the issue of increasing the retirement age.

The next negative factor contributing to tax evasion is the withdrawal of funds abroad. Since 2022, the scale of withdrawal of funds abroad has increased significantly, which in the circumstances of the uncertain risk of nationalization of the income of individuals by "unfriendly" countries indicates the possible loss of the Russian tax base, which could be the object of multi-stage progressive taxation.

Thus, from 1 July 2022 to their accounts abroad, individuals can transfer from Russian accounts not more than 1 mln dollars per month. For this and other reasons, specific to 2022, the net capital outflow was the largest in the history of Russia — 251 bln dollars, exceeding by one and a half times the 2021.[11]

Thus, proportional taxation in the Russian Federation did not solve the problems of insurance taxation, tax evasion, and capital withdrawal abroad. J.R. Repetti, for example, also acknowledges the inability to interpret the results of the research on investments and savings in an unambiguous manner, indicating that the expected benefits of improving their

[7] Official website of Rosstat. URL: https://rosstat.gov.ru/folder/13723 (accessed on 12.03.2023).

[8] Report No. 5-MET for 2021. Official website of the Federal Tax Service. URL: https://www.nalog.gov.ru/rn77/related_activities/statistics_and_analytics/forms/ (accessed on 25.03.2023).

[9] Report No. 1-NM for 2021. Official website of the Federal Tax Service. URL: https://www.nalog.gov.ru/rn77/related_activities/statistics_and_analytics/forms/10973378/ (accessed on 25.03.2023).

[10] Experts of HSE Research Institute assessed state losses from corruption in procurement. URL: https://anticor.hse.ru/main/news_page/eksperty_niu_vshe_otsenili_poteri_gosudarstva_ot_korruptsii_v_zakupkah (accessed on 14.02.2023).

[11] Medium-term forecast of the Bank of Russia from 28.10.2022. URL: https://www.cbr.ru/Collection/Collection/File/43430/forecast_221028.pdf (accessed on 15.02.2023).

effectiveness through low individual tax rates are speculative in nature [8].

SOCIAL ACCENTS OF PROGRESSIVE INCOME TAXATION

According to M. Friedman, progressive taxation leads to a decrease in interest in risk-related and high-income activities, thereby increasing the profitability of these activities, as well as to finding ways to avoid paying high income taxes [9].

A.V. Tikhonova and N.P. Melnikova confirm that progressive taxation of income leads to a decrease in incentives for labour and entrepreneurial activity, since labour income is not as large as the high income that can be obtained from the use of capital [10].

On the other hand, O. Nadirov, B. Dehning, and D. Pavelkova concluded that the transition to proportional income taxation resulted in a reduction in the amount of working time after analyzing the effects of progressive and proportional income taxation on incentives to work in Slovakia [11].

US recognizes consensus on neutrality of historical rate range impact on labour supply (J.R. Repetti [8]). A.N.C. Goldman, S.J. Lusch, G. Sadka note the effects of progressive tax during the COVID-19 pandemic in the US: economic activity constraints have led to even greater income inequality among different population groups, but the states with the highest progressive rate scales have been able to provide higher tax revenues compared to the low-rate states [12].

In our view, a person's desire to choose a less-income source than a higher-taxed source of income in order to avoid progressive income tax is contrary to human nature.

M. Friedman was also the author of the idea of negative income tax as an equity taxation, which provides for a real tax return from the budget to an individual with a negative difference between the amount of tax deduction and income [9]. E.A. Chernykh, by linking negative income tax to the concept of unconditional basic income, justifies the argument that both negative income tax and unconducive basic income are options for solving the same problem — achieving social equity [13].

V.G. Panskov supports the idea of socially oriented step-by-step progressive income tax in the form of complex progression, justifying a tangible non-taxable minimum income and progression with income that exceeds the average wage at least twice [5].

A.V. Tikhonova and N.P. Melnikova pointed out that the problem of compensation incomes, which may be deprived of the subjects of the Russian Federation due to the low level of incomes of the population as a result of their possible exemption from PIT (or a significant reduction in the rate) [10], can be solved either through federal transfers or by increasing rates for higher incomes or by introducing an autonomous regional income tax, which applies in the federal states.

Despite the fact that proportional taxation, at first glance, makes the system equity — the higher the income, the higher the amount of tax, in fact, as income rises, the tax rate decreases and leads to regression (see *Table*).

The hidden regression in PIT consists of an increase in the share of taxes and other expenses in the income of the individual with a decrease in income, in addition to the hidden regression in indirect taxation.

However, income tax should not be seen as a tool of "equalization": if, in this example, the rate of exemption of income for the second person (measured using any method of taxation) is increased to 40%, he or she will have half of the income received, and in order to equal the share of the remaining income of the first and second person, the percentage of tax exemption for the latter person must be raised to 77%. But this approach is obviously an excessive expression of equity.

To maximize the impact of tax benefits (deductions) utilized by the most disadvantaged individuals is an essential principle in the social context of population tax system construction [14].

Table

Comparison of the Results of the Application of Proportional Taxation

No.	Indicator	Subject of Taxation 1 (PIT Rate 13%)	Subject of Taxation 2		
			Rate 13%	Rate 40%	Rate 77%
A	B	1	2	3	4
1	Income received, rubles	720000	4900000		
2	PIT, rubles	93600	637000	1960000	3773000
3	Net income, rubles (p. 1 – p. 2)	564000	4263000	2940000	1127000
4	Utility payments, rubles	60000	60000	60000	60000
5	Child expenses (according to Rosstat), rubles	120000	120000	120000	120000
6	Other expenses, rubles	360000	360000	360000	360000
7	Disposable income, rubles (p. 3 – p. 4 – p. 5 – p. 6)	24000	3723000	2400000	587000
8	Disposable income in relation to income received,% (p. 7: p. 1)	12	76	49	12
9	Share of PIT revenue recovery and required expenditure, % (100% – p. 8)	88	24	51	88

Source: Compiled by the author.

However, the individual value of the most claimed deductions — standard and for children — is insignificant and depending on social status as at 01.01.2023 gives real savings on tax per year from 780 to 18 720 rubles, the maximum savings in social deductions is 15 600 rubles, the most tangible consequences of property deduction — up to 390 thous. rubles savings.

For example, the amount of deduction for the first child of 1 400 rubles was established since 1 January 2012 and has not been revised until now, while the rate of inflation (change in the consumer price index) for 2012–2022 was 2.2 times.[12] The limit value of deduction of education costs in the amount of 50 thousand rubles is in force from 1 January 12007, while the cost of education of children in higher educational institutions, according to Rosstat, in the period 2010–2020 increased by 2.3–2.6 times.[13] The limitation of the social deduction (excluding expenses for education of children and charitable purposes) in the

[12] Official website of Rosstat. URL: https://rosstat.gov.ru/storage/mediabank/ipc_mes-2.xlsx (accessed on 02.03.2023).

[13] Paid public service in Russia 2021. Statistical collection. Official website of Rosstat. URL: https://rosstat.gov.ru/storage/mediabank/Platnoe_obsluj_2021.pdf (accessed on 29.03.2023).

amount of 120 thousand rubles applied unchanged from 1 January 2009, while in addition to the increase in the cost of educational services, the price of medical services increased by 1.4 times.

Meanwhile, the average salary of employees for the period 2013–2022 and average per capita income increased at a smaller rate — 1.7–1.8 times.[14]

With a comparable average per capita income, the standard tax deduction, for example, in the People's Republic of China is about 100 times greater than in Russia (5 000 yuan per month, before 2018–3 500 yuan) while China also applies higher rates of deductions for children's education — 1 000 yuan a month (approximately 130 thous. rubles per year), as well as a special type of deduct for the care of elderly parents [15, 16].

In the Russian Federation in 2021, the amount of tax deductions, excluding investment deduction, amounted to 330 bln rubles, or only 1% in relation to income received from employers (31.3 trn rubles).[15]

Tax deductions should be based on approximately real figures, for example, expenditure on children, and, of course, the deduction in the amount of 1 400 rubles per month per child is insignificant in comparison with the actual expenditures on children. According to Rosstat, expenditure on a child per month is about 10 thousand rubles (obviously, this figure is also underestimated), and if you take this amount for tax deduction, the total amount of deductions will increase by 7 times (from 136[16] to 974 bln rubles) and will be about 3.0% in relation to income received from employers (974 bln rubles: 32 trn rubles[17]) (currently — 0.4%). Budget losses in this case will amount to approximately 109 bln rubles, which can be compensated by the introduction of progressive taxation of income.

Social deduction of costs associated with obtaining medical services, in 2021 received a little more than 11 thous. people out of more than 65 mln people receiving income (average 47.5 thous. rubles per person), deductions related to the purchase of medicines — only 56 people, which indicates that this benefit is not in demand, including because of its insignificance and the need for careful collection of supporting documents.[18]

Moreover, the size of paid services to the population in 2021 amounted to 1 trn rubles, while the expenditure of the federal fund of compulsory health insurance was 2.3 trn rubles or approximately 15 thous. rubles per insured.[19]

According to the results of the study of Rambler&Co and SberInsurance, approximately 60% of Russians use paid medicine,[20] and if at least half of the income recipients from employers (28 thous. people[21]) took advantage of the deduction of medical expenses, the total deduct, according to the author, would amount to 1.5 trn rubles, the tax refund would be 200 bln rubles.

One of the variants of equity taxation development is the differentiation of tax deductions (standard, social) depending on the level of income by analogy with the application of the progressive scale of tax rates: for example, with an increase in income, the amount of deductions may decrease, and when the income is reached, for example, 5 mln rubles, the deduction can be reduced to zero.

[14] Official website of Rosstat. URL: https://rosstat.gov.ru/folder/13397 (accessed on 29.03.2023).

[15] Report No. 5-PIT for 2021. Official website of Federal Tax Service. URL: https://www.nalog.gov.ru/rn77/related_activities/statistics_and_analytics/forms/ (accessed on 24.03.2023).

[16] See ibid.

[17] See ibid.

[18] See ibid.

[19] Report on the results of the Federal Compulsory Medical Insurance Fund in 2021. Moscow; 2022. URL: https://www.ffoms.gov.ru/system-oms/about-fund/fund-activities/%D0%9E%D0%A2%D0%A7%D0%95%D0%A2_%D0%A4%D0%9E%D0%9C%D0%A1_%D0%B7%D0%B0_2021_%D0%B3%D0%BE%D0%B4_28.11.2022.pdf (accessed on 15.02.2023).

[20] Research of Rambler&Co and SberInsurance: how many Russians use paid medicine? URL: https://doctor.rambler.ru/news/48364575-issledovanie-rambler-co-i-sberstrahovaniya-skolko-rossiyan-polzuyutsya-platnoy-meditsinoy/ (accessed on 13.02.2023).

[21] Report No. 5-MET for 2021. Official website of Federal Tax Service. URL: https://www.nalog.gov.ru/rn77/related_activities/statistics_and_analytics/forms/ (accessed on 25.03.2023).

Taking into account the hidden regression in the PIT, the loss of deduction is less critical for high-income persons — slightly more than 2% [15 600 rubles (savings with the application of social deductions): 650 thous. rubles [PIT from 5 mln rubles] than for low income persons.

It is equity that the deduction of social benefits for low-income persons and the compensation of such tax expenses by increased tax deductions for high-incoming persons, including the introduction of family taxation, should be the objective of tax policy. This idea is supported by most Russian scientists [17, 18].

In particular, family taxation should promote the institution of family and marriage and ensure that the interests of family members, especially children, are respected.

A. V. Falishtyanu, N. A. Dementeeva and G. A. Artemenko differentiate between two main methods of family taxation in other countries: the application of a special coefficient to the total income that is dependent on the size of the family (French system) and the joint family income declaration, in which the presence of children and the size of the household are taken into account when receiving tax benefits [19].

Moreover, the tax status of a family may be determined by civil law and national traditions of the development of a patriarchal or nuclear family. A. Hedau (India) proposes to move from separate taxation of family members to family taxation limited to spouses [20]. Italy, on the contrary, has shifted from family taxation to individual taxation, taking into account the change in the civil-legal status of the income accumulation model: from patriarchal taxation in which a man as head of the family was taxed on the income received by household members to taxation of the individual income earned by each family member [21].

The absence of the family concept in the Family Code of the Russian Federation gives freedom to choose the forms of family taxation in national tax law. In any case, the management of a joint household involves receiving a consolidated income and the implementation of aggregate costs, the order of which is determined even by the marriage contract. Therefore, it is reasonable for the taxable person to accept a "consolidated group" of individuals — the family — in analogy with organizations that constitute an association of individuals on the basis of statutory documents, and the expenses of the family to recognize the actual expenses incurred by the family with the determination of the level of essential expenses and adequate limitations of the amount of individual expenses depending on the level the total income of the household on all sources of income. There is strong support for the status of children as human capital that will bring economic benefits to both the family and society in the future, including through participation in the formation of national income and national tax capacity. A possible reduction in the tax base due to increased expenses and deductions may be accompanied by an adequate increase in rates and the introduction of progressive rates and higher rates for families with no children.

CONCLUSION

1. The following results were obtained in the part of the theory of PIT:

1.1. Proportional income taxation has been demonstrated to have no obvious positive effects on the size of budget revenues, does not prevent tax evasion, and is characterized by hidden regression.

1.2. It has been found that poor progression in PIT does not serve the redistribution of high incomes and their fair taxation, and the PIT base rate is subjectively insignificant and discredits the importance of tax.

1.3. It was confirmed that progressive taxation was more in line with the principle of fair taxation and could be implemented not only in the progressive scale of tax rates, but also through a system of differentiated tax deductions.

2. The following results of the study are of practical importance:

2.1. The indexation of standard and social tax deductions to the average statistical parameters for education, health care and child maintenance can be offset by the introduction of additional ranges of the PIT progressive rate scale. In the future, it is desirable to introduce a reversal of the amount of deductions from the level of income, including the zeroing of the deduction for high incomes.

2.2. Limiting the withdrawal of funds abroad and reducing the rate of insurance contributions to pension will three positive effects at once: 1) the legalization of incomes, which remain in the shadow due to high rates of insurance premiums, including the introduction of the digital ruble and the control of expenses; 2) the associated increase in the tax base and, as a consequence; 3) the increase in insurance contributions revenues.

2.3. The purpose of taxing the family with multi-level progression is not only to reduce the tax burden on families with children with low and medium incomes, but also to promote the institution of marriage and family.

2.4. Alternative sources of equity taxation aimed at enhancing tax capacity have been identified: improvement of the system of allocation of budget funds, measures to counter the concealment of the PIT tax base and insurance contributions.

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Conflicts of Interest Statement: The author has no conflicts of interest to declare.

The article was submitted on 13.03.2023; revised on 28.04.2023 and accepted for publication on 26.05.2023.
The author read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-150-159
JEL H25, H21, J08, J18

The Tax Policy and Macro Management: Evidence in Vietnam

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ABSTRACT

The relevance of the study is determined by the need to improve the tax policy of Vietnam. **The scientific novelty** of the study lies in the application of a regression model for analysing GDP dynamics to determine the optimal tax policy. **The purpose** of this study is to study the relationship between the tax-to-GDP ratio and economic growth, the optimal threshold for the tax-to-GDP ratio, and to compare empirical results with actual tax-to-GDP ratios as a basis for improving tax policy and government micromanagement. **The methodology** of this study includes a threshold regression model, a unit root test, and a cointegration test to examine the impact of the ratio of tax revenues to GDP-on-GDP growth. The author used actual data on the dynamics of tax revenues and GDP over a 25-year period: from 1994 to 2020, reflected the development of economic growth studies. **It is shown** that the ratio of tax revenues to GDP and GDP growth are closely related at the level of 86%. The relationship between Vietnam's tax policy and economic growth is long-term, and the optimal threshold for the ratio of tax revenue to GDP is 19%, which leads to economic growth. It is concluded that the government should make more efforts to improve fiscal policy and macro management to stimulate economic growth and reduce the budget deficit. Fiscal policy has a significant impact on business entities, that is, economic organizations that create wealth for society and high employment, which leads to a decrease in unemployment. The results of the study can be used to form the tax policy of Vietnam.

Keywords: Taxation; threshold model; fiscal policy; GDP growth; threshold regression

For citation: **Dinh D.V., Ha N.T. The tax policy and macro management: Evidence in Vietnam.** ***Finance: Theory and Practice.*** **2023;27(5):150-159. DOI: 10.26794/2587-5671-2023-27-5-150-159**

INTRODUCTION

Tax policy contributes to the government's orientation and regulates the economy in a timely and reasonable manner. The tax policy also encourages manufacturers and businesses to promote efficiency in promoting economic growth. In addition, taxes are the main source of revenue in the state budget and the government's economic management toolTax revenues meet public spending requirements and are also tools to regulate the domestic economy and promote development, as well as international trade. The issuance of tax policies is very important for promoting economic growth, and most countries are attentive to this issue.

D. Baiardi et al. [1] determine the relationship between GDP per capita, total tax revenue, and the tax structure. The findings indicate a negative correlation between tax policy and economic growth, suggesting that when taxes are raised by the government, economic growth declines and that changes in tax policy have an impact on economic growth. However, the author's results only reflect the correlation between tax policy and economic growth without mentioning the optimal threshold of taxes. S. Biswas et al. [2] said that unequal income affects economic growth through tax policies, and the tax policies applied to different areas have different effects on household employment and investment. The authors also show that, for economic growth, the government enacts appropriate tax policies to reduce income inequality between low- and middle-income households. The authors apply the USA state data and micro-level household tax returns over the past three decades to find out these impacts. Although this study focuses on tax policy and economic growth, the results are limited to low- and middle-income households in a particular context. J.D. Gwartney et al. [3] They applied a threshold regression model, focusing on tax policy and economic growth through the income tax threshold, to consider tax changes from 1980 to 1990 and how they affected economic growth. These findings demonstrate that nations with lower tax rates experience faster economic expansion. Most research has examined the relationship between tax policy and economic growth, and their findings indicate that tax policy significantly impacts economic growth.

To analyze the impact of tax policy on economic growth, the literature applies the threshold regression model because it is often applied to time-series data, or the

threshold can be regarded as another variable, such as the tax-to-GDP variable. If the tax-to-GDP optimal threshold is exceeded, economic growth slows down. Therefore, the government can adjust its tax policy to achieve the optimal tax-to-GDP threshold. This is a model to find the thresholds of many indicators and can be applied in economics to find thresholds such as inflation, public investment, economic growth, labor indicators, etc. Similar to other studies, this study applied the threshold model to determine the optimal tax-to-GDP threshold. The data were collected from 1994 to 2020 in Vietnam, which is the time series that fits the model because data before 1994 do not exist and data after 2020 have not been updated.

Inappropriate taxation will have an impact on economic growth; if taxes are too high, it will reduce individual sector net profits; and if taxes are too low, it may be difficult for the government to implement its investment plans because of budget deficits. Therefore, determining the appropriate tax policy through the optimal tax threshold is necessary for economic growth and meaningful for implementing appropriate macroeconomic policies.

Empirical results show that increasing tax revenue above or below the optimal threshold of tax revenue harms the economy, which suggests that the government should maintain the optimal tax threshold for economic growth when it has tax cuts or increased taxation. Moreover, studies performed to date have been limited to the effects of taxes on economic growth in specific contexts. Therefore, this study effectively complements the literature by proposing a detailed analysis of the impact of tax rates on economic growth in Vietnam, to determine the optimal tax revenue threshold. According to the findings, tax cuts do not stimulate economic growth; rather, excessive tax cuts by the government would have the opposite effect, as explained in the section below.

LITERATURE REVIEW

Tax policy plays an important role in economic development; therefore, the optimal tax threshold helps the government to develop an appropriate tax policy. So, several studies have focused on tax and fiscal policy issues by using optimal tax thresholds. To determine the optimal tax threshold, several models have been used to analyze the tax threshold and its impact on economic growth, such as non-linearity, threshold analysis, technical threshold dynamic panel, and the threshold regression method. Most of the literature has pointed out that the government's tax policy is not appropriate, that is, the government's tax revenue is above or below the optimal threshold, which means that the tax revenue to GDP ratio increases, so there is also This means that economic entities have to pay more taxes leading to a decrease in the profits, the companies' asset size is reduced, which will affect economic growth.

According to the literature, economic growth and tax-to-GDP ratio are related. The empirical results demonstrate that government tax money can have both favorable and unfavorable effects on the economic progress of nations. C. Aydin et al. [4] collected data from 11 countries to determine the impact of tax policies on economic growth by applying a panel threshold model and determining a non-linear correlation. The results show that the optimal thresholds are approximately 18.00% of GDP for transition economies, 18.50% of GDP for developing economies, and 23.00% of GDP for developed economies. In addition, G. Ofori-Abebrese et al. [5] also collected data on the tax-to-GDP ratio for the period 2007–2017 and applied the threshold model to determine the economic growth rate of 8.88%. To achieve this, the optimal tax rate is 15.30% instead of the current tax-to-GDP ratio of 27.69%.

The literature also argues that tax policy is closely related to economic growth because taxes are collected from economic entities, which means that economic entities must share a part of their profits to contribute to the state budget. However, according to Keynesian, the government should borrow domestic or foreign debt for economic growth, but should not raise taxes or issue money [6].

Besides S.A. Kharusi and M.S. Ada [7] focused on studying the impact of tax policy on economic growth through the relationship between the government's external debt. The results show a negative impact of external debt on economic growth; as external debt increases, the government must repay much more, while the economy slows down. Thus, the government must consider implementing an appropriate fiscal policy for economic growth and reducing its dependence on foreign public debt [8].

Regarding government debt, economic growth, and tax policy, the authors collected 40 years of data and applied a threshold regression model to determine the correlation between public debt and economic growth of the country. In Greece, empirical results show that this correlation is a positive and statistically significant effect of debt

on GDP growth. The public debt crisis in Greece started from the end of 2009 to 2010 and was considered part of the European debt crisis at that time. The debt crisis was concentrated over three years (2009–2011) with very serious consequences. The fact that the public debt crisis in Greece shows that its public debt management policy is inappropriate indicates serious weak issues related to public debt and economic growth [9, 10].

The literature is also related to public debt and economic growth, applying a threshold regression model to determine the optimal public debt threshold, which shows that public debt and economic growth have a negative relationship when the optimal tax threshold is exceeded. Thus, an increase in public debt adversely affects Africa's economic growth. The results of this study can serve as a reference for governments to determine the public debt threshold for an appropriate fiscal policy. Therefore, the threshold model is often used to determine the optimal threshold for economic events related to economic growth [11–14].

Besides, some studies mentioned public debt, economic growth, and tax policy, and applied a threshold model to find the optimal threshold. If the economic indicators exceed the threshold or are lower than this optimal threshold, it will negatively affect economic growth [15–19]. Although these studies do not directly deal with tax policy, most public debt is related to tax policy. Therefore, this study served as the basis for developing the methodology described below.

Tax policies and economic growth are also government's concerns, so the literature investigates the correlation between tax policy and economic growth. The empirical results show that tax policy and economic growth are causally related in Ghana [20, 21].

Tax policies play an important role in each country's socioeconomic development. Considering how tax policy affects economic growth, another study examined the relationship between tax revenue, government spending, and economic growth. In the short run, there is one-way causality between tax policy and government spending, and in the long run, a two-way relationship exists between economic growth and tax revenue [22, 23].

