Vol. 13 • No. 1 • 2025 ISSN 2308-944X (Print) ISSN 2311-0279 (Online)

Review of Business and Economics Studies

DOI: 10.26794/2308-944X

The journal was reregistered
in the Federal Service for Supervision
of Communications,
Informational Technologies,
and Mass Media:
PI No. ФС77–67072
of 15 September 2016

**Publication frequency —
4 issues per year
Founder: Financial University**

The Journal is included into the system
of Russian Science Citation Index, Scopus,
the Higher Attestation Commission (VAK)
List of journals
for scientific specialities: 5.2.3, 5.2.4, 5.2.5

The Journal is distributed by subscription.
Subscription index: 42137
in the consolidated
catalogue “The Press of Russia”

Издание перерегистрировано
в Федеральной службе по надзору
в сфере связи, информационных
технологий
и массовых коммуникаций:
ПИ № ФС77–67072
от 15 сентября 2016 г.

**Периодичность издания —
4 номера в год
Учредитель: Финансовый университет**

Журнал включен в систему Российского
индекса научного цитирования (РИНЦ),
Scopus, Перечень изданий ВАК
по научным специальностям: 5.2.3, 5.2.4, 5.2.5

Журнал распространяется по подписке.
Подписной индекс 42137
в объединенном каталоге
«Пресса России»

Review of Business and Economics Studies

REVIEW OF BUSINESS AND ECONOMICS STUDIES (RoBES) is the quarterly peer-reviewed scholarly journal published by the Financial University under the Government of the Russian Federation, Moscow. Journal's mission is to provide scientific perspective on topical economic and business subjects.

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ISSN 2308-944X

Вестник исследований бизнеса и экономики

Редакция научных журналов
Финансового университета
125167, Москва,
Ленинградский пр-т, 53,
комн. 5.6
Тел. +7 (499) 553-10-74
(вн. 10-88)
Интернет: https://rbes.fa.ru/jour

Журнал “Review of Business and Economics Studies” («Вестник исследований бизнеса и экономики») зарегистрирован в Федеральной службе по надзору в сфере связи, информационных технологий и массовых коммуникаций
15 сентября 2016 г.
Свидетельство о регистрации ПИ № ФС77-67072.

Подписано в печать: 08.04.2025.
Формат 60 × 84 1/8.
Заказ № 454
Отпечатано в отделе полиграфии Финуниверситета (Москва, Ленинградский проспект, д. 49/2).
16+

Review of Business and Economics Studies

Volume 13, Number 1, 2025

Вестник исследований бизнеса и экономики

№ 1, 2025

ORIGINAL PAPER

DOI: 10.26794/2308-944X-2025-13-1-6-23
UDC 331.556.4(045)
JEL J21, J24, J31, J61

International Migration to Russia: The Gender Aspect

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ABSTRACT

International population migration from an economic point of view has a significant impact not only on the labor markets of countries participating in it, but also on their economies and societies. On the one hand, international migration flows contribute to the development of trade and economic relations between countries. However, on the other hand, they can cause undesirable tensions within the host country's society and have negative economic consequences. **This study aims** to analyze the main factors influencing the decision to migrate to Russia through econometric modeling. The relevance of this study is determined by the growing migration pressure in the Russian Federation up to 2024 and the need to better understand this phenomenon within the context of the Russian economy. In the context of the changing migration policy, the study is even more relevant. **The novelty** of this study lies in the applied migration research methodology, which has revealed the relationship between male and female international migration to Russia over time, as well as the results obtained from this research. **The main findings** of the study include identifying and describing a "vicious cycle of male labor international migration" in both developed and developing countries. It also proves that in Russia, men's international migration is driven by job search, while women follow their partners and only then find employment and change their status from a migrant to a family reunification migrant or a migrant worker. Additionally, it is demonstrated that the Russian Federation is characterized by the development of "migration attractors," which makes it challenging to implement effective migration policies.