The threshold regression model has been applied in many studies to determine the optimal public debt threshold because public debt meets capital for development investment, offsets the state budget deficit, and creates resources for the state to regulate financial market information and monetary policy implementation. However, public debt increases the pressure on national economic growth and development. S.H. Law et al. [24] explored the impact of fiscal policies on economic growth through the public debts of 71 countries. For an economy to develop, public debt must not exceed 51.65%. Based on these results, governments can formulate appropriate fiscal policies for each economy.

Most studies have used the threshold model method and other models in different research areas to analyze the impact of tax policy through the tax-to-GDP ratio, public debt, and economic growth. These methods include nonlinear modelling, threshold analysis, panel threshold dynamics, and threshold regression. These methods are often used to analyze interrelated factors in the economic field. Therefore, to explore the optimal GDP tax threshold and issues related to tax policy and economic growth in Vietnam's economy, this study applies the threshold regression method [25].

Although there are many methods and criteria for evaluation, they depend on the research objective of each author. However, the results of previous studies are relevant only to the scope and context of the study, depending on the purpose of the literature. Therefore, this paper focuses on Vietnam's fiscal policy through the relationship between taxes -to -GDP, simultaneously, provides some criteria related to the optimal tax-to-GDP threshold for economic growth to suggest fiscal policies suitable for long-term strategic economic growth.

METHODOLOGY AND HYPOTHESES DEVELOPMENT

This study applies a threshold regression model to empirically analyze tax on GDP and economic growth because threshold models are widely used in financial and macro analyses because of their simplicity and clarity in policy implications. B.E. Hansen [26] proposed a threshold model with a fixed-effects estimate, which is commonly used for time-series data.

E.J. Hannan and B.G. Quinn [27] showed that economic growth is expressed as a percentage. By taking the difference of GDP between years, most countries use this index to formulate macro-policies such as high employment and inflation policies.

$\Delta_{GDP\ (\%)}$ is the GDP growth rate variable, the GDP growth rate is the annual change in a country's economic output, which is an important indicator used to measure the health of the economy. ($Tax\ \%_t$) is the tax-to-GDP

ratio, the tax-to-GDP ratio is the ratio at which the government's budget receives tax revenue compared to the gross domestic product (GDP). The World Development Indicators website has data collected from 1994 to 2020 in Vietnam, that are accessible there.[1]

S. Biswas et al. [28] examined how tax policy impacts economic growth and how the dynamics of economic growth are impacted differently by government taxation. Economic growth is the increase in the gross domestic product (GDP), gross national product (GNP), or national output per capita (PCI) over a given period. Regarding economic growth and tax policy, studies have focused on exploring economic growth and tax policy as well as how economic growth affects social welfare, such as inflation, unemployment, etc. [29–31].

According to B.E. Hansen [26] the paper applies a threshold regression model to estimate and assumes these thresholds are constant over time. The data from a balanced panel of tax-to-GDP and economic growth are as follows $\left(y_{it}, q_{it,} x_{it} : 1 \le i \le n, 1 \le t \le T\right)$, in which the subscript *i* indexes the individual and the subscript *t* indexes time, The dependent variable y_{it} ($\Delta_{GDP\,it}$ is GDP growth) is scalar, the threshold variable *q* is scalar and the regressor x_{it} ($Tax\%_{it}$ is a tax-to-GDP ratio) is a *k* vector, so the model is written as:

$$\Delta_{GDP\,it} = \mu_i + \beta_1 Tax\%_{it}\, I\left(q_{it} \le \gamma\right) + \beta_2 Tax\%_{it}\, I\left(q_{it} > \gamma\right) + \omega_{it}. \quad (1)$$

In which $I\left(\ldots\right)$ is the indicator function, so the formula (1) is written:

$$\Delta_{GDP\,it} = \begin{cases} \mu_i + \beta_1 Tax\%_{it} + \omega_{it}, \left(q_{it} \le \gamma\right) \\ \mu_i + \beta_2 Tax\%_{it} + \omega_{it}, \left(q_{it} > \gamma\right) \end{cases}$$

The formula (2) is set up for compact as follows:

$Tax\%_{it}\left(\gamma\right) = \begin{cases} \beta_1 Tax\%_{it}\, I\left(q_{it} \le \gamma\right) \\ \beta_2 Tax\%_{it}\, I\left(q_{it} > \gamma\right) \end{cases}$ and $\beta = \left(\beta_1 \beta_2\right)$ so that (2) equals

$$\Delta_{GDP\,it} = \mu_i + \beta_1 Tax\%_{it}\left(\gamma\right) + \omega_{it}. \quad (2)$$

D.N. Gujarati [32] showed that the observations are divided into two levels, this depends on whether the threshold variable q_{it} is smaller than or greater than the threshold γ, besides, the levels are distinguished by differing regression slopes, β_1 and β_2 which is required that the elements of x are not time-invariant. Furthermore, model (2) is assumed as the threshold q_{it} is not time-invariant, ω_{it} is independently distributed and identically distributed with zero mean and finite variance δ^2, excluded lagged dependent variables from $Tax\%_{it}$ variables:

Multi-threshold regression model, according to [26], if there exists a two-threshold effect, the regression model is defined in a reduced form as follows, with the assumption that $\gamma_1 < \gamma_2$:

$$\begin{aligned} \Delta_{GDP\,it} = \mu_i &+ \beta_1 Tax\%_{it}\, I\left(Tax\%_{it} \le \gamma_1\right) + \\ &+ \beta_2 Tax\%_{it}\, I\left(\gamma_1 < Tax\%_{it} \le \gamma_2\right) + \\ &+ \beta_3 Tax\%_{it}\, I\left(Tax\%_{it} > \gamma_1\right) + \omega_{it}. \end{aligned} \quad (3)$$

The paper only focuses on research methods for the two-threshold regression model, so this model is applied for estimating countries' optimum tax threshold and GDP growth.

G. Schwarz [33] showed that testing the threshold regression model is to test whether the threshold value is statistically significant in Equation (3), which is necessary to test the following hypothesis:

The hypothesis $H_0 : \beta_1 = \beta_2$ leads to H_0 is rejected, if the hypothesis H_0 : is not rejected, it can be concluded that the threshold effect between the variable $\Delta_{(GDP_{it})}$ and the variable $\Delta_{(GDP_{it})}$ of equation (3) does not exist, so the hypothesis $H_0 : \beta_1 \ne \beta_2$, H_0 is accepted. Besides, to test the existence of the threshold effect, [26] applied the bootstrap method to calculate the likelihood ratio.

H. Akaike [34] said that, the ADF test result, which is Akaike's Information Criterion, was used to select the optimal *k* lag for the ADF model. Thus, the *k* value is chosen when the AIC is the smallest:

Testing hypothesis:

$H_0 : \beta = 0$ $\Delta_{(GDP_{it})}$ $Tax_{\%t}$ are the non-stationary data time-series)

$H_1 : \beta < 0 \Delta_{(GDP_{it})}$, $Tax_{\%t}$ are the stationary data time-series).

The cointegration test for data series according to [35] is to determine the number of linear combinations of

[1] World-Bank-Development. World Development Indicators. 2020. URL: https://data.worldbank.org/indicator/GC.TAX.TOTL.GD.ZS ; World-Bank-Development. World Development Indicators. 2020. URL: https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG (accessed on 15.08.2023).

cointegration between stationary time series at the first difference, thereby showing how many relationships exist in an equilibrium system in the long run. M.H. Pesaran and Y. Shin [36] showed that Johansen's cointegration test, which is used in a multivariate framework, is applied to determine cointegration relationships between dependent and independent variables, so the paper applied this model to test whether the variables are I(0) or I(1) variables, and Johansen's methodology takes its starting point in ARDL model of order p given by S. Johansen [37]:

$$Z_t = AZ_{(t-1)} + \ldots + A_n Z_{(t-n)} + \beta X_t + \varepsilon_t, \quad (3)$$

where Z_t is the vector for the degree of difference 1 – I(1) independent and dependent variables, X_t is the vector of the non-random variable and ε_t is the error correction term, according to D. Dickey and W.A. Fuller [38], J.G. MacKinnon [39] the study applied methodology to explore the impact of the tax on GDP and GDP growth in Vietnam, America, and South Africa.

The above method is the basis for exploring the optimal thresholds of tax to GDP and how it affects economic growth if the tax revenue exceeds or collects taxes under this optimal threshold, so these issues are discussed below.

RESULTS

The paper applied unit root testing to check whether a time series variable is non-stationary, the results show that the economic growth and tax-to-GDP variables are non-stationary at lag I(0), as both Prob.* of 0.1319 and 0.6192 are greater than alpha at 0.05, and the test critical values of GDP are –3.71145,—2.98103, and –2.629906, respectively, which are greater than the Augmented Dickey-Fuller test statistic of GDP of –2.4787, alpha at 1%, 5%, and 10%, respectively. The tax-to-GDP variable is similar to the GDP variable (see *Table 1*).

As mentioned above, the data for GDP and tax-to-GDP are non-stationary at lag I(0); therefore, they continue to be 1st difference. The results show that both datasets are stationary at I(1) at the first difference; specifically, Prob.* of GDP and tax-to-GDP are 0.0020 and 0.0010, respectively, which are less than alpha (0.05), indicating that both data are stationary at an alpha of 1%, 5%, and 10%. In other words, both variables have test critical values for GDP (–3.724070,—2.986225, and –2.632604), which are less than the t-statistic values (–4.415401) at the alpha levels of 1%, 5%, and 10%. Tax-to-GDP data are interpreted similarly to the GDP data (see *Table 2*).

Although the data were fit and statistically significant with the model through tested data for stationarity at the first difference I(1), the cointegration test is necessary; thus, this study applied this method to consider whether the model is a spurious regression model, which shows that Vietnam's model has a cointegration at 0.05, specifically, the Critical Value of 3.841466 is greater than the Trace Statistic of 1.051070, so it has a cointegration at alpha 0.05 (see *Table 3*).

The results show that the regression threshold model of Vietnam in the case of taxes-to-GDP < 19.298549%, with a p-value of 0.0106 less than alpha of 0.05, this shows that Vietnam's tax-to-GDP is fit and statistically significant; however, to find the optimal threshold, the study applied the threshold specification method, so Vietnam's tax-to-GDP optimal threshold level is 19.19478%, and the correlation of the two variables is relatively close, with the R-squared of 65.2693% (see *Table 4*).

The inverse roots of the AR characteristic polynomial graph were applied to examine the stability of the threshold regression model, assuming that it is stable if the residual is a stationary time series and all solutions of the feature polynomial lie in the unit circle or if the computational modulus is less than 1. Therefore, this study relies on the stability of the threshold regression model to determine whether taxes-GDP and GDP growth have been stable.

In addition, the time-series data are tested using the inverse roots of the AR characteristic polynomial method to determine whether they fit the model, where the dot symbols are outside the circle, or if the test value of the time-series data is greater than one unit, which does not fit the model and is unstable or statistically significant. Therefore, the model is rejected. However, these empirical results show that Vietnam's data time series are inside the circle; that is, all the estimation values of the variables are less than one, so the data are fitted to the threshold regression models (see *Fig.*).

DISCUSSION

Based on the empirical results, governments with appropriate tax policies, especially Vietnam, should adjust to suit the economic growth, the empirical results show that GDP and the tax revenue rate are closely related because high GDP growth contributes to increased tax

Table 1

Summary of Unit Root Test at Lag I(0)

Item	Alpha level	Vietnam	
		GDP I(0)	TAX I(0)
Augmented Dickey-Fuller test statistic		Prob.*: 0.1319	Prob.*: 0.6192
		t-Statistic	t-Statistic
		–2.478759	–1.288550
Test critical values:	1%	–3.711457	–3.711457
	5%	–2.981038	–2.981038
	10%	–2.629906	–2.629906

Source: Compiled by the author from Eview 9.0.

Note: * MacKinnon [39] one-sided p-values.

Table 2

Summary of Unit Root Test at Lag I(I)

Item	Alpha level	Vietnam	
		D(GDP) I(I)	D(TAX) I(I)
Augmented Dickey-Fuller test statistic		Prob.* 0.0020	Prob.* 0.0010
		t-Statistic	t-Statistic
		–4.415401	–4.702749
Test critical values:	1%	–3.724070	–3.724070
	5%	–2.986225	–2.986225
	10%	–2.632604	–2.632604

Source: Compiled by the author from Eview 9.0.

Note: * MacKinnon [39] one-sided p-values.

Table 3

Summary of Vietnam's Unrestricted Cointegration Rank Test (Trace) of tax to GDP and GDP growth (Lags interval (in first differences): 1 to 2)

Item	Hypothesized	Eigenvalue	Trace Statistic	0.05	Prob.**
	No. of CE(s)			Critical Value	
Vietnam	None *	0.559614	20.73354	15.49471	0.0074
	At most 1	0.042849	1.051070	3.841466	0.3053

Source: Compiled by the author from Eview 9.0.

Note: * Trace test indicates 1 cointegrating eqn(s) at the 0.05 level;* denotes rejection of the hypothesis at the 0.05 level;** MacKinnon [39] one-sided p-values.

revenue. In addition, when the government's tax policy is unreasonable, the GDP growth decreases and vice versa. A reasonable tax revenue rate stimulates business activities, consumption, and the GDP growth.

The above empirical results are based on the hypothesis to evaluate the stationarity of the data, showing that the data is non stationarity at the difference I(0); thus, hypothesis H_0 is accepted. The results of the stationarity test for both Vietnam's variables are non-stationary at the difference I(0). Normally, GDP is calculated at the end of the year through the final goods and services. Therefore, a tax policy is a long-term process carried out by economic

Table 4

Discrete Threshold Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Taxes — to — GDP < 19.298549				
Taxes — to — GDP	0.238789	0.084191	2.836271	0.0106
C	2.211116	1.577643	1.401531	0.1772
19.298549 ≤ Taxes — to — GDP				
Taxes — to — GDP	–0.070903	0.088651	–0.799796	0.4337
C	7.379289	1.757826	4.197964	0.0005
Optimal threshold: Adjacent data values: **19.19478**				
R-squared: **0.862693**				
Adj. R-squared: 0.766276				

Source: Compiled by the author from Eview 9.0.

Note: Dependent Variable: Vietnam's GDP Growth; Threshold variable: Vietnam's taxes-to-GDP.

entities. The tax policy includes value-added tax, corporate income tax, import and export taxation, and special consumption tax. However, corporate income and value-added taxes contribute significantly to budget. Therefore, the results indicate that enacted tax policies do not affect economic growth immediately. Currently, an individual economy is identified as an important factor for economic development in Vietnam.

However, when the results of the stationarity test for both Vietnam's variables are stationary, hypothesis H_1 is accepted. They are stationary at the difference I(1), which shows that as Vietnam increases or decreases its tax ratio to GDP, there is an impact on GDP in the following year. As mentioned above, when fiscal policy is issued by the government, economic entities need to have time, which is usually a year, to assess the issues related to their production and business and consider the effects of fiscal policy on them. Therefore, the empirical results reflect the economic nature and are meaningful to policymakers.

Based on methodology, this study applies a threshold regression model to determine the optimal conditions for each model. If tax revenues exceed this level or lower, the economy slows down.[2] According to Revenue Statistics in Asia and the Pacific 2022 — Viet Nam, and Tax-to-GDP ratio compared to other Asian and Pacific economies and regional averages, 2020, Vietnam's tax-to-GDP ratio was 22.7% in 2020, above the Asia and Pacific average of 19.1% by 3.6 percentage points. It was below the OECD average (33.5%) by 10.8 percentage points. Based on formula (2), economic growth is forecasted at the optimal tax-to-GDP threshold as follows.

The model forecasts that GDP growth is 0.238789% (the tax-to-GDP ratio variable) + 2.211116% (the coefficients of the constant) = 2.449905%; the case 19.298549 ⩽ taxes-to-GDP shows that beta is negative, which means that the two variables are negatively correlated; when the tax variable increases, the GDP variable decreases, and vice versa, and its p-value is 0.4337, which is greater than 0.05 alpha, so the model, in this case, is not suitable and has no statistical significance. According to aggregated data from the Ministry of Finance, tax is the main source of budget revenue, often accounting for more than 70% to more than 80% of total state budget revenue. The tax revenue-to-GDP gradually decreased from 24% (2006–2008) to 18% (2014–2019). The density of indirect taxes increased sharply, whereas the density of direct taxes decreased rapidly.

CONCLUSION

This paper applied a threshold regression model to discover the optimal threshold tax-to-GDP ratio, and

[2] URL: https://www.oecd.org/tax/tax-policy/revenue-statistics-asia-and-pacific-vietnam.pdf (accessed on 15.08.2023).

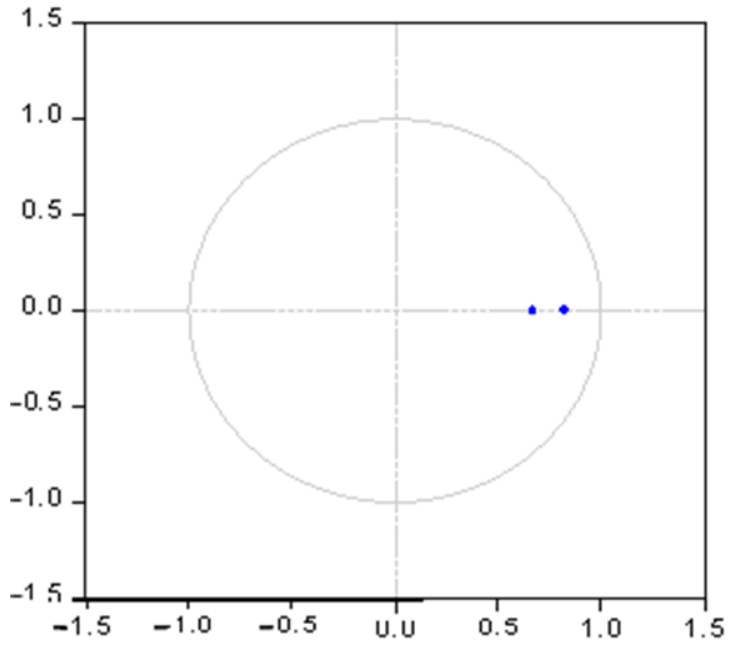

Fig. **Vietnam's Inverse Roots of AR Characteristic Polynomial**

Source: Compiled by the author from Eview 9.0.

built a model to predict the influence of thresholds on economic growth. In addition, there are suggestions for fiscal policies for each tax that the government should refer to when formulating fiscal policies in line with economic growth.

The results show that tax policy has positive effects on Vietnam's economic growth through the optimal tax-to-GDP thresholds. The tax policy includes taxes, and each tax has a different contribution. Almost all these taxes account for a large proportion of the budget, therefore, the government should prioritize the appropriate adjustment of tax rates for each economic entity. Simultaneously, the government improved its management to maintain revenue and promote each tax's role in economic growth. Based on the empirical results, governments should make greater efforts to improve fiscal policies to promote economic growth and reduce budget deficits.

Based on the empirical results, the government should make greater efforts to improve fiscal policies to promote economic growth and reduce budget deficits. Fiscal policy greatly affects economic entities; that is, economic organizations create wealth for society and high employment, leading to reduced unemployment. Tax-to-GDP ratio has a positive effect on GDP growth when tax policy is implemented based on an optimal threshold of tax-to-GDP. Currently, Vietnam's tax-to-GDP ratio tends to decrease, which has helped to increase enterprises' capital to reinvest in production and economic growth. In addition, tax policies should have incentives to attract domestic and foreign investors, which can help businesses improve their competitiveness.

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 27.08.2022; revised on 27.09.2022 and accepted for publication on 26.10.2022. The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-160-169
UDC 338.1(045)
JEL F64, O44

"Green" Financing and ESG: Opportunity for Sustainable Socio-Economic Development

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ABSTRACT

The implementation of the sustainable development strategy and the formation of a "green" economy model provide for the reorientation of financial resources, accounting by economic entities and public authorities and management of ESG-principles and the development of "green" financing tools. The **purpose** of the paper is to develop theoretical provisions and modeling of the impact of "green" financing on the socio-economic development of the subjects of the Russian Federation. **Methods** of data mining were used with temporary delays and corresponding lags responses of endogenous indicators, as well as cluster and correlation analysis. The result of the study was the specification of the economic content of the definition of "green" financing, as well as the construction of econometric models of the degree of interrelationship between "green" financing and the socio-economic development of the regions of Russia. The authors described the economic content of the definition of "green" financing, developed econometric models of the degree of interdependence of "green" financing and socioeconomic growth of Russia's regions, calculated an integral indicator of sustainable socio-economic development of the regions of the Russian Federation taking into account ESG-factors (social risks, environmental risks, quality of management). Clustering of Russian regions according to the level of influence of "green" financing on their socio-economic development has also been carried out. The article **concludes** that the relationship between the level of socio-economic development of the regions of the Russian Federation and the volume of "green" financing is direct, strong, and can be expressed by increasing linear regression. The prospects for further research may be related to the assessment of the real needs of the volumes of "green" financing in the context of ensuring sustainable economic growth.

Keywords: "green" financing; "green" finance; "green" economy; ESG; ESG rating; sustainable development

For citation: **Semenova N.N., Ivanova I.A., Eremina O.I. "Green" financing and ESG: Opportunity for sustainable socio-economic development. *Finance: Theory and Practice*. 2023;27(5):160-169. DOI: 10.26794/2587-5671-2023-27-5-160-169**

INTRODUCTION

The growing impact of human activity on the environment has become one of humanity's major problems in recent decades, posing risks to long-term sustainable socio-economic development. The annual World Economic Forum report on global risks notes that climate change is a catastrophic risk for world in 2021–2022 and beyond.[1] According to the report of the Intergovernmental Panel Climate Change, "Climate change: a threat to human well-being and the health of the planet", published in February 2022, in the next two decades, humanity has every chance of facing the inevitable many climate hazards, including an increase in the average ambient temperature to 1,5 °C.[2]

In this regard, the transition to a new resource-efficient economy model, in which the welfare of society, including employment, is combined with reduced environmental impact and greater environmental responsibility — the so-called "green" economy. In April 2021, the Climate Summit (with 40 participating countries) declared targets for reducing emissions and achieving carbon neutrality over the next 10–15 years. This is possible through the use of green funding tools, implementation of ESG principles, and regulatory mechanisms to accelerate the transition to a "green" economy [1, 2].

At present, greening of economic policy and "green" financing is based on the identification of new environmentally sustainable circuits and prospects for the development of the financial system through the sharp growth of the "green" segment of financial market and responsible investments [3–6]. The financing paradigm itself is changing in favor of so-called transformative investments (or influence investments) that not only meet a certain level of economic expectations, but also have the potential for social and environmental impact.

"GREEN" FINANCING AND ESG: THEORETICAL–METHODOLOGICAL FUNDAMENTS

It should be noted that there is no established definition of "green" financing in modern literature. According to the G20's approach, "green" financing is investment that contributes to improved environmental and sustainable development.[3] "Green" financing is focused on increasing the level of financial flows (bank, microcredit, insurance and investment) from the public, private and non-profit sectors to sustainable development priorities. According to A. Luzgina, "green" financing involves taking into account not only environmental but also management and social effects; its sources are the resources of banks, financial institutions, non-financial commercial institutes, individuals, the state and non-profit organizations [7].

State Corporation VEB.RF, implementing in our country the functions of a methodological center in the sphere of sustainable development. "Green" financing means the financial instruments used in the process of financing projects and activities on nature and biodiversity protection, adaptation to climate change and in the field of ecology.

Note that this approach is now widely distributed in modern literature. For example, B. Ilić, D. Djukic and G. Djukic consider that "green" financing includes various financial instruments that promote the development of a low-carbon economy and support investments in environmental projects [8]. According to O.V. Bogacheva and O.V. Smorodinov, "green" financial instruments allow business owners to

[1] The Global Risks Report 2022. URL: https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2022.pdf (accessed on 23.06.2022).

[2] Climate Change 2022: Impacts, Adaptation and Vulnerability: assessment report / Intergovernmental Panel on Climate Change. URL: https://www.ipcc.ch/report/ar6/wg2/ (accessed on 22.04.2022).

[3] G20 Green Finance Synthesis Report. URL: https://unepinquiry.org/wp-content/uploads/2016/09/Synthesis_Report_Full_EN.pdf (accessed on 18.07.2022).

conduct operations that improve the environment, reduce the effects of climate change, and promote more efficient use of resources [9].

It should be noted that in popular practice, among the instruments of "green" financing traditionally include: "green" bonds, "green" loans, "green" pollution liability insurance policies, "green" credit cards, " green" investment accounts, etc. Undoubtedly, the most common instrument is green bonds [10–12]. According to Climate Bonds Market Intelligence, the global market for green bonds reached 517.4 bln dollars in 2021 and will continue to expand rapidly. Thus, according to the forecast, the volume of the market of "green" bonds by 2025 will reach 5 trn dollars. More than half of all green bond settlements belong to the financial sector. In the region, the US, Germany and China lead.[4] The funds raised through the issuance of these bonds will be used to finance or refinance green projects in the areas of renewable energy; energy efficiency; sustainable waste management, water resources, land use and biodiversity conservation; clean transport; protection against climate change [13–16].

Thus, the definition of "green" financing can be described as a combination of different ways of financing technological processes and projects in the area of greening and climate change mitigation, as well as a wide range of financial instruments with an environmental component used to finance environmental programs and projects, environmental activities and biodiversity protection. In contrast to existing interpretations, in our article, "green" financing means the cost of investing in programmers, projects and activities to protect the environment and the sustainable use of natural resources, including current (operational) costs and equity investments aimed at environmental protection and the efficient use of nature resources, as well as capital repair costs of major environmental funds.

As the practice of "green" financing and responsible investment develops in the global community, a discussion has unfolded on the integration of environmental, social and governance (further — ESG) factors into the business model of operators, assessing their impact on investment attractiveness and achieving sustainable development. Among the most important ESG criteria discussed today are: 1) environmental issues; 2) relations with employees, customers and society (social); 3) corporate governance issues (corporate governance) [17–19].

The development of the ESG approach contributes to new requirements for carbon regulation, corporate non-financial reporting standards, improved green and responsible investment tools and approaches to ESG risk management. The Global Reporting Initiative (GRI) has developed ESG standards that establish the disclosure of information about those aspects of a company's activities that are socially significant and affect stakeholders of the company [20].

Currently, ESG criteria serve as the basis for various ESG ratings [21]. A significant number of rating agencies have developed their own ESG-rating methodologies, such as MSCI, S&P, Vigeo Eiris, Sustain Analytics, DEEP Ecosystems, and others. In Russia, examples of such rating agencies are the RAEX division, the NCR credit rating agency, part of the RBC media holding, which rank domestic companies and regions according to ESG criteria.

Thus, the use of "green" financing, implementation, and development of ESG principles is a modern mainstream for the global financial and investment community, increasing the transparency of international economic relations and expanding control over the social, environmental, and financial spheres of society.

[4] Emission of green bonds exceeds 500 bln dollars. URL: http://tp-bioenergy.ru/sitenews/Obiem-vypuska-zelenyh-obligacij-prevysil-500-mlrd-dollarov/ (accessed on 18.07.2022).

Table 1

ESG-Rating of Russian Regions in 2020

No.	Region	E	S	G	ESG
1	Republic of Tatarstan	19	12	1	1
2	Moscow	42	5	3	2
3	Lipetsk region	1	17	31	3
4	Khanty-Mansi Autonomous Area — Yugra	47	8	2	4
5	Kursk region	3	20	16	5
6	Tyumen region	27	13	4	6
7	Sverdlovsk region	9	30	7	7
8	Leningrad region	18	9	17	8
9	Saratov region	5	44	26	9
10	Kaluga region	7	29	28	10
….					
80	Komi Republic	82	42	48	78
81	Magadan region	79	11	75	79
82	Pskov region	66	70	79	80
83	Kabardino-Balkarian Republic	66	70	79	80
84	Republic of Tyva	15	83	80	82
85	Republic of Kalmykia	74	57	82	83

Source: European Rating Agency RAEX-Europe. URL: https://raex-a.ru/rankings/regions/ESG_raiting?#metodika (accessed on 19.07.2022).

ESG-RATING OF RUSSIAN REGIONS

In addition to being an important problem for individual operators, supporting sustainable development is also important in preserving regional stability. Most ESG ratings are based on the principle of combining the level of exposure to risk and assessing the effectiveness of its leveling. European rating agency RAEX-Europe presented ESG-rating of Russian regions, assessing environmental and social risks and the quality of public administration (*Table 1*).

This study demonstrated that, following a crisis put on, among other things, by COVID-19, the capital agglomerations and agricultural regions are recovering fastest. Subjects with strong industrial specialization and monopolists show a longer and stronger decline, correlating with the dynamics of commodity markets. The depressed regions of central Russia, especially those specializing in mechanical engineering, continue to stagnate. The southern subjects of the Russian Federation are developing unevenly, as the dynamics of their economy substantially depends on federal funding and the implementation of large projects.

The expected growth of social risks is more balanced in the regions that lead in the social sub-rating [the sparsely populated “oil-gas” regions, capitals (Moscow, St. Petersburg) and their surroundings], as the oil-gas rent

is transformed into high indicators of health, safety, well-being and basic education. With an obvious trend towards a decrease in total pollution from industrial enterprises, environmental risk leveling indicators are largely stagnating.

Regions that combine good budgetary discipline and transparency of local authorities with a high level of investment attractiveness (Moscow, Khanty-Mansi Autonomous District, etc.) are leading in the quality of state administration. The vast majority of regional budgets in 2020 have deficits, financially stronger entities are increasing their bank borrowing and bond issuance, and regions under the Ministry of Finance of the Russian Federation's restrictions are increasing their requests for transfers from the federal center, which may result in the sequestration of several non-priority items.

MODELING THE IMPACT OF "GREEN" FINANCING ON THE SOCIO-ECONOMIC DEVELOPMENT OF REGIONS OF THE RUSSIAN FEDERATION

The study used methods and models of intelligent data analysis taking into account temporary delays and corresponding logic responses of endogenous indicators as an approach to the quantitative assessment and modeling of the impact of "green" financing on the sustainable socio-economic development of the regions of the Russian Federation and, therefore, to the analysis of the transformation of economic growth indicators to relevant changes in the investment climate.

As a model, a system of three regressions (1) is constructed, including the linear, gradual and dynamic model of Sh. Almon with distributed lags:

$$\begin{cases} Y_{1t} = \alpha_0 \cdot E_t^{\alpha_1} \cdot S_t^{\alpha_2} \cdot G_t^{\alpha_3} \cdot \varepsilon \\ Y_{1t} = \beta_0 + \beta_1 X_t + \varepsilon_t \\ \ln(Y_{2t}) = \delta + \gamma_0 \ln(I_t) + \gamma_1 \ln(I_{t-1}) + \ldots + \gamma_l \ln(I_{t-l}) + u_t, \end{cases} \quad (1)$$

where Y_{1t} — integrated indicators of sustainable socio-economic development of the regions of the Russian Federation with ESG-factors; E_t — local environmental risk indicator with the following per capita regional statistics: volume of emissions into the atmosphere of pollutants from stationary sources; proportion of neutralized atmospheric contaminants in the total quantity of contaminants from fixed sources; volume of harmful (polluting) substances emitted into the air from road transport; share of vehicles capable of using natural gas as engine fuel; discharge of contaminated wastewater into surface waters; volume of water used; proportion of waste used and disposed of in total waste generated in the production and consumption processes; share of exported and recycled solid municipal waste; S_t — local indicator "Social risk (Social)", taking into account the following indicators of regional statistics: share of the population with incomes below the subsistence minimum; amount of expenditure of the consolidated budget of the region on "social policy", adjusted for cost of living; volume of the consolidated budget of the region for "Education" per capita, adjusted for the cost of living; infant mortality rate; volume of expenditure of the consolidated budget of the region on "Health", adjusted for cost of living; number of serious crimes registered in the reporting period per 100 thous. people of the population; volume of security expenditure in the region's consolidated budget, adjusted for the cost of living; ratio of the average population in the reporting year to the average in the previous 10 years; total number of jobs created by group of organizations with an average increase in the number of employees and by newly established organizations per 1000 persons per permanent population; G_t — local governance indicator, including the following regional statistical indicators: investment attractiveness and business support, level of

transparency of the regional authorities and anti-corruption procedures, quality of budget management and quality of assessment of regulatory impact, expenditure of the consolidated budget of the region under article "National issues" in relation to the GRP; Y_{2t} — gross regional product of the Russian Federation per capita; X_{1t} — "green" finances of the regions of Russia, total expenditure on environmental protection and the rational use of natural resources, including current (operational) costs on the protection of the environment, payment of environmental services; capital investments aimed at environmental protection and the efficient use of natural resources, capital repair costs of major environmental funds; I_t — capital investment in the Russian Federation; $\gamma_0, \gamma_1, ..., \gamma_l$ — short-term multipliers; $\sum_{k=1}^{l} \gamma_k$ — long-term multipliers characterizing the change in performance indicators as a result of a single change in exogenous variables in each of the future periods considered.

For the identification, analysis and verification of the model (1) the methods of correlation, linear and nonlinear regression, dispersion analysis, generalized method of least squares, method of instrumental variables were used.

Gross regional product (Y_{2t}) — is an endogenous indicator operating with a certain delay under the influence of investment policy, whose effectiveness depends on the indicators of sustainable socio-economic development of the regions of the Russian Federation on the principle of ESG.

In the result of mathematical transformations, the authors constructed an econometric model characterizing the dependence of sustainable development in the regions of the Russian Federation on local indicators of environmental (E_t) and social (S_t) risks and corporate governance (G_t), in the form of the Cobb-Douglas gradual function:

$$Y_{1t} = 0.211 \cdot E_t^{0.410} \cdot S_t^{0.331} \cdot G_t^{0.706} \cdot \varepsilon, \quad R^2_{norm} = 0.86, \text{ F} = 178.99 \qquad (2)$$

or

$$\ln Y_{1t} = -1.555 + 0.410 \cdot \ln E_t + 0.331 \cdot \ln S_t + 0.706 \cdot \ln G_t + \varepsilon. \qquad (3)$$

Elasticity coefficients $\alpha_1 = 0{,}410$, $\alpha_2 = 0{,}331$, $\alpha_3 = 0{,}706$ models (2) show that with an increase of 1% in environmental, social and management components, the sustainability of the region will increase by 0.410, 0.331 and 0.706%, respectively.

The model (2)–(3) is suitable for forecasting, as regression (3) and its parameters are statistically significant under the Fisher and Stuent criteria at the significance level 0.0001; determination factor $R^2_{norm} = 0.86 > 0.5$.

In order to assess the impact of "green" financing (X_t) on the sustainable socio-economic development of the subjects of the Russian Federation (Y_{1t}) due to the heterogeneity of the ix scales, the authors preliminarily completed the grouping of regions, built 3 clusters of regions (*Table 2*) and linear regressions for them:

$$\begin{cases} Y_{11t} = 0.275 + 0.396 X_t + \varepsilon_{11t}, \\ R^2_{norm} = 0.56 \; for \; I \; cluster, n_1 = 28 \\ Y_{12t} = 22.475 + 0.510 X_t + \varepsilon_{12t}, \\ R^2_{norm} = 0.74 \; for \; II \; cluster, n_2 = 27 \\ Y_{13t} = 49.711 + 0.376 X_t + \varepsilon_{13t}, \\ R^2_{norm} = 0.60 \; for \; III \; cluster, n_3 = 30 \end{cases} \qquad (4)$$

Models (4) are suitable for reliable investigation and confirmation of the hypothesis of the direct strong dependence of the level of socio-economic regional development on the scale of "green" financing, since parameters (4) are statistically significant under the Fisher and Student criterion at the significance level of 0.0001; determination coefficients R^2_{norm} exceed 0.5.

Table 2

Results of the Classification of Regions of Russia by Level of Impact of "Green" Financing on Socio-Economic Development

Cluster number	Regions
I	Kursk region, Novgorod region, Tver region, Nenets Autonomous District (Arkhangelsk region), Chuvash Republic, Kaluga region, Republic of Adygea, Tyumen region, Lipetsk region, Saratov region, Ryazan region, Republic of Dagestan, Kostroma region, Ulyanovsk region, Republic of Tatarstan, Voronezh region, Moscow, Khanty-Mansi Autonomous Area — Ugra, Leningrad region, Sakhalin region, Yaroslavl region, Tula region, Sverdlovsk region, Chukotka Autonomous District, Novosibirsk region, Republic of Mari El, Smolensk region, Bryansk region
II	Republic of Mordovia, Republic of North Ossetia-Alania, Altai region, Yamal-Nenets Autonomous District, Penza region, St. Petersburg, Vologda region, Khabarovsk Territory, Moscow region, Rostov region, Samara region, Chelyabinsk region, Krasnoyarsk region Republic of Sakha (Yakutia), Vladimir region, Republic of Altai, Irkutsk region, Kaliningrad region, Belgorod region, Stavropol, Republic of Karachay-Cherkessia, Orel region, Kirov region, Ivanovo region, Tomsk region, Republic of Ingushetia, Omsk region
III	Amur region, Republic of Buryatia, Chechnya Republic, Krasnodar region, Jewish Autonomous District, Tambov region, Trans-Baikal Territory, Nizhny Novgorod, Republic of Bashkortostan, Orenburg region, Primorsk Territory, Udmurt Republic, Murmansk region, Kamchatka region, Kabardino-Balkarian Republic, Republic of Kalmykia, Republic of Tyva, Magadan region, Pskov region, Kurgan region, Astrakhan region, Volgograd region, Republic of Karelia, Perm region, Republic of Khakassia, Arkhangelsk region, Kemerovo region, Komi Republic

Source: Compiled by the author.

Gross regional product (Y_{2t}) — is an endogenous indicator operating with a certain delay under the influence of investment policy, so the model of the dependency of the volume of gross regional product per capita (Y_{2t}) from the amount of equity investments aimed at environmental protection and sustainable use of natural resources (I_t),is constructed in the form of a dynamic regression model with a distributed lag:

$$\ln(Y_{2t}) = \delta + \gamma_0 \ln(I_t) + \gamma_1 \ln(I_{t-1}) + \ldots + \gamma_l \ln(I_{t-l}) + u_t. \quad (5)$$

The study determined the maximum values of lag l and the degree k of the polynomial (6), describing the structure of the lag for (5).

$$\gamma_i = d_0 + d_1 i + d_2 i^2 + \ldots + d_k i^k. \quad (6)$$

At the same time, by experimental means (using correlation-regression analysis, testing of the Hypotheses of Student criteria, assessment of *t*-statistics) it was shown in this study that it is advisable to use 3rd degree polynomials to evaluate the parameters of γ_i regression (5):

$$\gamma_i = d_0 + d_1 i + d_2 i^2 + d_3 i^3. \quad (7)$$

Using the method of instrumental variables, for model (5) the parameters for the new variables Z_0, Z_1, Z_2 were accessed:

$$\ln(Y_{2t}) = -9584.50 + 0.37 \cdot Z_0 - 0.46 \cdot Z_1 + 0.14 \cdot Z_2 + \varepsilon_t, \quad F = 201.46. \quad (8)$$

Following the Sh. Almon method's reverse transformations of the model's parameters (8), estimates of the parameters (5) of

dynamic regression with distributed lag were obtained:

$$\ln(Y_{2t}) = -9584.50 + 0.37 \cdot \ln(I_t) + 0.05 \cdot \ln(I_{t-1}) + \\ + 0.01 \cdot \ln(I_{t-2}) + 0.27 \cdot \ln(I_{t-3}) + u_t. \quad (9)$$

Analysis of the model (9) suggests that an increase of 1% in equity investments aimed at environmental protection and the sustainable use of natural resources (I_t) will mean an average increase of 0.366% in regional gross per capita product (Y_{2t}) in the current period; 0.413% in the next year; 0.426% in the following year; and 0.693% in two years.

In result, model of the impact of "green" financing (X_t) on the sustainable socio-economic development of the regions of the Russian Federation (Y_{1t}) and, therefore, on the volume of gross regional product per capita (Y_{2t}) depending on the change in the amount of capital investments aimed at environmental protection and the rational use of natural resources (I_t), is as follows:

$$\begin{cases} Y_{1t} = 0.211 \cdot E_t^{0.410} \cdot S_t^{0.331} \cdot G_t^{0.706} \cdot \varepsilon_t \\ Y_{11t} = 0.275 + 0.396 \cdot X_{1t} + \varepsilon_{11t}; \\ Y_{12t} = 22.475 + 0.510 \cdot X_{2t} + \varepsilon_{12t}; \\ Y_{13t} = 49.711 + 0.376 \cdot X_{3t} + \varepsilon_{13t}; \\ \ln(Y_{2t}) = -9584.50 + 0.37 \cdot \ln(I_t) + 0.05 \cdot \ln(I_{t-1}) + \\ + 0.01 \cdot \ln(I_{t-2}) + 0.27 \cdot \ln(I_{t-3}) + u_t. \end{cases} \quad (10)$$

CONCLUSION

At present, "green" financing is the world's dominant trend in the development of the economy, contributing to its structural and technological modernization. The growth of "green" financing suggests a progressive transition to ESG principles.

The survey, using official data of the Federal State Statistics Service of the Russian Federation for 2000–2021, as well as the results of ESG-ratings of Russian regions, assessing their environmental and social risks and the quality of public administration, builds:

- integral indicator of sustainable socio-economic development of the regions of the Russian Federation with ESG-factors in the form of the gradual regression model of Cobb-Douglas;
- three clusters of regions and linear regression for each of them in order to assess the impact of green financing on sustainable socio-economic development of the subjects of the Russian Federation due to the heterogeneity of their scale;
- model of the dependency of the volume of gross regional product per capita from the amount of capital investments aimed at the protection of the environment and the rational use of natural resources in the form of a dynamic regression model with a distributed lag Sh. Almon.

The scientific and practical significance of the study is that its results can be used by public authorities and management in the development of strategic program documents in the field of the development of the "green" economy and tools of "green" financing.

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 22.07.2022; revised on 16.08.2022 and accepted for publication on 26.09.2022.
The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-170-181
UDC 334.7.021,334.72,336.64(045)
JEL D22, G34, Q57

Assessment of Homogeneity and Convergence of Environmental Performance of Enterprises into One Holding

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ABSTRACT

Taking into account the need for transition to sustainable development of the economy, it seems **relevant** to consider whether the holding is an effective structure to minimize the negative impact on the environment: is there a convergence of the environmental performance of the holding's enterprises with a general increase in its responsibility? **The purpose** of the research is to assess the degree of homogeneity and convergence of the environmental performance of Russian enterprises within the same holding, as well as to determine the relationship between the current level of homogeneity of the holding and the rate of its convergence and overall environmental responsibility. The environmental performance of 11 Russian holdings and 105 constituent enterprises for 2017–2021 was examined. **The methodology** involved the calculation of entropy and descriptive statistics; the evaluation of the homogeneity of holdings and its convergence, phase transition periods, and the relationship between homogeneity and other characteristics using analysis of variance and regression. **The results** of the study showed that Russian holdings correspond to the ascending line of the entropic criterion of social development, but at present the phase transition from a heterogeneous to a homogeneous state is incomplete, and homogeneous holdings are unstable. The influence of the type of corporate environmental policy on the homogeneity of the holding, the degree of its convergence and environmental responsibility was revealed. **The scientific novelty** of the work lies in the consideration of homogeneity and convergence of environmental characteristics of systematically unstudied objects — the enterprises of one holding; the inappropriateness of the perception of holdings as homogeneous objects is confirmed. Theoretical significance has shown the possibility of using the entropic criterion of the theory of social development and dialectical logic to study the homogeneity and convergence of the indicators of holdings, as well as the developed methodology of their assessment. **Recommendations** for the authorities and managers of companies, the implementation of which will increase the sustainability of the economy, are of practical value.

Keywords: environmental responsibility; sustainable development; Russian companies; homogeneity; convergence; entropy; phase transitions; corporate environmental policy; uniform environmental standard

For citation: **Karginova-Gubinova V.V. Assessment of homogeneity and convergence of environmental performance of enterprises into one holding.** ***Finance: Theory and Practice.*** **2023;27(5): X-X. DOI: 10.26794/2587-5671-2023-27-5-170-181**

INTRODUCTION

Stakeholders of Russian companies (holdings, groups), which combine several subsidiaries and affiliated enterprises, branches, are interested in data on their activities. In particular, authorities, creditors, suppliers, and contractors on the indicators of the consolidated financial statements analyze the economic state of the holding as a whole. Recently, in connection with the understanding of the need to ensure sustainable development of the economy [1], interest in the environmental characteristics of companies has increased [2]. At the same time, the economic performance of holdings can be considered to a greater extent based on aggregated data of the enterprises in them (the inability of the state to receive taxes from one of them can partially offset the other; the presence of more profitable enterprises within the group increases the credit rating and less profitable, etc.). At the same time, the environmental characteristics cannot be summed up: instantaneous and spatially localized exceeding of the limit level of carbon dioxide emissions by one enterprise even at zero emissions of another requires cleaning activities. Accordingly, the

use of consolidated non-financial reporting by stakeholders is advisable only with a high level of homogeneity among enterprises in one holding, but data on the ecological homogeneity of Russian companies to date are not available.

At the same time, given the significance of the environmentalization problem, it is important to consider whether the holding is an effective structure for coordinating and reducing negative environmental impacts, and whether there is an integration (convergence) of the levels of environmental indicators of holding enterprises with the overall increase of its responsibility.

The purpose of this study is to assess the degree of homogeneity and convergence of environmental characteristics of Russian enterprises belonging to the same holding, as well as to determine the relationship between the holding's current level of homogeneity and its rates of convergence and overall environmental responsibility.

The study examined the environmental characteristics of 11 Russian holdings and 105 of their enterprises for 2017–2021. Indicators of descriptive statistics, entropy, homogeneity of holdings, and convergence of their enterprises were calculated, and periods of phase transitions (qualitative changes in state) were determined. The relationship between homogeneity and convergence, in addition to the overall environmental parameters of the holding, is analyzed using variance and regression analysis.

The scientific concept of the study is to consider the homogeneity and convergence of environmental indicators in relation to previously systematically unstudied objects — enterprises under the same holding.