Keywords: international migration; women's migration; male migration; labor migration; migration modeling; living conditions; gender disproportionality; migration statistics

For citation: **Seleznev P.S., Arzhaev F.I., Zvereva A.D. International migration to Russia: The gender aspect. *Review of Business and Economics Studies*. 2025;13(1):6-23. DOI: 10.26794/2308–944X-2025–13–1-6-23**

ОРИГИНАЛЬНАЯ СТАТЬЯ

Международная миграция в Россию: гендерный аспект

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АННОТАЦИЯ

Международная миграция населения как экономический процесс значительно влияет не только на рынки труда стран — участниц международной миграции, но и на их экономики. Международные миграционные потоки, с одной стороны, способствуют развитию торгово-экономических отношений между странами, а с другой — могут провоцировать нежелательную напряженность в социуме принимающей страны и создавать негативные экономические эффекты. Миграция в России остается не до конца изученной темой, особенно в гендерном разрезе, что ограничивает возможности объективной оценки ее эффектов для российской экономики. **Целью** проведенного исследования является анализ с использованием эконометрического моделирования основных факторов международной миграции, влияющих на принятие решения о миграции в Россию. **Актуальность** исследования обусловливается возрастающей миграционной нагрузкой в Российской Федерации (РФ) и необходимостью осмысления данного явления применительно к РФ. **Новизна** исследования складывается из примененного метода исследования миграции, который позволил выявить взаимосвязь между мужской и женской миграцией в Россию во времени. К основным

результатам исследования можно отнести выявление и описание порочного круга мужской трудовой миграции международной миграции развитых и развивающихся стран, а также доказательство того, что в России в основе миграции мужчин лежит поиск работы, а женщины следуют за мужчинами и только затем находят работу и меняют статус с мигранта для воссоединения с семьей на трудового мигранта. Помимо этого, обосновано, что для РФ характерно формирование «аттракторов миграции», затрудняющих реализацию миграционной политики.
Ключевые слова: международная миграция; женская миграция; мужская миграция; трудовая миграция; моделирование миграции; условия жизни; гендерная диспропорциональность; миграционная статистика

For citation: **Seleznev P.S., Arzhaev F.I., Zvereva A.D. International migration to Russia: The gender aspect. *Review of Business and Economics Studies*. 2025;13(1):6-23. DOI: 10.26794/2308–944X-2025–13–1-6-23**

Introduction

International migration is a complex and diverse phenomenon that is of great scientific and practical importance today, given the increasing number of migration flows around the world, particularly international labor migration. However, there is still a lack of clear understanding of the causes and processes that lead to these migration flows, especially when considering all countries as a whole. The search for universally applicable solutions to migration issues often results in the neglect of certain aspects, such as the issue of gender-specific international migration flows to Russia, which has been poorly explored, making it even more significant in the context of Russia's current international migration policy shift. Labor and family international migration a priori transforms the age and gender composition of the population in a country, sometimes leading to social tensions in certain regions, as many migrants move to Russia to meet their economic and cultural needs [1].

In this study, we aim to explore the features and relationships between male and female international migration to Russia, as well as the factors that influence these migrations, including work and family.

We hypothesize that the decision to migrate to Russia depends on gender. For men, it is driven by the need to improve living standards, regardless of their marital status. For women, it is influenced by family factors, regardless of living conditions, and forms a "family international migration" pattern.

To test this hypothesis, we will use econometric and statistical methods to analyze data on male and female migrants in Russia. We will also explore the economic effects of international migration on recipient countries and identify any potential vicious circles in the labor market. Additionally, we intend to investigate why some migrants may not assimilate in Russia and how this relates to the specific characteristics of the migrant influx and the formation of "attractor international migration" groups.

Research on international migration in Russia has a relatively young history compared to other countries. During the Soviet era, domestic researchers were restricted in their access to information from other countries, which slowed down the theoretical understanding of international migration and its effects on the countries involved. E.P. Pletnev saw international labor migration as an important part of the global economy and argued for an integrated approach to studying it due to its connection with capitalist production cycles and the movement of people, goods, and capital [2].

According to some modern researchers [3], the international migration of people from post-Soviet countries, especially Central Asia, to Russia over the past 30 years has significantly impacted the formation of certain stereotypes among younger and middle-aged male migrants. For example, working in Russia provides not only an opportunity to earn money to support their families in their home country [4], but also the possibility of bringing their families to the country where they work [5]. As a result, Russia has become one of the largest destinations for migrant workers in the world [6].