The theoretical significance is determined by the demonstrated possibility of using the entropic criterion of the theory of social development and dialectical logic to study the homogeneity and convergence of the characteristics of holdings, as well as, in the developed methodology of their evaluation on the example of environmental parameters. Recommendations for authorities, as well as managers of companies, the accounting and implementation of which will increase the resilience of the Russian economy, are of practical value.

REVIEW OF THE LITERATURE

Study of Homogeneity of Objects in Economics

The ideas of "homogeneity" and "nonhomogeneity" are general scientific concepts with an important role in social development theory. Economic development has resulted in social division of labor and thus increased heterogeneity in the economy [3], but in the next few periods there has been enlargement and consolidation of economic actors, with monopolies [4] and transnational corporations [5] playing a prominent role in recent decades. Similarly, territorial union and separation were formed primarily for economic reasons (see, for example, [6]).

However, despite the fact that the formation on the basis of independent territories of one spatial unit is based on their community, these territories, on a number of indicators, for example, economic and environmental, are heterogeneous [7]. And although enterprises in the holding are often perceived as similar, their targets depend on the availability and limitations of infrastructure, technologies, and equipment, and these parameters can be different even within the same holding. Companies with subsidiaries in other countries have demonstrated their ability to improve their overall level of environmental responsibility by implementing corporate environmental standards, ensuring enterprise uniformity in countries with strict and lenient legislation [8, 9]. Simultaneously, the practice of shifting productions with a higher environmental footprint to countries with lower regulations was formerly popular [8]. As a result, the level of enterprise homogeneity inside one company did not increase. Furthermore, the heterogeneity of a company's environmental

indicators may be related to the distance of control (holding management) [10].

In general, the homogeneity of indicators is often considered together with their convergence, as it can be both a cause and a consequence of homogeneity.

Economic Studies on Convergence of Indicators

The concept of convergence corresponds to dialectical logic, namely Heraclitus' idea of the unity and struggle of opposites and the triad of George Hegel, which became known in the simplified formulation of Heinrich Chalybäus as "thesis — antithesis — synthesis" [11].

Priority was given to indicators of countries and regions in economic theory when studying problems related to convergence of different systems: initially income ([12] and etc.), later many other economic parameters (human development index [13], labor productivity [14, 15], investment, unemployment [15], and etc.), and, for example, environmental factors were considered [16–18].

The number of papers studying the convergence of environmental indicators at the microlevel is significantly smaller, and companies from different countries are often compared. Thus, it is confirmed that in 1999–2002, there was a convergence in the environmental reporting of transnational corporations in Japan and Europe, with differences within European states [19]. There is a convergence of a number of environmental characteristics of firms in India and developed countries due to Indian companies borrowing innovation and targets. In general, however, the corporate models used in India are highly heterogeneous due to different responses to external pressure and differences in opportunities for environmentalization [20].

Differences in understanding of corporate responsibility and sustainability [21], as well as the holding's ability to promote its interests [22], could hinder the convergence of firms' environmental performance. In turn, the introduction of non-state standards [23] and a number of public initiatives can contribute to the convergence of ecological indicators [24].

For the purposes of the study, a comparison of the commitments to ensure sustainable development of the Australian university's campuses, which are separate business units of the same organization, is of particular interest. For the campuses studied, there is convergence in understanding the need for and use of elements of sustainable development, such as plans and reporting, but their application is non-standardized [25].

Based on the overall growth in corporate environmental responsibility [26], as well as the implementation of a common corporate policy within the holdings and the convergence of the development commitments of the structural units of the Australian university [25], it can be assumed that:

H_1: Convergence of monitoring levels of environmental responsibility for enterprises in the same holding.

Based on the high rates of improvement in the overall environmental performance of non-ecological Chinese macroregions [18] and the sustainability indicators of European states [17], as well as the entropy criterion of social development on the correspondence of the upward line to the reduction of entropy and heterogeneity and the downward one to their growth [3], we further propose the following hypotheses:

H_2: Increased homogeneity of holding enterprises leads to lower convergence rates, reduced homogeneity — to accelerated convergence.

H_3: There is a direct relationship between the holding's homogeneity and their level of environmental responsibility.

MATERIALS AND METHODS

As the data was processed, four indicators of the environmental responsibility of ERA rating agency enterprises were presented:

1) energy-resource efficiency — the degree of useful use of energy and resources; geometric average from energy efficiency

Table 1

The Companies under Study and their Subsidiaries

Industry	Number of holdings	Number of enterprises
Oil and gas extraction and pumping	4	52
Engineering and Metal processing	2	8
Transportation	1	19
Chemical industry	1	4
Energy industry	3	22
TOTAL	11	105

Source: Author's calculation.

(the ratio of corporate revenue adjusted to the average sub-sector margin to the amount of energy spent) and resource effectiveness (excluding the division of revenue into normalized indicators of water spent, waste, emissions into the atmosphere and polluted water discharges);

2) technological efficiency — environmental efficiency of activities, ratio of energy spent to resources used and types of environmental impacts (the list is presented in the description of resource efficiency);

3) ecosystem efficiency — the ability of the territory where the company is located to assimilate harmful impacts; the ratio of the area of vegetation to the intensity of environmental impact (resource efficiency indicators are used);

4) transparency of environmental and energy reporting — share of disclosed parameters in the total number of analyzed parameters.

The rating was selected because, when it was developed, the firms were compared not by industries, but by enterprises with similar energy-resource ratios and, thus, under other equal conditions, having similar impacts on the environment. In this regard, for example, nuclear power plants and dam-hydroelectric power plants were considered separately. This approach has allowed us to correctly compare the level of environmental responsibility of enterprises belonging to the same holding and engaged in different activities.

During the study, 11 Russian holdings (companies, groups) and 105 enterprises (their branches, subsidiaries or subsidiary companies) were studied (for the only company from the UK, assets in the Russian Federation were analyzed) (*Table 1*). Holdings were selected for which the environmental indicators of two or more enterprises were openly available. Data from 2017 to 2021 were considered.

Initially, the entropy of environmental characteristics was calculated for each year to assess the orderliness of the various types of environmentalization of enterprises for each holding and on average for all holdings, see formula (1):

$$E_i = \sum_{j=1}^{n} \left[X_{ij} \ln\left(X_{ij} \right) \right], \qquad (1)$$

where E_i — entropy of i-holding; n — number of environmental indicators; X_{ij} — level j- environmental indicator of i- holding.

In order to facilitate interpretation, a minimum normalization of entropy (0 — is the minimum level of order, 1 — is the maximum level) was performed. Previously, the proposed approach to the calculation of entropy was tested in the assessment of differentiation of Russian regions [27].

Table 2

Normalized Entropy Value for Different Types of Environmental Responsibility

Holding number	Min	Max	Average	Standard deviation	Difference between 2021 and 2017 indicator
1	0.000	0.032	0.009	0.013	–0.003
2	0.055	0.271	0.110	0.093	0.215
3	0.562	1.000	0.773	0.202	0.423
4	0.007	0.065	0.028	0.026	0.021
5	0.035	0.107	0.070	0.030	–0.056
6	0.100	0.474	0.275	0.138	0.157
7	0.017	0.188	0.088	0.087	0.148
8	0.095	0.457	0.218	0.141	–0.362
9	0.021	0.091	0.052	0.032	0.058
10	0.058	0.113	0.085	0.024	0.055
11	0.166	0.580	0.376	0.148	–0.185
TOTAL	0.000	1.000	0.190	0.236	0.043

Source: Author's calculation.

Furthermore, for all holdings individually and for their combination for all years, the four characteristics of the level of environmental responsibility are calculated as descriptive indicators: variance, variation coefficient, asymmetry and excess. An analysis of the convergence of the levels of environmental responsibility of enterprises of one holding was carried out. The main convergence measures are beta-convergence and sigma-convergence [28]. In this paper, we used the concept of sigma-convergence, describing a state in which the variation of characteristics at the end of a period is less than at the beginning.

According to all companies and the characteristics of the environmental responsibility of enterprises, the variation factors for different periods were compared. With the reduction of the coefficient of variation, i.e. increasing the homogeneity of enterprises, their convergence was confirmed, as was the approximation of environmental characteristics. With the increase of the variation — divergence, the reverse process.

Also, periods of phase transitions, i.e. qualitative changes in the state of the system, were defined for each holding in relation to homogeneity and convergence [27]. For homogeneity in phase transition, a heterogeneous holding with a coefficient of variation of more than 33% becomes homogenous, or, on the contrary, a homogenic holding is transformed into a heterogeneous holding. The phase transition by convergence, respectively, is recorded when the decrease of the indicators in the enterprises of one holding by their discrepancy or at the beginning of the decreasing of previously divergent characteristics.

Variance and regression analyses have been conducted to assess the relationship between the homogeneity of the holding and the level of its environmental responsibility, as well as the homogeneity and degree of convergence.

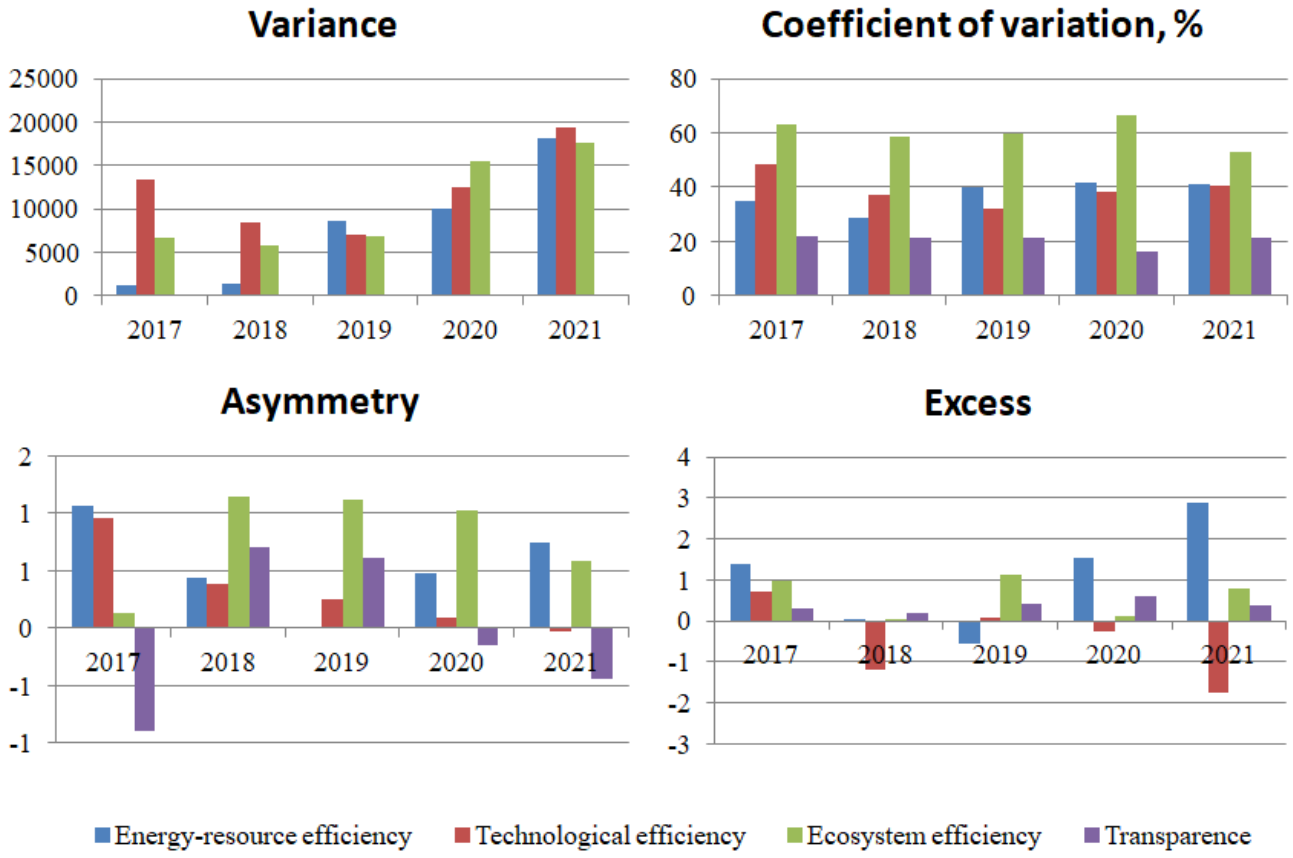

Fig. **Indicators of Descriptive Statistics of Environmental Enterprises into to the Same Holding**

Source: Author's calculation.

RESULTS

Today, the environmental performance of holdings is disorderly (*Table 2*). At the same time, in 2017–2021, the share of this disorder has increased by 4.3% on average. Entropy increased in most holdings (63.6%), with more than half of the increases exceeding 10%. As a result, the characteristics of environmental responsibility of firms must be examined independently by type.

For 2017–2021, for all environmental indicators of enterprises belonging to the same holding, the variance increased, the exception is only disclosure of information (see *Fig.*). And the variation factor predominantly decreased, growth occurred only according to the characteristics of energy and resource efficiency. In terms of energy-resource and ecosystem efficiency, holdings are dominated by under-average enterprises, in terms of transparency of reporting, above-average enterprises; with regard to technological efficiency, since 2017, the proportion of those whose performance was below average has gradually decreased, and by 2021, most enterprises had performance above average. The share of emissions in all environmental characteristics, except technological efficiency, can be recognized as high — above the normal distribution.

Homogeneous holdings prevail in energy-recurrence and technological efficiency indicators, as well as in the level of disclosure; from 2021 homogenous holdings have also become dominant in ecosystem efficiency (*Table 3*). In the whole, it can be noted that during the analyzed period, the homogeneity of holdings increased with simultaneous increase and stability of their state (decrease in the number of phase transitions — transformation of homogenous holdings into heterogeneous and vice versa).

Table 3

Homogeneity and Convergence of Environmental Characteristics of Enterprises of the Same Holding

Indicator	2017	2018	2019	2020	2021	Average	Average share of holdings with phase transitions
Energy and resource efficiency – share of holdings: with homogeneous enterprises	63.64	54.55	54.55	45.45	63.64	56.36	31.82
with enterprises convergence	No data	36.36	27.27	54.55	54.55	43.18	27.27
Technological efficiency – share of holdings: with homogeneous enterprises	45.45	54.55	72.73	54.55	45.45	54.55	31.82
with enterprises convergence	No data	54.55	54.55	54.55	45.45	52.27	31.82
Ecosystem efficiency – share of holdings: with homogeneous enterprises	9.09	18.18	18.18	18.18	36.36	20.00	29.55
with enterprises convergence	No data	45.45	63.64	72.73	63.64	61.36	27.27
Transparency – share of holdings: with homogeneous enterprises	63.64	81.82	72.73	81.82	81.82	76.36	25.00
with enterprises convergence	No data	45.45	54.55	63.64	27.27	47.73	22.73
Homogeneity: average	45.45	52.27	54.55	50.00	56.82	51.82	–
average share of holding with phase transitions	No data	25.00	15.91	13.64	20.45	18.75	–
Convergence: average	No data	45.45	50.00	61.36	47.73	51.14	–
average share of holding with phase transitions	No data	No data	61.36	59.09	50.00	56.82	–

Source: Author's calculation.

Convergence indicators, compared to homogeneity, differ more in terms of different environmental characteristics: periods of convergence of some indicators are accompanied by differences in others. In 2021, convergence was observed for half of the characteristics of the level of environmental responsibility and divergence for the remaining half. This resulted in a slight increase in convergence over the five years under review; the number of phase transitions decreased. At the same time, in 2021, half of holdings with converging holders began to divide, diverge, or converge (holdings with

Table 4

Interrelation of Homogeneity and Convergence Levels of Holding Companies*

Model type	R^2	F-criterion	Significance of the F-criterion
Energy and resource efficiency: linear	0.019	0.823	0.369
logarithmic	0.021	0.892	0.350
inverse	0.020	0.860	0.359
quadratic	0.020	0.413	0.665
cubic	0.020	0.268	0.848
exponential	0.139	6.759	0.013
Ecosystem efficiency: linear	0.081	3.705	0.061
logarithmic	0.066	2.966	0.092
inverse	0.042	1.837	0.183
quadratic	0.084	1.889	0.164
cubic	0.087	1.268	0.298
exponential	0.283	16.556	<0.001

Source: Author's calculation.

Note: * Data are given only for those environmental characteristics for which there is a statistically significant relationship.

phase transitions in homogeneity were only 20.5%).

Given that in 2017–2021, the average share of holdings characterized by convergence was 51.1%, and in 2021 this value did not even reach 50%, we cannot consider convergence to be the dominant trend in holdings, so the H_1 hypothesis is refuted.

Only in terms of energy-resource efficiency and ecosystem was it established that there was a statistically significant dependence of the convergence level of the holding indicators on their current homogeneity, and in both cases the relationship can be described most accurately using an exponential curve: in more heterogeneous holdings, the rate of convergence growth is higher than in homogeneous holdings (hypothesis H_2 for a number of indicators is confirmed; *Table 4*). At the same time, we note that both models have a very low determination coefficient, less than 30%. Accordingly, the level of convergence of enterprises is predominantly determined by the non-current homogeneity of the holdings.

It's also important to remember that the current similarity in companies is based only on the technology component of environmental responsibility, and it's best defined by the cubic curve (*Table 5*). Newton's method determines that the minimum function, namely 48.0, is achieved with a variation factor of 32.1%, which practically corresponds to the threshold value indicating the transition of a homogeneous object into a heterogeneous object. Consequently, it can be concluded that with the decrease in homogeneity of the holding, its level of environmental responsibility first decreases,

Table 5

Relationship between the levels of homogeneity and technological efficiency of holdings*

Model type	R^2	F-criterion	Significance of the F-criterion
Linear	0.019	0.823	0.369
Logarithmic	0.021	0.892	0.350
Inverse	0.020	0.860	0.359
Quadratic	0.020	0.413	0.665
Cubic	0.020	0.268	0.848
Exponential	0.139	6.759	0.013

Source: Author's calculation.

Note: * There is no statistically significant correlation for other studied environmental characteristics.

and then, after the phase transition of holding to heterogeneity, the degree of responsibility begins to increase. On this basis, the H_3 hypothesis is refuted.

DISCUSSION

The possibility of describing the relationship between the homogeneity and the overall technological efficiency of the holding using the U-shaped curve suggests that Russian companies are using two main strategies of environmentalization: the first is the adoption of uniform corporate standards and increased responsibility of each enterprise that is part of the holding; the second is the formation of "model" enterprises, with minimal environmental footprint, due to which the public pressure on the company is reduced, while retaining other economically profitable enterprises that have a significant negative impact on the environment. The choice of the second strategy may be due to the fact that it is easier to implement, given the limited possibility of greening or the extremely low return on environmental investment in a number of sub-sectors. This can be related to, among other things, statements from a number of holdings, such as the joint company "RUSAL" and Evraz Group, about the planned allocation of the "dirtiest" assets to the new structures (both allocations were not officially held due to changes in taxation rules and the introduction of foreign economic sanctions).

Note that the use of the strategy of "model" enterprises can also be explained by the current low level of homogeneity and convergence of enterprises of one holding. Other possible factors include the holdings' attraction to investment firms that do not have direct control over assets, invest in securities, and try to maximize profits. Furthermore, because firms within the same holding may be in different sub-industries, they could face varying external pressure from stakeholders.

Furthermore, the practice of developing "model" enterprises inside the holding results in a lack of correlation between the amount of homogeneity and convergence on this indicator. In terms of transparency in company reporting, the statistical insignificance of the correlation can be explained by firms' propensity to reveal the characteristics for which they specialize.

Unlike technological efficiency (using greener technologies), increased energy-resource efficiency (resource savings) and ecosystem efficiency (greenery) in most

cases do not require such significant capital investments. As a result, it appears that the holdings mostly utilize a unified corporate approach in regard to these areas, leading to the improvement of the most environmentally enterprises. At the same time, compared with emerging competitors, there is a decrease in the relative characteristics of previously greener enterprises, because they are given less attention and their internal motivation is insufficient to accelerate greening. Thus, in relation to resource savings and greenery, there is a convergence of indicators (growth of non-ecological characteristics and decrease of more environmental characteristics) without a general change in the performance of holdings.

The large number of phase transitions confirms the weakness of the internal motivation of enterprises, the unequal attention of managing bodies to them over different years, as well as the prevalence of border states of homogeneity and heterogeneity of holdings.

CONCLUSION

According to the study, the transformation of Russian holdings corresponds to the ascending line of the entropic criterion of social development, but the phase transition from heterogeneous to homogeneous state has not been completed, and homogenic holdings are stable. Thus, in 2021, the number of holdings with homogeneous enterprises only slightly, by 6.8 p.p., exceeded the numbers of heterogeneous enterprises, but in the last five years this figure has increased by 25%. At the same time, the convergence of the environmental performance of enterprises in 2017–2021 was observed on average for only half of them, respectively; this trend cannot be recognized as dominant.

Therefore, the availability and speed of phase transitions are largely determined by the corporate policy: the introduction of uniform environmental standards or the practice of "model" enterprises. The first type of policy is mainly implemented for areas that do not require significant investments (resource savings and greenery), increases enterprise homogeneity and the rate of their convergence, but often with the goal of reducing the negative impact of previously least environmentally friendly enterprises; attention is weakened to those that have already had a lower environmental footprint, and because of their insufficient internal motivation for environmentally sound conduct. Based on the above, uniform environmental standards do not significantly improve the overall performance of the holding.

The transition to ecological technologies often requires significant capital investments. And Russian holdings, apparently, sometimes decide not to conduct general environmentalization but to create enterprises with a minimal environmental footprint while preserving non-environmental, but profitable. With this in mind, there is currently no increase in uniformity and convergence in the level of environmental impact of the technologies used. At the same time, there is a U-shaped relationship between the homogeneity of enterprises in terms of technological efficiency and its overall size for the holding: the decrease in homogeneity of a holding at first reduces its level of environmental responsibility, and then, after the phase transition of the holding to heterogeneous (introduction of the practice of "model" enterprises), the level of responsibility begins to increase. Companies prefer to reveal the characteristics in which they perform best.

In view of the above, due to the impossibility of selecting the incentive and disincentive instruments of environmental responsibility of individual enterprises to rely on the indicators of the consolidated non-financial reporting of the holding, it is worth recommending to the state and regional authorities to use the reports and to request the environmental performance of each of the enterprises. In their goals, managers should consider the demonstrated consequences of

implementing all types of corporate policy and improve its effectiveness by preventing typical errors (in particular, non-systematic monitoring and insufficient attention to enterprises with the current minimum environmental footprint in the holding). Implementation of these recommendations in practice will contribute to the overall improvement of the resilience of the Russian economy.

ACKNOWLEDGEMENTS

This article was prepared as part of the state assignment by the Karelian Research Centre RAS "Comprehensive research and development of the fundamentals of sustainable development management of the northern and border zones of Russia in global challenges". Institute of Economics of the Karelian Research Centre of the Russian Academy of Sciences, Petrozavodsk, Russia.

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Conflicts of Interest Statement: The author has no conflicts of interest to declare.

The article was submitted on 11.01.2023; revised on 30.01.2023 and accepted for publication on 26.02.2023.
The author read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-182-194
UDC 339.7.01(045)
JEL G15, G17

Transmission of Systemic Risk Between the Banking Systems of Asia-Pacific Countries and Russia

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ABSTRACT

The subject of this research is systemic risk transmission between financial sectors in the international financial market. **The purpose** of our paper is to determine topology characteristics for the network connecting banking systems in the Asia-Pacific region (APR) and Russia. Given the growing role of this region in the global financial market, its susceptibility to crises can be dangerous for other countries. This determines the **relevance** of our study. To build the network, we used the SRISK indicators, which reflect capital losses in the financial institutions' capital losses in case of a large-scale crisis. The networks were built with the use of the *NETS* algorithm, proposed by Barigozzi, M., & Brownlees, C. (2019). This **method** is based on sparse vector autoregressions estimated by LASSO. As a result of the application the algorithm, we get two networks — simultaneous interconnections and using the values of the lagged variables. The networks were constructed for the 2005–2020 time period and separately for sub-periods including the global financial crisis (2005–2013) and the COVID-19 pandemic period (2014–2020). Based on the **results** obtained, the networks over the entire time period seem to be quite susceptible to external risks. China, Japan, Singapore and Taiwan are the largest shock donors in this region. Russia mainly accepts risks, generated by other countries, in the period 2014–2020. Strengthened/weakened cooperation with the largest risk exporters in this region will increase/decrease the likelihood of systemic risk transfer to the Russian financial sector.

Keywords: systemic risk in the financial sector; network analysis; sparse vector autoregressions; Granger causality test; network topology; centrality

For citation: **Dzyuba S.A., Tishkovets V.S., Shchepeleva M.A. Transmission of systemic risk between the banking systems of Asia-Pacific countries and Russia. *Finance: Theory and Practice*. 2023;27(5):182-194. DOI: 10.26794/2587-5671-2023-27-5-182-194**

INTRODUCTION

After the global financial and economic crisis of 2007–2009, researchers decided to actively investigate the subject of systemic risk in the financial industry. During that time period, the catastrophic effects of systemic risk implementation in the US financial sector were related to a prolonged local recession as well as the rapid diffusion of risk to other countries. This paper examines the later negative element of systemic crises, namely the transfer of risks between different countries' financial sectors.

The high interdependence of financial institutions both within national and international financial systems contributes to the development of the financial sector, but, on the other hand, creates the preconditions for a possible crisis due to the increasing risk of infection. Moreover, problems in the financial sector could spread to the real economy, causing lower industrial output, higher prices, and higher unemployment.

Asian countries experienced how rapidly financial contagion could grow in 1997–1998. At the present, it is important to determine whether similar events may arise in the future, how infection can develop today, and how rapidly risk can be transported to other countries. Furthermore, given the APR countries' growing dominance in the global financial system, the region's vulnerability to crises may pose a risk to other countries as well. All of this indicates the importance of our research, the purpose of which is to discover the characteristics of the network connecting the banking systems of the APR and Russia.

We used SRISK data from Volatility Laborator to build the network.[1] The SRISK index is currently recognized as the most accurate indicator of individual institutional losses in the event of a large-scale crisis [1]. The indicators for countries were obtained by summing the SRISK values for the largest national banks. The network was constructed using the NETS algorithm proposed by M. Barigozzi and C. Brownlees [2]. It is based on the construction of sparse vector autoregression, measured by the LASSO method.

The results indicate that the network of banking systems in the region is highly interdependent. This density generally indicates that the system is quite vulnerable to external shocks. At the same time, there are four countries that have a key influence on financial stability throughout the region: China, Japan, Singapore and Taiwan.

We examined how the network topology changed throughout the global financial and economic crises, as well as the COVID-19 pandemic lockdown. According to our estimations, the network density indicator grew from January 2014 to December 2020, indicating an increase in regional risk. The number of interconnections has increased in comparison with the period of the global financial crisis. It was also found that the number of "influential" nodes that could actually be "donors" of shocks has increased. While only Singapore was the largest source of shocks in the period from January 2005 to December 2013, Japan, Thailand, Taiwan and Hong Kong also added to the list of "donors" during the pandemic.

This study is intended to add to the literature on risk transmission between financial sectors in different countries. Using ATR countries as an example, we determined how the network's characteristics could change as a result of different crisis scenarios, as well as which countries are donors and risk-acceptors. A new element in our paper is the use of SRISK indices, rather than raw indicators, such as returns or volatility, to study risk transfer.

The paper is structured as follows: the first section provides an overview of the literature on the application of the network approach in finance; the following is a description of the data and methodology of the study; the third section presents an analysis of the results obtained; in the fourth — summary and direction of further research.

[1] URL: https://vlab.stern.nyu.edu/ (accessed on 20.06.2022).

REVIEW OF PREVIOUS STUDIES ON RISK TRANSMISSION IN THE FINANCIAL SECTOR

In recent years, network analysis has been actively used in financial research. It is based on the presentation of the objects of the system in the form of nodes of the graph, and the presence of relationships between them — as ribs.

Most theoretical research on financial sector network analysis examines how the density and shape of the network can affect the risk of infection and the possibility of a systemic crisis.

F. Allen and D. Gale [3] found that "complete" systems, where each object has connections with the others, are more stable. This view was also supported in the paper [4].

Later, in 2007, E. Nier and co-authors [5] modified a method of simulation to expand the F. Allen and D. Gale model, and came to the opposite conclusion: they identified a non-monotonous relationship between the degree of a connection of network participants and the probability of infection. Subsequently, M. Čihák and co-authors [6] showed that the dependency between the degree of interconnection of the system and its stability can be represented in the form of the letter M.

In 2015, P. Glasserman and H. P. Young [7] in their study that even small changes in the interconnection of banks can lead to a disproportionate increase in the risk of infection. Furthermore, according to the authors' calculations, losses in highly interconnected systems resulting from infection are, on the contrary, higher than in incomplete systems. The paper [8] also showed that when the shock value exceeds a certain threshold, a network of greater density becomes more fragile.

It is also important to remember that the source of the initial shock, as well as the degree of homogeneity among the participants, may have a role in determining its long-term viability. The authors of the paper [9] expect that the impact of shocks on the banking system will differ significantly according to where the shocks affect the network.

Much empirical research has been conducted on the global financial market. The study by C. Minoiu and J.A. Reyes [10], which examines a network based on data on cross-border borrowing and loan transactions between banks for 184 countries from 1978 to 2009, is one of the most popular papers in this area. According to the results of the study, the network as a whole was characterized by a high degree of interconnections and consequent instability, particularly in the run-up to the 2007–2009 crisis. A number of additional papers examine and confirm the topology of the global financial market during the 2007–2009 crisis [10–13].

However, later researchers [14], on the other hand, concluded that connectivity in the global banking network has decreased, while interdependence between players in regional networks has increased, and this trend has been determined to a greater extent by countries such as Australia, Canada, Hong Kong, and Singapore.

The purpose of this research is to examine the characteristics of the regional network, which includes the countries of the APR and Russia.

The earliest papers on a network approach to Asian countries were devoted to studying the interrelationships of Asian markets during the Asian financial crisis of 1997–1998. The paper [15] provides a complete overview of the literature on the analysis of infection during this period. Various statistical and econometric methods were used to construct networks — correlation analysis [16], Granger causality tests [17], quantum regression [18].

Subsequently, more elaborate methods were used for the construction of networks, in particular GARCH [19–22], dynamic conditional correlations [23], vector autoregression models [24–26]; copules [27, 28]. Despite the fact that there are many methods of building networks when it comes to causal relationships between participants, vector autoregression and Granger tests are most commonly used, given that the concept itself is most likely to reflect temporary correlation rather than real causality.

DATA AND METHODOLOGY

The methodology proposed by M. Barigozzi and C. Brownlees is used to analyze the risk

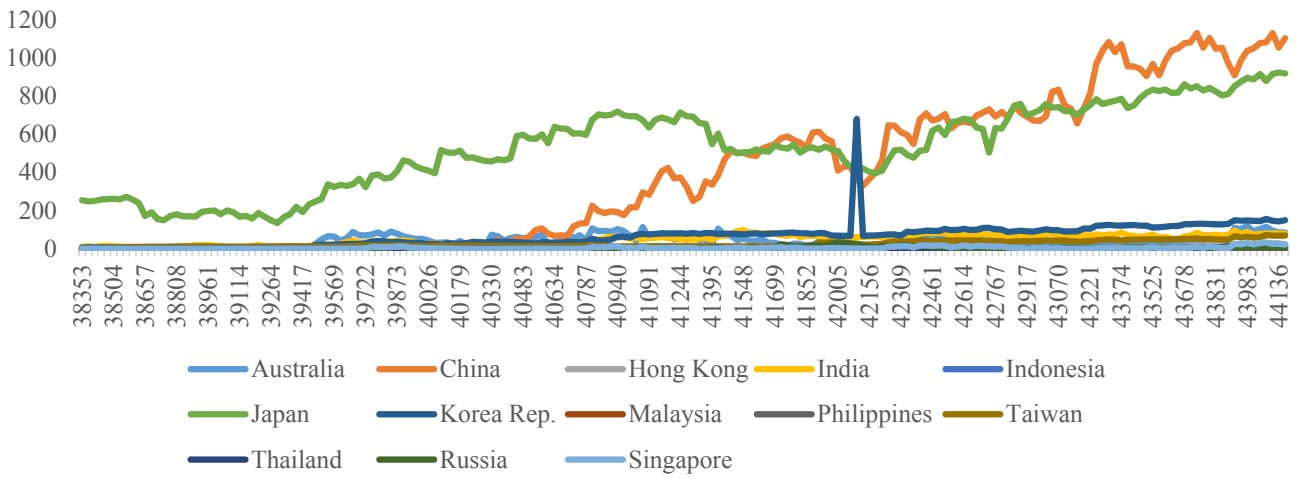

Fig. 1. **Dynamics of the National SRISK Indicators in 01.01.2005–31.12.2020**

Source: Author's calculations.

transmission between the APR countries and Russia [2].[2]

For data quality, we used monthly SRISK index values from the Volatility Laboratory website to build the network. The SRISK indicator for a particular bank represents the amount of capital losses of the institution under the condition of a catastrophic scenario in the financial market. Our sample covers 12 APR countries, including Russia.[3] Study period from 1 January 2005 to 31 December 2020, resulting in 192 observations per country.

Fig. 1 shows the dynamics of the SRISK national indicators. National systemic risk indicators have shown a growth trend since the start of the international financial and economic crisis in 2007–2009. At the same time, the level of SRISK varies and depends on the characteristics of the banking systems of these countries. The highest SRISK values are recorded in Japan and China.

In the first step of the analysis to "clean" the national SRISK indicators from the influence of market fluctuations, we pro-regressed these indicators to three global factors: the VIX volatility index, the global credit risk indicator TED Spread, and the US yield curve. Regression balances will continue to be used as indicators reflecting net risk dynamics in the countries concerned. The regression developed during the first stage indicates this:

$$SRISK = \alpha + \beta_1 VIX + \beta_2 TED + \beta_3 US\_YIELD + \varepsilon_i, \quad (1)$$

where *VIX* — Chicago Stock Exchange Volatility Index. It reflects the price volatility of options on the S&P 500; *TED* — the differential between the short-term interest rate on interbank loans and the rate on treasury bills; *US_YIELD* — the US yield curve, reflecting investors' expectations regarding the future interest rate structure; ε_i — the balances in the regression model [29–31].

Then we build sparse vector autoregression based on the residues obtained from the regression at the previous step. The variables of the diluted model, according to the *NETS* algorithm, are measured by LASSO, the loss function of which includes a penalty depending on the regulation parameter λ_T. Equation (2) presents the standard losses function for the LASSO method, equation (3) presents a formula for estimating coefficients for variables based on LASSO.

$$\ell(\theta, y_t, c) = \sum_{i=1}^{n} \left(y_{it} - \sum_{k=1}^{\rho} \sum_{j=1}^{n} \beta_{ijk} y_{jt-k} - \sum_{\substack{h=1 \\ h \neq i}}^{n} \gamma_{ih} y_{ht} \right)^2, \quad (2)$$

[2] The calculations were implemented in the NETS package for the R language.

[3] The sample included Australia, China, Hong Kong, India, Indonesia, Japan, South Korea, Malaysia, the Philippines, Taiwan, Thailand, Russia and Singapore.

$$\hat{\theta}_T = \arg\min_{\theta\in\mathbb{R}}\left\{\frac{1}{T}\sum_{t=1}^{T}\ell(\theta, y_t, c)+\lambda_T{}^{G}\sum_{k=1}^{\rho}\sum_{j=1}^{n}\frac{|\alpha_{ij}|}{|\tilde{\alpha}_{Tijk}|}+\lambda_T{}^{C}\sum_{\substack{h=1\\h\neq i}}^{n}\frac{|\rho^{ih}|}{|\tilde{\rho}_T{}^{ih}|}\right\}. \quad (3)$$

The optimal value of the regulation parameter λ_T was selected on the basis of the Akaike and Bayesian criteria, and in our paper, it was set at the level of 0.001.

As a result of sparse VAR, we obtain a matrix of private correlation coefficients, reflecting simultaneous relationships between objects, as well as a matrix of coefficients, calculated on the basis of the Granger test. The VAR model can be described as follows:

$$y_{it} = \sum_{k=1}^{\rho}\sum_{j=1}^{n}\left(\alpha_{ijk} - \sum_{\substack{l=1\\l\neq i}}^{n}\rho^{il}\sqrt{\frac{c_{ll}}{c_{ii}}}\alpha_{ljk}\right)y_{jt-k} + \sum_{\substack{h=1\\h\neq i}}^{n}\left(\rho^{ih}\sqrt{\frac{c_{hh}}{c_{ii}}}\right)y_{ht} + u_{it}. \quad (4)$$

where y_{it} — residues from MNC-regressions built in the first step; α —autoregression parameter; ρ — specific correlation factors; c — elements of the diagonal of the concentration matrix; k — lag of model, which in our case is equal to 1.

The first equation describes the relationships between objects along the Granger, and the second is the simultaneous relationships among objects. Using the matrix of association for this equation, you can construct an unoriented graph reflecting simultaneous relationships between objects, and a directed graph for relationships on the Granger.

RESULTS OF EMPIRICAL RESEARCH

According to the results of the calculations, we have two networks: a network of simultaneous interrelations, obtained by means of private correlation coefficients, and a Granger network, which used SRISK index lags.

To start, we will provide a general feature of the networks based on many topological indicators (*Table 1*).

A network density measure is calculated as the ratio of the real connections in the network to the maximum possible number of connections, and the cluster coefficient characterizes the overall trend towards the formation of internally interconnected groups within the network. As shown in *Table 1*, these indicators are close to 1 for the Granger network. This suggests that the graph is tightly grouped, i.e. the shocks can "infect" quite a large number of countries. At the same time, the minimum average distance between nodes is 1.05, and the diameter of the network, i.e. the maximum distance between the nodes, is 2. These two indicators give us an idea of the minimum and maximum rates of potential shock spread in the network. The high degree of interdependence of countries in the region is also demonstrated by the proportion of interconnections, which represents 95% of the total possible number of connections. The assortment factor reflects network nodes' proclivity to join other nodes that share some features. In our case, the Granger network has no inclination to connect countries on a similar basis.

The network of simultaneous interconnections, as shown in *Table 1*, is sparser (the density measure is 0.5), and therefore more resistant to external shocks.

Different measures of centrality are used to determine the degree of "importance" of individual peaks in the graph. For the network of simultaneous interconnections, we have not been able to identify the central nodes, and for the Granger network, the corresponding indicators are given in *Table 2*.

The most commonly used indicators for characterizing "important" nodes are centrality by degrees, mediation and their own vector. The higher the degree of centrality, the more connections the node has with other nodes. The mediation centrality indicator characterizes the role of a node in the path between other network nodes. The high indicator indicates that this node can serve as a shock transmission channel. The centrality by its own vector takes into account both the centrality of the node

Table 1

Main Topological Indicators for the Network in 01.01.2005–01.01.2020

	Contemporaneous linkages	Granger linkages
Density measure	0.5	0.95
Clustering coefficient	1	0.99
Share of reciprocal links	1	0.96
Number of interconnections	78	71
Number of asymmetrical connections	0	6
Disconnectedness	0	1
Diameter	1	2
Average distance between nodes	1	1.05
Associativity	–	–0.10

Source: Author's calculations.

Table 2

Centrality Indicators for the Network of Granger Causalities in 01.01.2005–31.12.2020

	Degree	Closeness	Betweenness	Eigenvector	Bonachich	Alpha
Australia	23	0.083	0.455	0.966	0.079	–0.082
China	24	0.083	0.788	1.000	0.079	–0.122
Hong Kong	22	0.077	0.606	0.925	0.076	–0.082
India	22	0.077	0.606	0.928	0.080	–0.082
Indonesia	22	0.077	0.606	0.925	0.076	–0.082
Japan	24	0.083	0.788	1.000	0.079	–0.122
Republic of Korea	23	0.083	0.455	0.966	0.079	–0.082
Malaysia	22	0.077	0.364	0.928	0.074	–0.082
Philippines	20	0.067	0.364	0.847	0.068	–0.082
Russia	23	0.077	0.697	0.961	0.074	–0.122
Singapore	24	0.083	0.788	1.000	0.079	–0.122
Taiwan	24	0.083	0.788	1.000	0.079	–0.122
Thailand	23	0.083	0.697	0.961	0.079	–0.061

Source: Author's calculations.

itself and the centrality of its neighbors. High centrality on its own vector has nodes that have a large number of connections with other "central" nodes.

In our case, China, Japan, Singapore and Taiwan have the greatest degree of centrality. This means that if the shocks originate in these countries, they can be broadcast to a large number of other nodes.

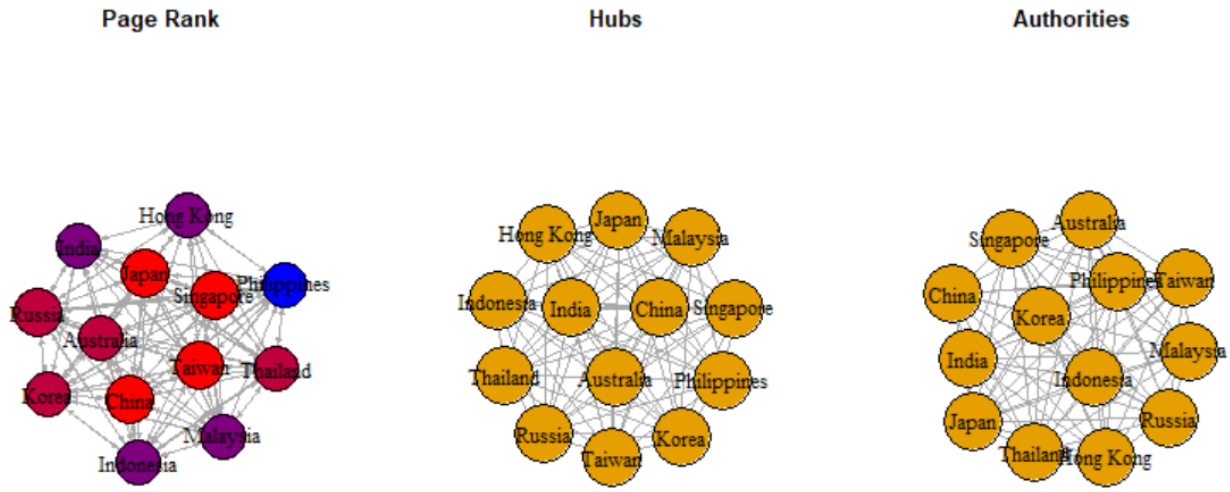

Fig. 2a. **Contemporaneous Networks on Page Rank, Hub Score and Authority Score Rankings for the Period 01.01.2005–01.01.2020**

Source: Author's calculations.

Note: Red corresponds to the highest value of the indicator, blue — to the lowes.

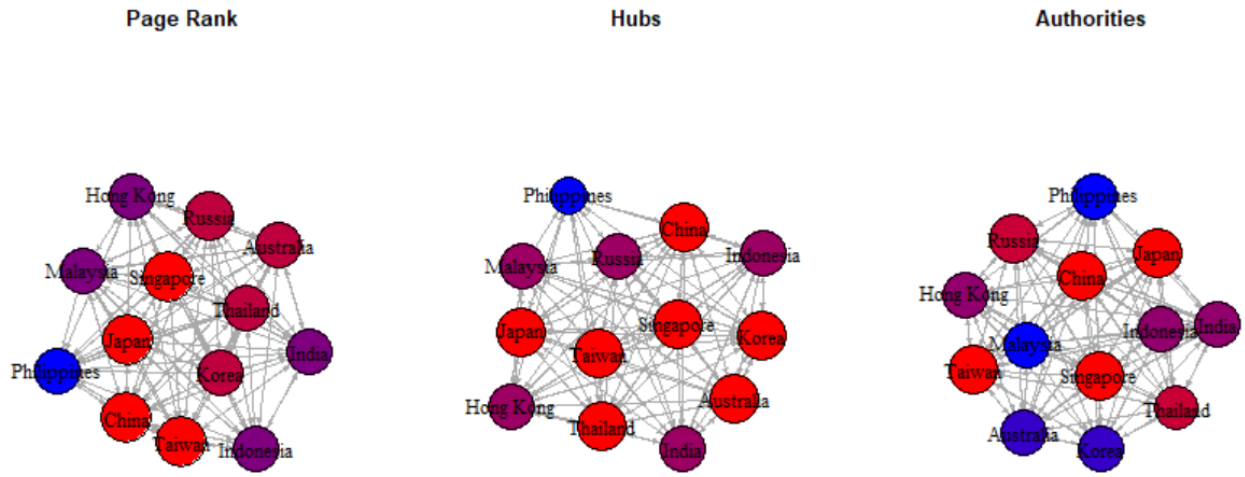

Fig. 2b. **Granger Causality Networks on Page Rank, Hub Score and Authority Score Rankings for the Period 01.01.2005–01.01.2020**

Source: Author's calculations.

The same leaders in mediation are China, Japan, Singapore, and Taiwan, but Australia, the Republic of Korea, and Thailand are also joining them. These countries act as channels for shock transmission. Given their degree of importance, the scale of the shock will be greatest in China, Japan, Singapore, and Taiwan.

Finally, the countries with the highest rates of centrality in their own vectors are China, Japan, Singapore and Taiwan. They are connected with other countries, which also have many connections. This emphasizes once again that the emergence of a crisis in one of these four countries will be the most destructive for the region.