It is especially worth noting the works that explore the reasons for international female labor migration [7]. The authors of gender international migration theory [8] analyzed the geography of female international migration as a main, independent phenomenon, in contrast to international migration "with her husband" [9]. Based on databases of "arrivals" and "departures" by age and gender [10], it is observed

that gender imbalance in international migration affects not only the demographics of the migrant's destination but also the origin country [11]. Modern Internet search queries indicate a growing interest in the topic that we intend to explore in our study.

Works on family international migration are also of interest [12], as they indicate the reasons for the displacement not only of the male or female population but also entire families with children. This type of international migration has a significant difference from labor or educational international migration, as family reunification involves admission to the country regardless of qualifications, education, or potential contribution to the economy [13].

Such studies allow us to consider family international migration with children in the context of socio-demographic characteristics. However, due to limited statistical information, it is not possible to determine the proportion of migrants with children in Russia or to create a detailed portrait of this group [14, 15].

Materials and methods

The research methodology is based on the analysis of the time series of migration in the Russian Federation since 2001. International migration is studied exclusively; however, to prove the hypothesis, the migration flow is divided by gender (total men (M) and women (F)), by age (men (M1460) and women (F1460) of working age — for statistics of the 2000s, the working age is reduced to 14–60 years for comparability of the series), according to the purpose of arrival (Work, family circumstances (FamBus)), as well as marital status (married (Family) and the sum of those who have never been married, divorced and widowed (Single)). Such a selection of statistics is determined by the hypothesis of the study — to prove that men migrate to improve the standard of living of their or their family, it is necessary to identify both all men and those of working age. If there is a significant difference in the factors describing these processes, then the hypothesis of men is rejected. For women, there may be a clear difference — at working age, they can migrate both for family reunification and for starting a family. In these cases, the hypothesis is confirmed; however, if they migrate to find work, it is rejected. Outside of working age, the absence of a work factor as a determinant of their migration is sufficient to prove the hypothesis. Thus, it is necessary to identify both gender and age components, as well as those characterizing the migrant himself (the purpose of migration and marital status). A detailed justification for this approach is given below.

Since migration statistics in the Russian Federation are incomplete, they were supplemented using the "k nearest neighbors" method, while k is determined using the correlogram of the series and is assumed to be equal to the number of lags for which the correlation is higher than 0.4. At the same time, quarterly data are not available for most periods, which does not allow us to use it for the improvement of the model quality. When referring to the statistics of external labor migration, it is possible to obtain non-corrected data; hence, the methodological approach, described hereinafter, tends to be more accurate. Some of the models include up to 8 variables, with the number of observations equal to 23. In case a model has more than 4 parameters, despite the other adequacy criteria, it can be considered overapproximated and hence less trustworthy. To prove the quality of these models, their residuals were tested for normality with a high $\alpha = 0.5$. In case the residuals are normally distributed, it can be stated that they are white noise, proving the adequacy of the fit of the model. All the models are to have a normal distribution of residuals on this confidence level to be considered adequate.

To test the hypothesis, the following approach is used for the male population. Using the Dickey-Fuller test, the presence of a single root in the series describing male migration and international migration of men of working age is revealed. Then, based on the best value for the options "without constant", "with constant", "with constant and trend" and "with constant, trend and quadratic trend", the corresponding ARIMA model is constructed. The orders of the autoregressive process (AR) and the moving average process (MA) parts are selected according to the Akike criterion up to and including the 5th order. Further, the value of the coefficient of determination is checked in the obtained models. An additional criterion is the significance of the coefficients for regressors, verified by the Stu-

dent's test, and the value of the Akike coefficient is preserved. Then, the normality of the distribution of the remnants of the model is checked, and if they are distributed normally, then such a model is accepted as adequate. For both dependent variables, the fit of the model changes to ARIMAX, where, in addition to trend variables (in accordance with the Dickey-Fuller test), regressors are added that characterize marital status and the purpose of arrival in the Russian Federation. Since the correlation matrix for all regressors demonstrates a high correlation of individual regressors, the variant with the main components for all 4 regressors is tested separately, with two main components together and separately for a set of regressors (the first set is "Work", "Single" and the second set is "FamBus", "Family"). For each ARIMAX model resulting from the addition of regressors, all the above procedures are carried out to achieve the adequacy of the specification.