Thus, when all criteria of centrality are considered, China, Japan, Taiwan, and Singapore will always be the most "important". The Philippines has the lowest centralization rates. This indicates that when it involves coordinating

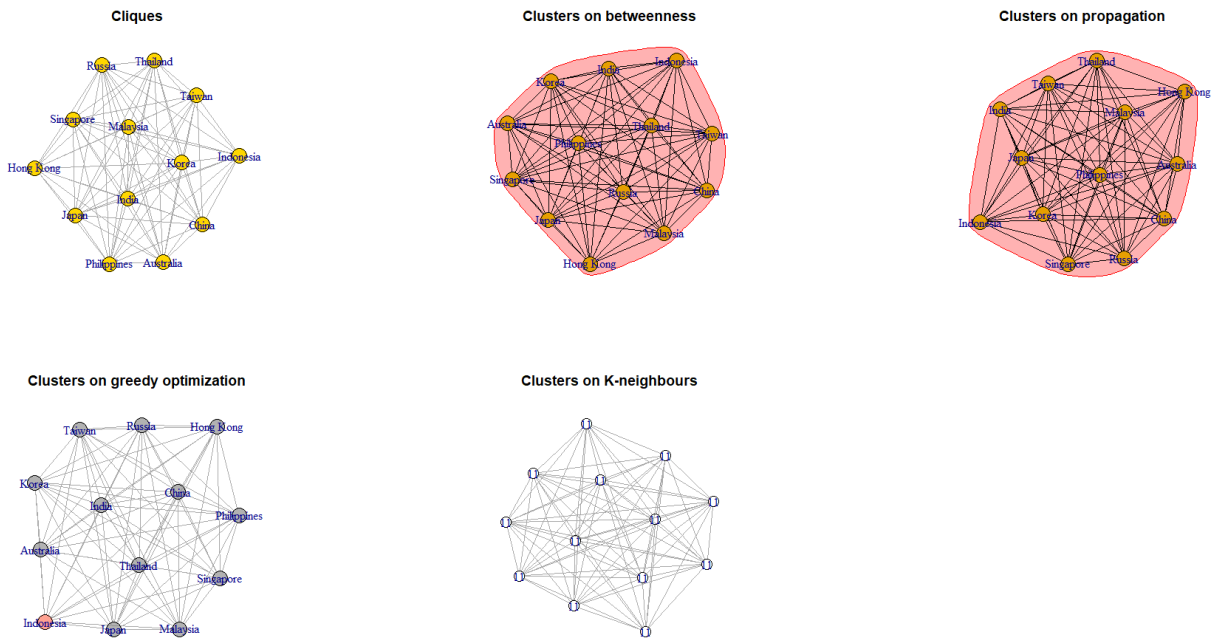

Fig. 3. **Cluster Identification in Granger Causality Network for the Period 01.01.2005–31.12.2020**

Source: Author's calculations.

Note: only one of the algorithms — on the evaluation of optimization of two clusters: to the first refers to Indonesia, to the second — all the other participants of the network. Other cluster algorithms are not observed.

macroprudential measures in the APR region, special consideration should be given to the state of the banking systems in the four countries stated above.

Also, in the analysis of the network to identify "influential" players, in addition to indicators of centrality, use such indicators as page rank, or Page Rank, suggested by L. Page and co-authors [32], hub score and authority score, calculated by J.M. Kleinberg algorithm [33].

According to *Fig. 2a* and *2b*, the highest rates of "authority" and mediation are found in the same four countries: China, Japan, Singapore, and Taiwan. It is also worth noting that Russia ranks well in terms of the indicator of authority. The Philippines' isolated participation has been established.

Finally, let's examine if we can identify individual clusters within the region itself. For this purpose, we have used a variety of methods to identify subgroups in the network: by proximity, by mediation, by label propagation algorithm, by modularity optimization, by K-core decomposition. However, we were unable to detect the established stable clusters neither within the network of simultaneous connections nor in the Granger network of connections.

We also examine how the network's structure changed as a result of situations of crisis. To that purpose, we are rewriting the entire procedure separately for the periods 01.01.2005–31.12.2013 and 01.01.2014–31.12.2020, which include the global financial and economic crisis of 2007–2009 as well as the COVID-19 pandemic lockdown.

From *Table 3*, the density measurements indicate that during the lockdown period, the network was the densest and therefore the most vulnerable. The ratio of interconnections has increased, and the average minimum distance between nodes has decreased, suggesting the potential for shocks to spread faster than during the global financial and economic crisis.

Furthermore, we also identify key countries in the network. In both sub-periods, we focused only on Granger networks, because the algorithm does not identify "influential" participants for the network of simultaneous connections.

Table 3

Main Topological Indicators for the Network 01.01.2005–01.01.2020

	01.01.2005–01.01.2020		01.01.2005–31.12.2013		01.01.2014–01.01.2020	
	Contemporaneous linkages	Granger linkages	Contemporaneous linkages	Granger linkages	Contemporaneous linkages	Granger linkages
Density measure	0.5	0.949	0.5	0.859	0.5	0.929
Clustering coefficient	1	0.987	1	0.975	1	1
Share of reciprocal links	1	0.959	1	0.866	1	0.924
Number of interconnections	78	71	78	58	78	67
Number of interconnections	0	6	0	18	0	11
Disconnectedness	0	1	0	2	0	0
Diameter	1	2	1	2	1	2
Average distance between nodes	1	1.051	1	1.14	1	1.07
Associativity	–	–0.101	–	–0.233	–	–0.188

Source: Author's calculations.

At the height of the global financial and economic crisis, Singapore became the leader in terms of "authority". At the same time, he has also acted as a major mediator in the transmission of crisis phenomena, along with China, Japan, Hong Kong, India, and the Republic of Korea. Indonesia, the Philippines and Malaysia were on the periphery of the network, as they had low Page Rank, "authority" and mediation values. During the period under review, these countries could not be a source of infection for other network participants.

In the period of lockdown, the picture of Page Rank (*Fig. 5*) and the intermediaries did not change much, but the "greatest authority" among the countries began to enjoy Japan, Thailand, Taiwan and Hong Kong. Singapore, as a result of crisis incidents, has disappeared from the network. The Philippines, Malaysia, and Indonesia remained unchanged as peripheral countries. During both crises, Russia only acted as a mediator in the risk transfer.

The cluster results for the networks of the subperiods under consideration are similar to those we obtained for the entire period.

So, considering the evolution of the networks of banking systems in the countries of the APR and Russia, we can conclude that during the lockdown period they became more fragile. The mediators of crisis phenomena in both crisis subperiods were the same: Hong Kong, Japan, Taiwan, Thailand, Singapore, Russia. Changes in risk "donor" composition: Singapore had the highest "authority" in 2005–2013 and Japan, Thailand, Taiwan and Hong Kong in 2014–2020.

The results of the analysis may be of interest to regulators. On the one hand, strengthening Russia's involvement with the APR countries contributes to the financial development of all participating countries. On the other hand, given the role of all participants in the network

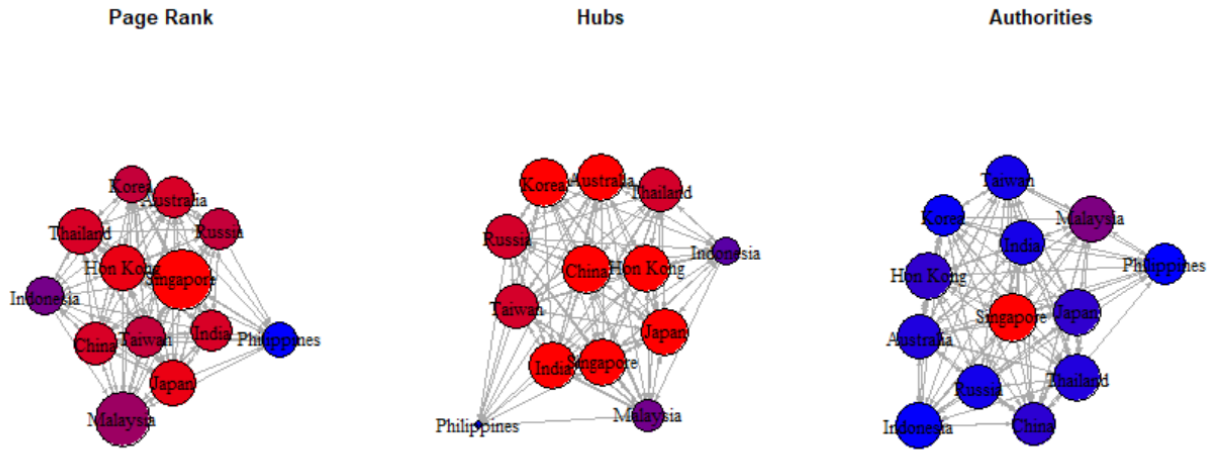

Fig. 4. **Granger Causality Networks on Page Rank, Hub Score and Authority Score Rankings for the Period 01.01.2005–01.12.2013**

Source: Author's calculations.

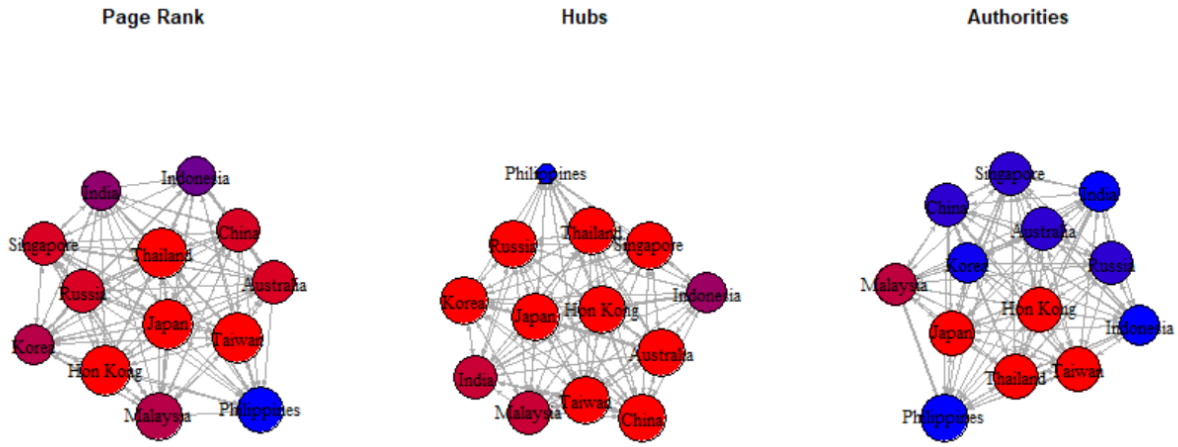

Fig. 5. **Granger Causality Networks on Page Rank, Hub Score and Authority Score Rankings for the Period 01.01.2014–01.12.2020**

Source: Author's calculations.

as risk acceptors or donors, it turns out that increasing the intensity of financial cooperation with China could increase the likelihood of the shocks being transmitted to Russia. At the same time, weakening financial ties with other major risk exporters — Japan, Singapore and Taiwan — helps to reduce the likelihood of infection for Russia.

It is evident that the high risk of contamination in the region is the opposite of increased commerce and financial cooperation among countries. Is it possible to reduce the degree of risk transmission without reducing cooperation? Strengthening domestic macro-prudential policies in each of the countries seems most obvious, taking into account the state of affairs in the partner countries: risk-exporting countries need to apply preventive macro-prudent instruments as soon as they notice signs of a bubble, knowing that their internal instability can spread to neighboring countries. Importing countries must take market conditions in the risk-exporter countries into account when monitoring

financial stability in the internal market and developing hedging instruments against potential risks. Supranational coordination of domestic macro-prudential policy measures is also required to avoid arbitrage in regulations when tightening in one country results in a flow to neighboring countries with less stringent regulations.

Considering Russia's role as a risk recipient throughout the period under review, macroprudential policy cooperation with China, the greatest risk exporter, is becoming increasingly critical.

CONCLUSION

This paper examines the mechanism of risk transfer between the banking systems of the APR countries and Russia in the period from 2005 to 2020. The analysis was based on networks built using SRISK indices obtained using the NETS algorithm of M. Barigozzi and C. Brownlees [2].

The following results were obtained in the course of the paper: first, it was found that the banking systems of the countries concerned were highly interdependent, which was a sign of vulnerability in the event of a major external shock; second, we have identified a group of parties (China, Japan, Singapore, and Taiwan) whose banking system stability must be prioritized. The appearance of a shock in one of them will have catastrophic consequences for the entire region.

Considering the increased intensity of China-Russia financial cooperation, there is a greater possibility that Chinese shocks will be transferred to our country, although reducing connections with Japan, Singapore, and Taiwan, on the other hand, reduces the risk of infection.

Thirdly, we have analyzed how the network changes under the influence of different crisis episodes. It was revealed that the countries that could serve as a transmission mechanism for shocks remained the same in both cases, and the authoritative peaks changed. The number of shock donors has increased. Singapore played a key role during the global financial and economic crisis, followed by Japan, Thailand, Taiwan and Hong Kong.

Our paper is aimed at adding to current knowledge on the transfer of systemic risk between countries. Our research contributes in two ways: methodologically and substantively. Firstly, to analyze risk transmission in the network of banking systems in the APR region and Russia, we used a new methodology, more suitable for larger timeline panels. We also conducted a dynamic analysis of how the characteristics of the network changed over the period of three different crisis episodes. Secondly, from a substantive point of view, our contribution is to identify exporting countries, risk-importing countries and transferring countries. This information can be used to define the infection process in the APR and to develop control strategies.

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 24.07.2022; revised on 04.09.2022 and accepted for publication on 26.10.2022. The authors read and approved the final version of the manuscript.

REVIEW PAPER

DOI: 10.26794/2587-5671-2023-27-5-195-204
JEL G2, G3, M1, M2

Responsible and Sustainable Lending by Financial Institutions: A Literature Review

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ABSTRACT

The **subject of the study** is to use an extensive literature review to evaluate how academic research on corporate social responsibility (CSR) is developing. The journals and papers in the ISI Web of Science, SCOPUS, and Taylor&Francis databases served as the foundation for this literature review. The **purpose of the study i**s to highlight essential papers, referenced journals' importance, and potential future study directions. Determinants that impact the CSR performance of an organization are governance, profitability, firm characteristics, and minimum expenditure. The impact of CSR has been measured using accounting-based market value, risk, excess return on a stock, and moral capital. All the variables are discussed with strongly supported literature and then concluded by giving a framework. The **novelty of our study** is that it analyses new research trends while concentrating on the CSR research frontiers. The **conclusion** identifies possible areas for scientists to further develop their expertise, including sustainable and responsible financing and ESG strategy.

Keywords: CSR; Moral capital; Excess return; Sustainable banking; financial companies

For citation: **Sachdeva S., Ramesh L. Responsible and sustainable lending by financial institutions: A literature review. *Finance: Theory and Practice*. 2023;27(5):195-204. DOI: 10.26794/2587-5671-2023-27-5-195-204**

INTRODUCTION

Corporate social responsibility (CSR) has been extensively used in the corporate and research areas. Initially, this concept was used by corporations to communicate with the outside world to ensure the quality of work and balance maintained in society. Over the years, this concept has been integrated into primary business activities [1]. The application of CSR has evolved from helping society to the strategic use of CSR activities [2] to improve business performance [3]. The application and the defining boundary have also changed from external to internal stakeholders [4]. In recent research, [5] has described the meaning of CSR as the responsibility of businesspeople towards society. H.R. Bowen [4] defines CSR as doing right and good things for internal and external stakeholders.

There is an increase in interest among academic researchers to find determinants and impact of CSR practices in various sectors like manufacturing, information technology, banking, and the hotel industry. It has been studied by [6] the determinants of CSR for non-financial companies. Also, CSR practices impact the financial performance of companies [7–9]. Researchers have mixed positive, negative, and neutral results on the organization's performance. Few studies exist on Indian financial companies (banks and NBFCs) due to strict regulation with separate RBI guidelines.

The motivation of this paper emerges from exploring the determinants and impact of CSR among financial companies. One such factor is corporate governance, which is researched as a determinant of CSR [10]. Also, CSR practices impact financial performance [7], the excess return of stock [11], and the moral capital of financial companies [2].

Contributions towards CSR activities by financial companies depend on numerous factors [6]. This paper's primary goal is to conceptualize a Corporate Social Responsibility (CSR) framework by conducting an in-depth review of existing literature. This paper's main purpose is to construct a CSR framework through an extensive literature review, organized into six sections: Introduction, Methodology, CSR Concept and Theory, Determinants, Impact on Financial Companies, and a Conclusion with limitations and future research directions.

CONCEPTUAL DEVELOPMENT AND REVIEW

This section covers the conceptual model's foundation and the CSR's theoretical background. This study explicitly covers the stakeholder theory of management

studies related to CSR practices adopted by financial companies. Stakeholder theory addresses the premises of organizational stakeholders like employees, customers, regulatory authorities, the community, and others. In the subsequent section, all the aspects of the conceptual model are discussed concerning stakeholder theory. The ISI Web of Science, SCOPUS, and Taylor and Francis literature review databases used different keywords concerning CSR. Articles with more than 200 citations were examined as determinants and impacts of CSR in financial companies, and a model was created. The *Table* shows the list of searched keywords in databases.

Understanding corporate social responsibility

India comprises 28 states and eight union territories, evident in its diversified culture. The second most populated nation in the world requires citizens' welfare and is attempted by corporations in the country. Taking measures for the welfare of the citizens and community is not a new concept in India. It has been followed for ages. Considering stakeholder theory, India became the second nation (after Mauritius) to mandate corporate CSR spending.

Corporate social responsibility is called many other names by researchers and practitioners, like corporate responsibility, corporate sustainability, corporate citizenship, or responsible business. For the last seven decades, researchers have been contributing to this area, as per [12], CSR still has a long way to go. With evolving business policies, the concept of CSR has also been developing.

In 1980, the stakeholder theory of CSR was propounded by [13]. The primary proposition of this theory is that, in the long term, every business must consider its stakeholders. A stakeholder is the one who interacts with the business, and it is classified into two parts, i.e., internal and external stakeholders. Internal stakeholders include employees and customers, whereas external stakeholders include suppliers, the community, and regulatory bodies. Researchers strongly support the stakeholder theory [14]. Also, stakeholder theory has been empirically tested and proven by [13, 15–17] in financial performance and [2, 18] in moral capital and excess stock return.

The impact and determinants like transparency with stakeholders and profitability also help an organization become more successful and socially responsible. This strong evidence from the literature convinces researchers that there is still a broader scope for research in CSR.

Determinants

In this section, the determinants of CSR will be discussed. This study will determine the factors affecting the CSR score of financial companies. Corporate governance, profitability, firm characteristics, and minimum expenditure (2% of net profits) are the factors that affect the CSR of an organization. A description of these factors is as follows:

Corporate Governance

Honest reporting of the organization comes under the purview of the stakeholders' approach. Viewing corporate governance through a broader lens gives a clear vision of stakeholders [19]. The embedding of corporate governance has been conceptualized by CSR practices [10]. Various measures are taken into consideration.

Institutional Ownership

Institutional ownership in the stakeholder theory assumes that the more stakeholders in an organization, the more transparent the organization will be [20]. Researchers have widely used institution ownership as a determinant of CSR disclosure [21, 22]. A company with a diversified stakeholder pattern is considered more socially responsible [23].

Prior studies in developed economies [20] and developing economies [7] indicate that organizations with more diverse stakeholders tend to have better social performance. Top management holding more shares makes organizational decisions biased and tends to lower social performance [24]. Also evident from the Kenya bank study [25], the U.S. bank study [26], the Pakistan Bank study [27], and the Bangladesh bank study [28] there is a positive relationship between the independent board and CSR performance. However, [29] shows no relationship between institutional ownership and Indian Banking. Whereas [30] concluded a negative relationship between institutional ownership and CSR in Jordanian Banks.

Here, institutional ownership will be measured as the percentage of shares held by the board of directors in the organization [31]. Several studies use different scales to measure institutional ownership shares held by the company's three to five largest shareholders [32].

Table

List of Keywords Searched in Different Databases

No.	Keyword	Number of Articles	Number of articles with more than 200 citations
1	CSR or Corporate social responsibility	10464	42
2	Corporate governance	15493	167
3	Institutional ownership	7987	30
4	Directors of Company	9875	56
5	Profitability	9653	45
6	Return on assets	6745	34
7	Credit rating	3406	78
8	Market value	9841	78
9	Risk of financial companies	1023	42
10	Excess return and FAMA French	3983	65
11	Moral capital	567	12

Source: Authors' compilation.

Proposition 1: Institutional ownership has a significant relationship with CSR score.

CEO/ Chairman Duality

CEO/ Chairman duality refers to the same person holding both positions in a company or two different persons holding two positions [33]. This CEO/Chairman duality does not exist in government organizations. However, in a private organization, this situation can cause differences in steward relationship issues [34] because the CEO tends to be less inclined toward social issues. In contrast, the chairperson may consider it a strategic motive for the organization [28]. Whereas [22] consider it a positive relation between CEO/Chairman duality and social performance. However, most studies [35, 36] concluded a negative relationship between CEO/Chairman duality and the organization's social performance.

Proposition 2: CEO/Chairman duality significantly correlates with CSR score.

Board Size

Board size means the number of directors on the organization's board [37]. From a stakeholder point of view, a giant board will consist of more diverse members who favour social responsibility [30]. Hossain [29] argues that a giant board will have diverse thinking and perspectives about the organization's social performance, per resource dependency theory. Researchers from different markets show mixed results. U.S. commercial banks [22], Jordan Banks [30], and Indian banks [23] show the positive impact of larger board sizes on social performance.

Proposition 3: Board size has a significant relationship with CSR score.

Number of Independent Directors

As per the Companies Act 2013, the minimum number of independent directors in an organization is one-third of the total number of directors [23]. Also, their roles, responsibilities, and duties are mentioned in the Companies Act 2013. As per the previous [30], more independent directors lead to better social performance and, hence, better CSR score for the organization.

Proposition 4: The number of independent directors significantly correlates with the CSR score.

Profitability

The organization's profitability is directly linked with CSR performance [38]. The higher the profits, the better the CSR performance of an organization. Larger and more profitable organizations have more visibility among stakeholders, which helps them to be socially active and more responsible. We are measuring this proposition's profit after tax [29] and returns [27].

Profit after tax

Researchers present inconclusive results regarding profitability as the determinant of CSR performance. There are optimistic, pessimistic, and insignificant results. D. Hackston and M.J. Milne [39] argue that highly profitable organizations spend on socially

responsible activities. However, few studies by [40] assert that organizations consider spending on societal activities as a financial burden, such as contributing to charity, developing society, or contributing to economically backward people.

Proposition 5: Profit after tax has a significant relationship with CSR score.

Return on Assets

Return on Assets (ROA) is a widely used parameter to measure financial companies' profitability [8] and found a positive relation between ROA and CSR performance. However, [41] contradicted the negative results and concluded that higher ROA reduces the organization's social performance.

Proposition 6: Return on assets has a significant relationship with CSR score.

Firm's Characteristics

Firm characteristics play a significant role in determining the level of CSR an organization employs. The following sections discuss firm type, firm age, size, and credit rating from a financial company's perspective.

Firm type

In India, financial companies are categorized as private and public organizations. A study by [23] on 50 companies in India concludes that public organizations are better regarding social performance. Similarly, studies by [42] show that public sector companies' performance is superior to that of the private sector.

Proposition 7: Firm type has a significant relationship with CSR score.

Firm age

Among firm characteristics, one critical variable is the firm's age. Previous researchers have concluded that long-established organizations perform better CSR [6]. Whereas there are findings from the research of [39] on established firms that are not concerned about social responsibility scoring based on previous literature studies.

Proposition 8: Firm age has a significant relationship with CSR score.

Firm size

Larger companies have more social visibility, making them more socially responsible [6]. Also, larger organizations have more resources to be socially active and responsible toward society [30]. Studies conducted by [29] conclude that larger organizations are better at social responsibility activities, leading to a better score.

Proposition 9: Firm size has a significant relationship with CSR score.

Credit rating

P. Sengupta [43] argues that a firm's credit rating and quality information disclosure play a vital role in investment decisions, which leads to strategic investment in CSR. N. Attig et. al. [44] argue that the benefits of credit rating are an intangible form of CSR score. S.A. Waddock and S.B. Graves [41] hold that a better credit rating leads to better social performance of an organization. S. El Ghoul et al. [14] argue that a low credit rating leads to a higher idiosyncratic risk for the firm, which results in less involvement in socially responsible activities [45]. H.-L. Chih et. al. [46] propound that better-performing companies are more inclined towards socially responsible activities. N. Attig et al. [44] conclude that by increasing firms' credit ratings, firms focus more on socially responsible activities.

Proposition 10: Credit rating has a significant relationship with CSR score.

Minimum Expenditure

The statutory requirement of CSR contribution as 2% of net profits under a prescribed set of conditions leads to the argument of whether an organization's CSR score is affected by mandatory contribution. As per [23], mandatory CSR does not reflect many benefits to the company's stock price. D.V. Moser et. al. [47] suggested that socially responsible investments should benefit shareholders, which can be increased when corporations pursue a visible agenda [48]. As a result, investors are prepared to consider a company's CSR initiatives before making an investment choice [49].

Proposition 11: Minimum expenditure has a significant relationship with CSR score.

Impact of CSR on Financial Companies

O. Weber et. al. [50], the financial sector has a significant economic and environmental impact; risk management concerns and stakeholder pressure drive the financial sector on a more sustainable path. In contrast to

polluting industries, the financial industry has no direct impact on the environment or society through emissions or resource use. In analysing corporate financial performance, various metrics were used [49]. Studies commonly use accounting and market-based metrics for corporate financial performance, measuring short-term and future profitability [40, 52, 53]. Accounting-based parameters include return on assets, equity, and earnings per share [7, 48, 50]. Market value parameters like the book-to-market ratio and price-to-earnings ratio [23] are considered. To calculate the impact of CSR on the risk of financial companies, measures such as Z-score [54] and risk density are used. Then, to measure the impact of CSR on the stock market, the Fama French model [11] will be used.

Accounting Based Parameters

Management objectives and decisions choose accounting rules and regulations. In recent literature, accounting measurements of financial performance have proliferated. Return on assets, equity, and earnings per share are used by [55]. Accounting data is considered reliable and less susceptible to manipulation due to strict rules, external audits, and public accessibility [56]. On the other hand, accounting indices are backward-looking and dependent on convention and company choice; therefore, they might be skewed, incomparable, and susceptible to manipulation [57].

Proposition 12: CSR score has a significant relationship with financial companies' accounting-based parameters.

Market Value

Market-based performance measurements are less prone to managerial subjectivity, manipulation, or opportunism since they focus less on accounting figures or regulations [58]. External and independent evaluations of the firm's performance produce market-based indicators, which reflect investors' perceptions and expectations of the firm's future success [57]. Market metrics have limitations, as they focus on financial stakeholders, neglecting non-financial stakeholders affected by CSR [59]. Market metrics enable diverse benchmarks and data triangulation, promoting balanced and objective performance evaluations [14]. To measure the impact of market value, book-to-market ratio [60] and price-to-earnings ratio [7]. These indicators are widely explicitly used by financial companies.

Proposition 13: CSR score has a significant relationship with financial companies' market value.

Risk

According to the existing literature on sustainability, corporate sustainability minimizes idiosyncratic firm risk. However, in public debate, the true definition of sustainability is a broad concept that encompasses more than just environmental concerns. Instead, the term "sustainability" is frequently used interchangeably with CSR. According to the literature, CSR and corporate risk are negatively associated [61]. This research considers F. Neitzert and M. Petras [56] idiosyncratic and portfolio risks. Different Z-score specifications estimate default risk [62, 63]. The Z-score compares the standard deviation of return on assets with the bank's ROA plus its capital adequacy ratio (CAR). J.F. Houston et. al. [64] define CAR as the equity-to-total assets ratio. The risk density is a good approximation of portfolio risk. The amount of risk-weighted assets (RWA) over total assets recorded on the balance sheet determines risk-weighted assets [65, 66].

Proposition 14: CSR score has a significant relationship with financial companies' risk.

Excess Return on a Stock

Knowledge of the impact of business environmental performance on financial performance contributes to the argument over whether managers routinely miss profit opportunities by opting out of environmental protection [67]. Overall, current thought on the implications of corporate social responsibility on financial performance is equivocal [41, 68]. Examining positive, negative, and neutral effects, neoclassical microeconomics can support arguments for a detrimental impact. According to this, the underlying principle of shareholder wealth maximization is harmed because the operating costs of corporate environmental [69] or social activities outweigh their financial benefits (due to cost reductions through, for example, energy savings, waste reduction, or recycling). As a result, CSR can result in poorer earnings, company values, competitive disadvantage, and lower shareholder returns, leading [70] to claim that CSR has no purpose.

Proposition 15: CSR score has a significant relationship with financial companies' excess return on stock.

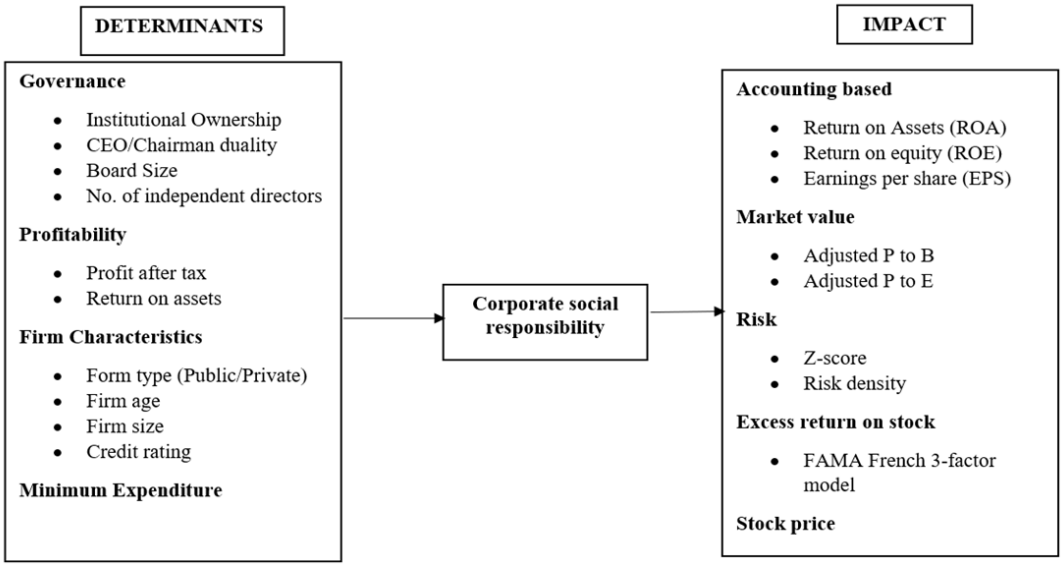

Fig. **Conceptual Framework of Determinants and Impact of CSR on Financial Companies**

Source: Authors' compilation of CSR Model of financial companies.

Moral Capital

Moral capital is the capital firms generate by doing something good for society. It covers the firm as insurance-like property and does not harm much during an adverse event. In this section, the impact of the CSR score will be checked against the moral capital of the firm, which a firm creates through involvement in community service, service development, or employee empowerment. There are few entirely generous contributions, and CSR efforts will be just one of several signals' stakeholders use to gauge a firm's altruistic inclination [2]. D.A. Kennett [71], furthermore, profit-making is the macro-institutional norm for business [2], which is well understood and accepted by public actors in a capitalist society.

Proposition 16: CSR score has a significant relationship with financial companies' moral capital.

EXPLAINING FRAMEWORK

The review adds to our understanding of the subject. A review of existing worldwide and national literature on CSR suggests that accounting-based measures, market-based measures, corporate governance, mandatory requirements, and moral capital are all crucial factors in encouraging the CSR activities of financial companies. A thorough review of secondary literature has aided in developing the study's theoretical foundation and concrete definition of corporate social responsibility. The links can be given as a conceptual model since exhaustive literature research gives logical, methodical, and consistent justification for selecting identified variables. Three main components that constitute the conceptual model for the present investigation are shown in *Fig.*

This proposed corporate social responsibility framework can be validated using quantitative analysis for financial companies. While quantitative analysis, the relationship between determinants and CSR score, panel data analysis can be used. Similarly, the relationship between impact and CSR score and regression analysis can be used. Various methods exist to calculate CSR scores, like qualitative data analysis, content analysis, etc.

CONCLUSION

CSR is a promising concept in corporate culture. This concept has been evolving for the last six decades. The future of corporate social responsibility in the financial sector is sustainable lending, responsible lending, and the ESG framework. After conducting an extensive literature review, it was concluded that financial companies are more responsible toward society. As they are into lending money to corporations, investing money in sustainable businesses and projects started by corporations is necessary. This research has been done explicitly with the financial sector because of the differences in their business operations.

Previous research on CSR and corporate financial performance has received mixed reviews. This research

framework is divided into two steps. The first step is to determine the determinants of CSR, which explain the behaviour of different components of financial companies affecting CSR. The second step is to measure the impact of CSR on the performance of financial companies. By following the above-discussed propositions, the Figure 1 framework is presented. It summarizes the determinants and impact of CSR on financial companies. All these variables are taken into consideration after an extensive literature review.

The major limitation of this research is that there is no uniformly accepted CSR scale in India. ESG (Environment, Social, and Governance) is a suggested framework. However, not all companies report on the ESG framework. According to A. Bhatia and A. Dhawan [72], the Ministry of Corporate Affairs has mandated that the top 1000 companies in India report the sustainability report in the ESG framework. So, it becomes a challenge to calculate the CSR score.

As a result, an empirical investigation is required to identify relationships between the constructs. Despite the constraints, the findings have the potential to be extremely useful for academics and practitioners alike, as the findings show that CSR is more than just an abstract idea or a sign of passive views. It is, instead, a fundamental principle that may be translated into sustainable finance.

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 19.06.2022; revised on 03.07.2022 and accepted for publication on 26.07.2022. The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2587-5671-2023-27-5-205-218
JEL E42, E52

Can an Electronic Money Transaction Raise the Inflation Rate? (Indonesian Pre-Pandemic)

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ABSTRACT

Along with the rapid growth of technology, payment instruments are also changing. Electronic money is slowly but surely replacing the role of paper money and coins. The emergence of electronic money can provide convenience for consumers, it can lead to an increase in the demand for goods and services that ultimately leads to demand-pull inflation. The **purpose** of this study is to determine the impact of electronic money transactions (both in natural and in value terms) on inflation growth. By using the Chow Breakpoint Test, Difference-in-Differences and Propensity Score Matching shows that the inflation trend has tended to decline since the Bank of Indonesia launched its national non-cash campaign. By using the ordinary least squares (OLS) **method** was revealed that an increase in the volume of electronic money transactions in the long-term may affect a decrease in inflation, but not in the short-term. The rate of interest of the Bank of Indonesia, the growth of lending and GDP led to the decline in inflation. It was **concluded** that the Bank of Indonesia could expand the use of electronic money to manipulate inflation levels in the long-term. The policy that can be implemented by Bank Indonesia is to distribute electronic money infrastructure services more evenly and increase the socialization of the use of electronic money, especially in remote areas.

Keywords: electronic money; inflation rate; short-run; long-run; error correction model; propensity score matching; difference in differences; Chow test

For citation: **Fadli F., Devia V. Can an electronic money transaction raise the inflation rate? (Indonesian pre-pandemic). *Finance: Theory and Practice*. 2023;27(5):205-218. DOI: 10.26794/2587-5671-2023-27-5-205-218**

INTRODUCTION

Technological developments have penetrated all fields, including the transaction activities carried out by the public when carrying out consumption activities. The use of non-cash payment instruments has become a habit of society today. Non-cash payments are more effective and efficient compared to cash because the non-cash payment instruments considered by the community are beneficial. According to Kochergin and Yangirova (2019), the use of electronic money are considered to facilitate transaction activities and they are safe, fast, and convenient to use [1].

Bank Indonesia, in its role to reduce people's dependence on cash, implemented a jargon called the National Non-cash Campaign on August 14th, 2014. The jargon announced by Bank Indonesia is aimed at the public to increase the public's use of non-cash instruments for the creation of a cashless society. The presence of the cashless society is expected to reduce the rate of crime and fraud because the public does not use cash for daily transactions. Apart from that, the government, through Bank Indonesia, wants to improve its payment systems to catch up with developed countries.

In carrying out its innovations, Bank Indonesia cooperated with three government banks, namely Bank Mandiri, Bank Negara Indonesia, and Bank Rakyat Indonesia, in signing a Memorandum of Understanding regarding the integration of Electronic Data Capture (EDC). Bank Indonesia greatly appreciates the steps taken by the three banks to help improve efficiency in the retail payment system. Bank Indonesia, in achieving its objectives, strongly supports other payment system operators to follow the steps of Bank Indonesia in realizing people who use non-cash instruments.

Some non-cash payment instruments issued by banks in Indonesia to facilitate transaction activities are debit cards, credit cards and electronic money. Debit cards and credit cards are impractical because of their complicated administration and high cost. Electronic money is a solution to the needs of payment instruments because it can make payment processes cheap and fast [2].

The form of electronic money also varies. Some are shaped like cards with a method for replenishing

balances (this form is often used in Indonesia). Another form is the more sophisticated use of applications on smartphones that are connected to a server. The diversity of electronic money types shows that the government, through Bank Indonesia, encourages the use of electronic money. The encouragement has also taken the form of providing an infrastructure suitable for the use of electronic money. The following is data on the provision of electronic money infrastructure (reader machines) in Indonesia.

In achieving its goals, Bank Indonesia tends to focus on the public when conducting small amounts of transactions, thus that the initial step taken by Bank Indonesia is to innovate one of the non-cash instruments, namely electronic money.

As an initial step to introduce the public to non-cash payments, electronic money is very easy to use and has low costs. With the advantages possessed by electronic money, non-bank financial institutions and telecommunications companies have also participated in helping Bank Indonesia to create a cashless society.

The use of electronic money, which is increasing year over year, can also affect the velocity of money [3]. This is because the use of electronic money makes transactions more comfortable and faster. According to the Irving Fisher Money Quantity Theory, the money supply and the velocity of money can affect price. Electronic money cannot affect the amount of money in circulation because it only replaces its role as a medium of exchange [4]. With the amount of money circulating fixed and the velocity of money increases, there will be an increase in prices [5].

After the emergence of a new means of payment, namely electronic money, it is evident that the velocity of money circulation is not constant. Some research resulted that inflation has shown that inflation has decreased drastically in developed countries. It was not caused by monetary policy but by the use of non-cash payment instruments [6].

Several studies have given different results on the relationship between electronic money and inflation. Depending on the case study, some have a negative impact, and some have a positive impact. Therefore, this study analyses the impact of electronic money on inflation in developing countries such as Indonesia. This research focuses on Indonesia because it has wide financial literacy disparities. The use of electronic money is collected on the island of Java and in the big cities on the islands of Sumatra, Kalimantan and Sulawesi. This is due to the geographical condition of Indonesia which is an archipelago country. The use of the difference-in-differences method as a robustness check is very suitable. This is because there are areas that can be used as control groups and treatment groups.

This research uses the difference-in-difference and the ordinary least squares method as a robustness check that has never been done in other studies. Research on the short-term and long-term impacts of electronic money on inflation using the Error Correction Model in developing countries such as Indonesia has never been carried out. The results of this study will later become input for policymakers in Indonesia to be able to control the inflation caused by electronic money (Bank Indonesia and the Ministry of Finance).

METHODOLOGY

Error Correction Model (ECM)

The general ECM model according to Engle-Grange is as follows:

$$\Delta Y_t = \alpha 0 + \alpha 1 \Delta X_t + \alpha 2 EC_t + e_t, \quad (1)$$

whereas,

$$EC_t = \left(Y_t - 1 - \beta 0 - \beta 1 X_t - 1\right). \quad (2)$$

The EC_t difference value is referred to as a disequilibrium error. The coefficient α0 is a constant and α1 is the short-term coefficient. β1 is the long-term coefficient. The imbalance correction coefficient in the form of an absolute value explains how fast of a time is needed to get the balance value [7].

The ECM model in this study:

$$INF_t = \alpha + \beta 1 EMVO_t + \beta 2 EMVA_t + yEC_t + \varepsilon_t. \quad (3)$$

INF_t is inflation in *t* period. $EMVO_t$ is an electronic money volume transaction (how many transactions are done) in *t* period. $EMVA_t$ is the electronic money value transaction (the number of transactions measured in Indonesian currency) in *t* period. α is constant. β is the coefficient. *y* is the speed of adjustment. The coefficient y is the residual velocity in the previous

period used to correct the change in the coefficient y to equilibrium in the next period. The coefficient y must be negative and significant to state whether the ECM model used is valid or not. That is, the p-value < α (5%). EC_t is a residual error in the long-run equation. $The\,\varepsilon$ error in the short-term equation shows that t is the time.

Ordinary Least Square (OLS)

OLS is a method in multiple regression analysis to determine the effect of independent variables on dependent variables [8]. The data scale referred to above is for all variables, especially the dependent variable. The OLS model in this study:

$$INF = \alpha + \beta 1 RATE + \varepsilon, \quad (4)$$

$$INF = \alpha - \beta 1 GDP + \varepsilon, \quad (5)$$

$$INF = \alpha + \beta 1 CRD + \varepsilon. \quad (6)$$

INF is inflation. RATE is a 7-day repo rate of Bank Indonesia. *GDP* is a *GDP* real (not nominal) growth rate. The negative relationship between *INF* and the growth rate of real *GDP* follows from the Fisher's quantitative money theory equation. *CRD* is a lending growth. α is constant. α is constant. β is a Slope or the coefficient estimate. $The\,\varepsilon$ is an error.

The regression results obtained the Best Linear Unbiased Estimator (BLUE). A classic assumption test is needed, we can include Linearity test, Normality test, autocorrelation test, normality test, heteroscedasticity test and a multicollinearity test [9].

Cochrane Orcutt

The Cochrane-Orcutt method is a method used to improve when a regression model is found to be autocorrelated [10]. When the autocorrelation structure is unknown, the $\hat{\rho}$ value (autocorrelation coefficient) can be determined using the following formula:

$$\hat{\rho} = \frac{\sum_i^n e_i e_{i-1}}{\sum_i^n e^2_{i-1}}, i = 2,3,4\ldots,n, \quad (7)$$

where e_i is the error value in the i-th observation, e_{i-1} is the error value in the $(i-1)$-th observation and n is the number of observations. In this method, autocorrelation is removed gradually from its simplest form so that autocorrelation can be overcome.

$$INF_i - \hat{\rho} INF_{i-1} = \beta_0 - \hat{\rho}\beta_0 + \beta_i EMVO_i - \hat{\rho}\beta_i EMVO_{i-1} + \\ + \beta_i EMVA_i - \hat{\rho}\beta_i EMVA_{i-1} + \hat{\rho}\varepsilon_i - \hat{\rho} \quad (8)$$

$$= \beta_0 \left(1 - \hat{\rho}\right) + \beta_i \left(EMVO - \hat{\rho} EMVO_{i-1}\right) + \\ + \left(EMVA - \hat{\rho} EMVA_{i-1}\right) + \hat{\rho}\varepsilon_i - \hat{\rho}\varepsilon_{i-1}. \quad (9)$$

So that it is obtained

$$INF_i^* = \beta_0^* + \beta_i^* EMVO_i^* + \beta_i^* EMVA_i^* + \varepsilon_i^*, \quad (10)$$

were

$$INF_i^* = INF_i - \hat{\rho} INF_{i-1}, \quad (11)$$

$$\beta_0^* = \beta_0 - \hat{\rho}\beta_0, \quad (12)$$

$$EMVO_i^* = EMVO_i - \hat{\rho} EMVO_{i-1}, \quad (13)$$

$$EMVA_i^* = EMVA_i - \hat{\rho} EMVA_{i-1}, \quad (14)$$

$$\beta_i^* = \beta_i. \quad (15)$$

In this step, it is not known whether the $\hat{\rho}$ value obtained in the first iteration is the best value in overcoming autocorrelation. The value of $\hat{\rho}$ is transformed into Equation the equation in the third step above so that the error value of the new model is obtained. This step needs to be repeated until the convergent $\hat{\rho}$ value is obtained.

Chow Breakpoint Test

The Chow Test is used to test whether two or more regressions are different [11]. The Model Stability Test is conducted to determine within a certain period from the entire range of estimated time periods, whether the model can still be used as a valid prediction. Usually, if there is a policy variable, then the equation model assessment can predict well

from the policy issuance period to the end of the observation period.

$$F = \frac{\left(RSS^R + RSS^U\right)/(k+1)}{\left(RSS^U\right)/(DoF)}, \quad (16)$$

where RSS^R is the restricted sum of squared residuals, RSS^U is the sum of squared residuals from subsample u, DoF is the Degree of Freedom, and k is the number of parameters in the equation.

Difference in Difference

The Difference-in-Differences (DID) is a statistical technique used in econometrics and quantitative research in the social sciences that attempts to mimic an experimental research design using observational data by studying the differential effect of a treatment on a "treatment group" versus a "control group" in a natural experiment [12]. This research used Jakarta as a state capital of Indonesia for treatment group and Jayapura as the capital and largest city of the Indonesian province of Papua.

$$INF_{it} = \beta_i + \beta_t + \gamma Treated_i \; X \; Post_t + u_{it}, \quad (17)$$

where the dependent variable is the inflation rate of city i at date t; β_i are city-specific, time-invariant fixed effects and β_t are the time-specific, city-invariant fixed effects. $Treated_i$ denotes a vector of the dummy variables: $Treatedi$ = 1 for the treatment group, and $Treatedi$ = 0 for the control group. $Post_t$ denotes a vector of dummy variables: $Post_t$ = 1 in the post-treatment periods when the application of the jargon of the non-cash national movements by Bank Indonesia was announced at date $t \geqslant 0$, and $Treated_i$ = 0 otherwise. u_{it} are the error terms. γ is the coefficient of enthusiasm for Specification. This research utilizes two sources of variation to distinguish γ. Initially, γ is recognized utilizing the variety between the treatment group and the control group. Second, γ is likewise distinguished utilizing the variety inside each group before and after the application of the jargon of the non-cash national movements by Bank Indonesia is announced.

Propensity Score Matching (PSM)

Propensity Score Matching (PSM) method is used to minimize the possibility of selection bias. PSM can reduce to a one-dimensional score of various multidimensional matching variables [13].

The first order in applying the PSM method is to use logistic regression models as this distribution is often approximately normal. Given the observed covariate vectors (x_i), as conditional probabilities for specifying certain treatments (w_i = 1) versus non-treatment (w_i = 0), PSM will define the trend scores for individuals. The covariates in vector X are called matching variables.

$$P\left(x_i\right) = pr\left(w_i = 1 | X = x_i\right). \quad (18)$$

The second-order matches treated subjects to non-treated subjects which supports the calculable propensity scores. The main matching methods are nearest neighbour matching, radius matching, kernel matching, and stratification matching.

The third order is balance assessment, which checks whether the propensity scores are balanced across treatment and matched groups and whether the matching variables are balanced across treatment and matched teams among the strata of the propensity scores.

RESEARCH RESULTS

Error Correction Model

The first step in the ECM method is to perform a unit root test using the ADF method. The unit root test results using ADF are as follows.

Based on *Table 1*, the ADF Unit Root test results show that the electronic money transaction volume variable and the electronic money transaction value are not stationary at the degree level. Only the variable of inflation is stationary at the degree level. Therefore, it is necessary to test the degree of integration to see if the data will be stationary in the first difference or second difference degree. The reason for the transformation of variables into natural logarithms is to smooth the data due to the different units of measurement of each different variable.

After the first difference, the results of the degree of integration test using the ADF show that all the stationary data is in the first-degree difference. This is

Table 1

Unit Root Testing Results

Level Difference			1st Difference		
Variable	Prob.	Results	Variable	Prob.	Results
INF	0.0317	Stationary	INF	0.0000	Stationary
LN_EMVO	0.9847	Not stationary	LN_EMVO	0.0000	Stationary
LN_EMVA	0.8749	Not stationary	LN_EMVA	0.0000	Stationary

Source: Compiled by the authors.

Table 2

Cointegration Test Results

Variable	Prob.	Result
RES(−1)	0.0077	There is Cointegration

Source: Compiled by the authors.

Table 3

Ramsey RESET Test

	Value	Df	Probability
t-statistic	0.597719	116	0.5512
F-statistic	0.357268	(1,116)	0.5512
Likelihood ratio	0.369020	1	0.5435

Source: Compiled by the authors.

evidenced by the probability value being smaller than the α of 5% or 0.05. Therefore, it can be concluded that all the variables of this study were stationary at the first difference degree. After the integration requirements are met, it can enter the next stage.

Table 2 explains that the residuals tested by the ADF method show there to be a cointegration between the research variables. The probability value is smaller than α, thus it can be concluded that there is cointegration between the research variables. Before proceeding to the next step, the classic assumption test must be run to produce a BLUE-regression.

The linearity test is carried out to check whether the independent variables are linearly related to the dependent variable. The linearity test in this study using the Ramsey RESET test as shown in *Table 3*. The result of this test was 0.5512, which is > 0.05. Thus, it can be concluded that the independent variables are linearly related to the dependent variable.

The Breusch-Pagan Godfrey Test as shown in *Table 4* was carried out to check whether heteroscedasticity occurred. The p-value is indicated by the value of the probability, which is equal to 0.2757. This is > 0.05. This means that the regression model shows homoscedasticity. In other words, there is no problem with the assumption of non-heteroscedasticity.

Table 4

Breusch Pagan Godfrey Test Results

F-statistic	1.306652
Obs*R-Squared	3.922595
Scaled explained SS	8.869701
Probability F(3,115)	0.2757
Prob. Chi-Square(3)	0.2699
Prob. Chi-Square(3)	0.0311

Source: Compiled by the authors.

Table 5

VIF Results

Variable	Centred VIF	Uncentered VIF	Coefficient Variance
LNEMVO	0.008549	2763.831	26.06883
LNEMVA	0.012392	2290.884	26.06883
C	0.102260	119.8602	NA

Source: Compiled by the authors.

Table 6

Normality Test

Jarque-Bera	Probability
0.563623	0.754416

Source: Compiled by the authors.

Table 7

Short-run ECM Estimation Results

Dependent Variable: Inflation (Y)			
Variable	**Coefficient**	**Prob.**	**Results**
D(LN_EMVO)	0.058921	0.4523	not significant
D(LN_EMVA)	–0.012317	0.8568	not significant
RES(–1)	–0.086002	0.0193	significant negative

Source: Compiled by the authors.

Table 8

Long-run ECM Estimation Results

Dependent Variable: Inflation (INF)			
Variable	**Coefficient**	**Prob.**	**Results**
D(LN_EMVO)	0.191657	0.0404	Significant positive
D(LN_EMVA)	–0.316882	0.0052	Significant negative
C	–2.266917	0.0000	Significant negative

Source: Compiled by the authors.

Table 9

Long-run ECM Estimation Results (Cochrane Orcutt)

Dependent Variable: Inflation (INF)			
Variable	**Coefficient**	**Prob.**	**Results**
D(LN_EMVO)	–0.156377	0.0063	Significant negative
D(LN_EMVA)	–0.024433	0.7343	Not Significant
AR(1)	–0.947936	0.0000	Significant negative

Source: Compiled by the authors.

The results of the multicollinearity test, as shown in *Table 5,* indicate that the Centered VIF value for all variables is below 10. It can be stated that there is no multicollinearity problem present in the prediction model.

The normality test, as shown in *Table 6* in this study, used the Jarque-Bera Test. All the significant values of the test are < 0.05. It results in the acceptance of H0 which means the residual is normally distributed.

The Durbin-Watson Stat value in the model of this study was 0.186876 (details are in the appendix). This value is the value of the Durbin-Watson (DW) test. The Durbin-Watson test table has the critical values of dl = 1.68531 (Durbin-Watson test table for lower critical values) and du = 1.71889 (Durbin-Watson test table for upper critical values). The results are DW < DU and value (4 — DW) > DU, indicating that there is a negative autocorrelation problem. To eliminate the symptoms of autocorrelation, one can use Cochrane Orcutt (the results of the calculations are in the appendix). After transforming the model using Cochrane Orcutt, a DW value of 1.878212 was obtained. Moreover, this research also conducted a robustness check using OLS against other factors that could affect inflation to accommodate the possibility of errors in the model specification, for example, significant explanatory variables are missing because the Durbin-Watson test rejected the hypothesis of no autocorrelation in a random perturbation.

The results of the short-run ECM estimation in *Table 7* shows that in the short-run, the variables

Table 10

Chow Breakpoint Test Results

Chow Breakpoint Test: 2014M08				
Null Hypothesis: No breaks at specified breakpoints				
Varying regressors: All equation variables				
Equation Sample: 2009M01 2019M12				
F-statistic	23.68388		Prob. F(1,130)	0.0000
Log likelihood ratio	22.09196		Prob. Chi-Square(1)	0.0000
Wald Statistic	23.68388		Prob. Chi-Square(1)	0.0000

Source: Compiled by the authors.

of electronic money transaction volume (EMVO) and electronic money transaction value (EMVA) cannot affect inflation (INF). According to Keynes (1937), prices are sticky in the short-term [14]. Wage rigidity causes the prices to change in the long-run [15].

The results of the ECM analysis in the long-term in *Table 8* show that the variable volume of electronic money transactions (EMVO) can affect inflation positively. The value of electronic money transactions (EMVA) can negatively affect inflation (INF). However, the results of the long-run regression analysis experience symptoms of autocorrelation (the test results are present in the discussion of the classic assumption test), meaning that they must be transformed using Cochrane Orcutt.

The ECM results in the long-term in *Table 9* indicate that only the volume of the electronic money transaction (EMVO) can affect the inflation variable (INF). This is consistent with the theory of the velocity of money proposed by Fisher. This states that the velocity of money can affect prices [5]. The volume of electronic money transactions (EMVO) illustrates how much electronic money is used for transactions. This means describing how quickly electronic money can change hands. The value of electronic money transactions (EMVA) only illustrates the nominal amount of electronic money transactions.

Chow Breakpoint Test

Table 10 shows the Chow Breakpoint Test gives an F statistical value of 23.683 > F table 3.91 with a probability of 0.000. The conclusions obtained accept the hypothesis that the parameters are unstable for both periods before August 2014 and after August 2014 at the 5% significance level. These results indicate that for both periods, the parameters change significantly, or that the application of the jargon of the non-cash national movements by Bank Indonesia has an impact on the inflation movement.

Difference in Difference (DID)

This research also applied the Difference in Difference (DID) method for robustness checking. The use of the DID method is to find out whether the period of the application of the jargon of the non-cash national movements by Bank Indonesia has an impact on the inflation movement. Before applying the DID method, a common trend assumption test was performed. The common trend assumption is the assumption set where no treatment results from the treatment group and the control group has the same trend [16]. Common trend assumptions usually use pre-treatment data to show the same trend.

Based on *Fig. 1*, it shows that in the period before the implementation of the jargon of the non-cash national movement in August 2014, inflation in the Jakarta and

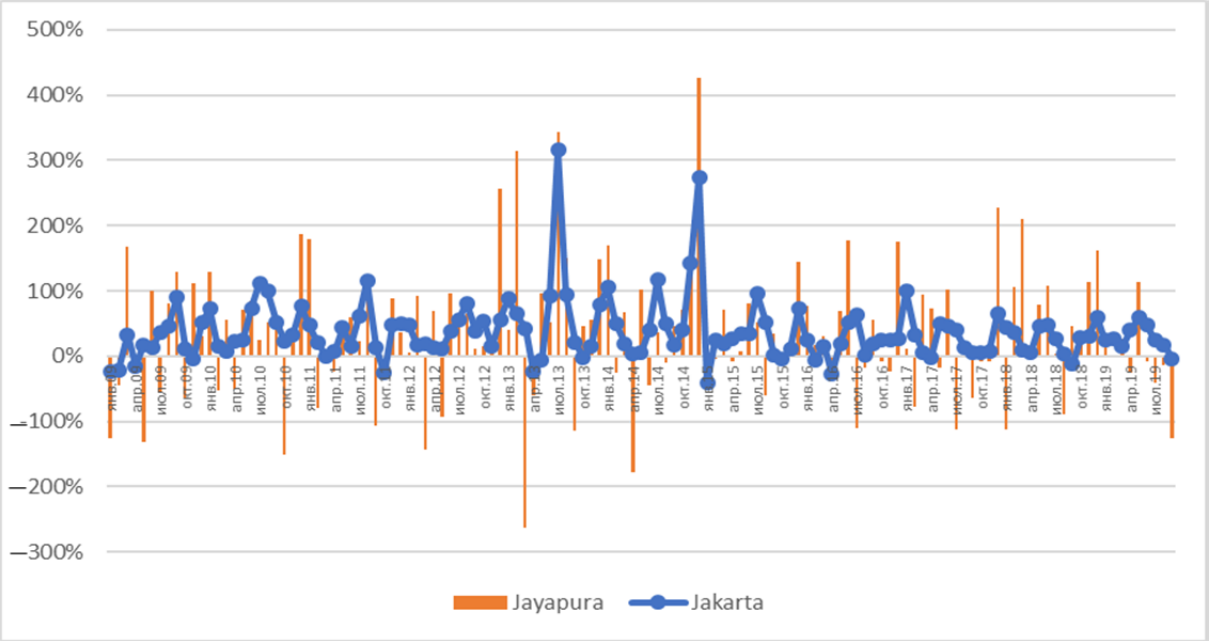

Fig. 1. **Common Trend Inspection Source: Compiled by Author**

Source: Compiled by the authors.

Table 11

Difference in Differences Results

Test	Coef.	Std. Err	T	P > |t|	95% Conf. Interval	
DID	–0.9308841	0.1938362	–4.80	0.000	–1.313156	–0.5486118
Placebo	–0.0511369	0.0781356	–0.65	0.515	–0.2064914	0.1042177

Source: Compiled by the authors.

Jayapura regions had the same trend. The choice of the city of Jakarta as the treatment group is due to the very frequent use of electronic money. This is because Jakarta is the capital of Indonesia. The selection of Jayapura city as a control group is due to the almost non-use of electronic money in the city. This is because the city of Jayapura is a remote area that does not have the infrastructure to support the use of electronic money.

The results of the Difference in Differences method on the *Table 11* show a similarity to the Multiple Linear Regression method. The coefficient value shows negative and significant results. As shown in the results of *Table 10*, the coefficient value of –0.9308841 with a probability value ($P > t$) below 5%. These results indicate that in the period after the implementation of the jargon of the non-cash national movement, the inflation movement has decreased.

A second way to test the assumption of equal trends would be to perform what is known as a "placebo" test [16]. The placebo test performs additional difference-in-difference estimates using a "sham" treatment group, that is, the group not affected by the program [12]. This research uses inflation data from Singapore as a treatment group and Brunei Darussalam as a control group for the same period as the DID test. Singapore and Brunei Darussalam are used because they are neighboring countries, have direct borders

Table 12

Matching Methods Results

Matching Methods	ATT	t
Nearest Neighbor	–0.543	–5.432
Radius	–0.543	–5.432
Stratification	–0.543	–5.432

Source: Compiled by the authors.

Table 13

Other Factors Multiple Linear Regression Estimation Results 1

Dependent Variable: Inflation (INF)				
Var.	**Coeff.**	**t-Stat.**	**Prob.**	**Results**
RATE	–0.003528	–3.778618	0.0005	Significant negative
C	0.051118	10.71255	0.0000	Significant positive
R-squared	0.267990			
F-statistic	14.27795			
Prob(F-statistic)	0.000528			
Linearity	0.3330			
Normality	0.193816			

Source: Compiled by the authors.

Table 14

Other Factors Multiple Linear Regression Estimation Results 2

Dependent Variable: Inflation (INF)				
Var.	**Coeff.**	**t-Stat.**	**Prob.**	**Results**
CRDT	0.212780	6.450438	0.0000	Significant positive
C	1.756366	2.900618	0.0055	Not Significant
R-squared	0.454197			
F-statistic	41.60815			
Prob(F-statistic)	0.000000			
Linearity	0.0509			
Normality	0.464029			

Source: Compiled by the authors.

with Indonesia and are included in ASEAN countries. The inequality of the results from the placebo test also strengthens the results of the analysis. The application of the jargon of the non-cash national movement only has an impact on the inflation rate in Indonesia (Placebo test probability above 5%).

Propensity Score Matching (PSM)

Table 12 shows the results of the estimation of the Average Treatment of Treated Effect (ATT) with 3 matching methods (Nearest Neighbor, Radius, and Stratification). The ATT value shows conformity with the DID results (–0.543) and the t-test shows

Table 15

Other Factors Multiple Linear Regression Estimation Results 2

Dependent Variable: Inflation (LINF)				
Var.	**Coeffi.**	**t-Stat.**	**Prob.**	**Results**
LGDP	1.531864	2.744967	0.0078	Significant positive
C	–0.850147	–0.905328	0.3686	Not Significant
R-squared	0.102466			
F-statistic	7.534845			
Prob(F-statistic)	0.007788			
Linearity	0.6603			
Normality	0.192873			

Source: Compiled by author.

significant results (> t table). This means that when the jargon of the non-cash national movement is applied, there is a decrease in the inflation rate, showing the same result as DID coefficient. These results indicate that it is appropriate to use Jakarta as the treatment group and Jayapura as the control group.

Robustness Check

Other factors that influence inflation

$$INF = 0.051118 - 0.003528RATE + \varepsilon. \quad (19)$$

The regression results of the inflation variable with the 7-day repo rate of Bank Indonesia in *Table 13* show negative results, this is in accordance with the explanation in the previous paragraph. The results of *Table 13* show that any increase in interest rate in 2009–2019 (monthly) in Indonesia by 1% will have an impact on reducing the inflation rate by 0.003%. The increase in the Volume of Electronic Money for the Transaction was accompanied by an increase in the interest rate. The volume of transactions on electronic money increased due to changes in the use of cash into electronic money [17]. Therefore, the transaction remains the same.

$$INF = 1.756366 + 0.212780CRDT + \varepsilon. \quad (20)$$

The policy of increasing the interest rate by Bank Indonesia resulted in lowering demand for credit, thereby reducing the price level (deflation). The regression results of the credit growth variable with inflation in *Table 14* also show a positive relationship. The results of *Table 14* show that any decrease in credit growth in 2005–2019 (quarterly) in Indonesia by 1% will have an impact on reducing the inflation rate by 0.21%. This indicates that the decline in credit growth due to an increase in interest rates will lead to a decrease in the inflation rate [18].

$$INF = -0.850147 + 1.531864GDP + \varepsilon. \quad (21)$$

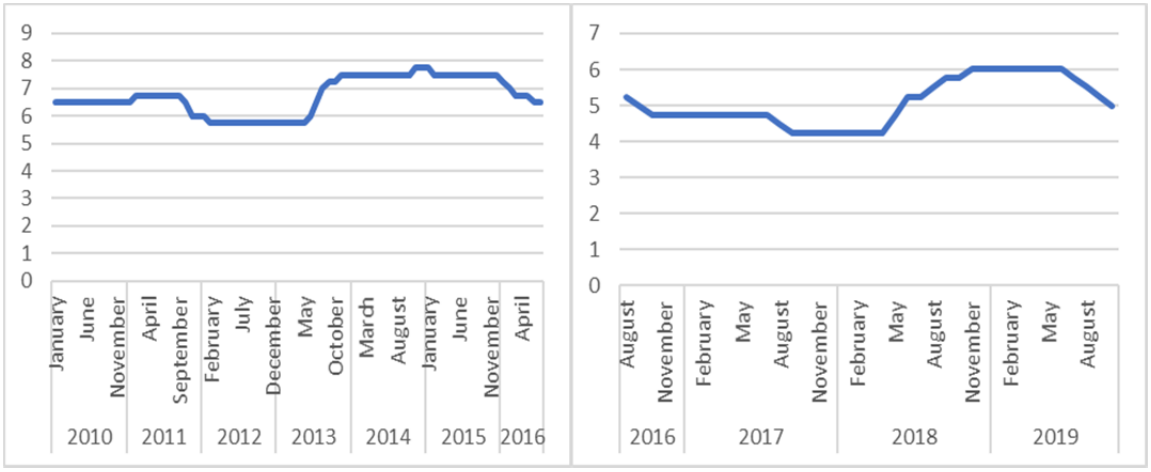

Fig. 2. **BI Rate % and 7-Day Repo Rate, %**

Source: Bank Indonesia.

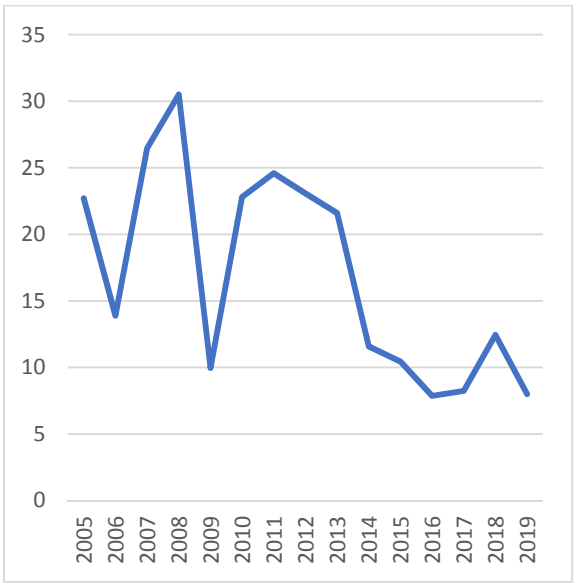

Fig. 3. **Credit Growth, %**

Source: Bank Indonesia.

Fig. 4. **Indonesia GDP Real Growth, %**

Source: Statistic Indonesia.

Table 15 shows the positive relationship between inflation and GDP. An increase in GDP growth will lead to an increase in the inflation rate [19]. The results of *Table 12* show that a decrease in GDP growth in 2003–2019 (quarterly) in Indonesia by 1% will have an impact on reducing the inflation rate by 1.53%.

DISCUSSION

The results obtained from the study show there to be a negative relationship between the volumes of electronic money transactions (EMVO) and inflation (INF). This means that the higher the volume of electronic money transactions, the lower the inflation. The results of this study are in line with the research results of Frida Calson-Öhman and Ramon Marimon which have been described in the literature review above.

Moreover, the results of the study are in line with the theories of Baumol and Tobin. The higher the interest rate that occurs in society, the greater the costs borne by someone who holds cash [20, 21]. The increase in volume of electronic money transactions (EMVO) is a result of a shift in payment methods that previously used cash to now use electronic money.

Apart from encouragement from the government, such as using electronic money to pay for toll road use, the public would prefer to use electronic money as a transaction tool compared to cash because, by using electronic money, the public does not need to bear the costs of losing to the interest rate, as stated by Baumol and Tobin. The easy top-up process (transferring the nominal money from a bank account to electronic money) causes people to tend to use electronic money only for current transaction needs and prefer to keep most of their money in a bank account. Therefore, when the interest rate is high, people will be reluctant to make transactions.

Apart from that, electronic money providers being in competition to attract people is also a factor causing there to be a negative relationship between electronic money transaction volume and inflation. Almost all electronic money providers cooperate with e-commerce companies using the "burn money" marketing strategy by giving cashback and discounted prices [6]. This marketing strategy can drive a large volume of electronic money transactions, accompanied by lower prices for goods.

Figure 2 shows the interest rates in Indonesia during the period 2010–2019. From 2010 to 2016, Bank Indonesia still used the BI rate. From 2016 until now, Bank Indonesia has used 7-day repo rates. Based on this data, during the period 2010–2019, interest rates experienced a positive trend. When interest rates increase, the amount of money held for transactions decreases. In other words, the transaction component of the demand for money is negatively related to the interest rate [16, 22].

Figure 3 shows that Indonesia experienced a decline in credit growth from 2005 to 2019. The decline in credit growth was the result of the increase in the interest rate. Meanwhile, a decrease in credit growth can cause a decrease in the inflation rate [13, 23, 24].

Figure 4 shows Indonesia's real GDP growth which is experiencing a downward trend. This indicates that the growth in the use of electronic money is not accompanied by a growth in GDP. Meanwhile, GDP is influenced by the inflation rate [19, 25]. Hence, the decline in Indonesia's GDP causes deflation. GDP growth in Indonesia based on the figure above has experienced a downward trend from 2011–2019 although the use of electronic money has increased. Besides, higher inflation expectations were reported by individuals who focused more on how to cover their future expenses and on prices they pay (rather than on the inflation rate) and by individuals with lower financial literacy [26]. Therefore, the low level of financial literacy in Indonesia has resulted in lower inflation.

CONCLUSIONS

Based on the research results above, it can be concluded that electronic money has no impact on inflation in the short-term. In the long-term, electronic money has a negative effect on inflation. The increase in the use of electronic money as a transaction is a result of changes in the payment method, which previously paid used cash and is now using electronic money, so that it does not affect the price level. The marketing strategy of electronic money service providers, in collaboration with e-commerce companies, is competing to provide massive discounts on their merchandise prices if buyers use electronic money as a means of payment that can trigger a price decline. Another cause is the positive trend of interest rates implemented by Bank Indonesia, declining credit growth, declining GDP growth, and low financial literacy rate. Moreover, in the period after Bank Indonesia implemented the jargon of the national non-cash campaign, the inflation rate has decreased.

This research can be used as an input for the government to increase cooperation and coordination when supporting the electronic money infrastructure in various regions with Bank Indonesia under the national non-cash campaign program. To avoid inequality, only a few large cities in Indonesia tend to use electronic money. Nevertheless, it should be more evenly distributed across all regions in Indonesia. In addition, increasing the level of financial literacy of the Indonesian people also needs to be done.

The limitation of this research is that it only uses the variable transaction volume and the electronic money transaction value to see its effect on inflation. This is because there were limitations regarding the availability of the data.

ACKNOWLEDGMENTS

Thank you to the Department of Economics, Faculty of Economics and Business, Brawijaya University for supporting us in completing this research.

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The authors read and approved the final version of the manuscript.
The article was submitted on 23.08.2022; revised on 15.09.2022 and accepted for publication on 26.10.2022.