The resulting models are compared by the coefficient of determination and the Akike and Schwartz coefficients. The result of the comparison is the choice of the best model, on the basis of which a conclusion is drawn about the significance of certain regressors in the models.

For the analysis of female international migration, a similar approach is used as for male international migration, however, it is supplemented by the lags of the variables "M" and "M1460". The number of lags is determined using a cross-correlogram of variables before the lag when the correlation decreases to 0.4.

Due to the fact that M and M1460 and Family and Single have an obviously high degree of correlation, as they are derived from the same statistical rows, while the other regressors are independent (Annex 1, *Fig. 1and 2)* the authors set this as a limitation of the study and avoid the use of both factors in one model, where possible without the loss of the model quality. In case both named variables are used, their use is explained from an economic perspective.

Theoretical prerequisites for the migration choice of men and women (for international migration to the Russian Federation)

In general, the reasons for international migration to Russia have been studied in great detail. These include job search, education and tourism, among others. However, migration issues related to family reunification have not been given enough attention, as it is difficult to determine whether a migrant returns to their family or the family moves to Russia. This is because it is difficult to establish the cause of such migration.

It is customary to highlight two key issues here — the problem of integration of migrants, especially those who live in large mononational families, and the challenge of increasing the burden on the social system due to the active influx of migrants into the Russian Federation [16].

In the context of family reunification international migration, these issues can be described as follows: If a migrant worker and his family come to Russia for temporary employment, and their family subsequently relocates to the Russian Federation, their impact, unlike that of the migrant, is negative on the economy as they become net consumers of social benefits [17]. The other opinions, including the controversial influence of families and the influence of the single male migrants on the Russian economy and social policy, are described in several works [18], stating that the negative impact is also significant.

Conversely, if a family member of a migrant is already residing in the Russian Federation as a citizen, and a new individual or individuals join them, they are more likely to establish themselves in Russia, integrate with Russian society, and contribute to economic growth. There are two opposing flows of migrants traveling to Russia in order to reunite with their families. These flows have both economic and social implications for Russian society, with significant consequences.

In order to separate the different types of international migration, it is important to understand the links between them and their impact on overall migration flows. Although the importance of these two types of migration differs among male and female migrants, as shown by practice[1]

[1] Ivakhnyuk I. Labor migration to Russia: a look through the prism of political, economic and demographic trends. 2023. URL: https://russiancouncil.ru/analytics-and-comments/analytics/trudovaya-migratsiya-v-rossiyu-vzglyad-cherez-prizmu-politicheskikh-ekonomicheskikh-i-demograficheskikh/ (accessed on 31.01.2024).

and various studies [19–20], the main reason for male international migration is usually related to providing for a family or improving one's own well-being. The conditions in the receiving country play a significant role in determining whether or not someone will migrate, compared to the conditions in their home country [21].

The main reason for male international migration is often the search for better job opportunities that pay more than what is available in the donor country. This leads to the conclusion that international inequality and poverty in the migrant's home country are often the driving forces behind male international migration. However, it is worth noting that despite the fact that male international migration can lead to some redistribution of resources, there is usually not a significant shift in the overall distribution of wealth between the recipient and donor countries [22]. For example, although the salaries of migrants may be higher than those of locals in some cases, they are still often lower than the average income in the destination country. Additionally, living conditions for migrants are often worse than those of the local population. Despite these challenges, male migrants contribute significantly to the economy of the recipient country through their work, with their value added being higher than the cost of their labor, thanks to more efficient systems of production and allocation of resources. As a result, countries that attract migrants create a driver for their economic growth by further distributing the added value they produce. Considering the geography of international migration, net recipient countries are generally more developed than net donor countries. This is why exporting labor from donor countries does not lead to sustained economic growth but rather allows them to benefit from large income receipts from abroad (including through remittances from migrants).

At the same time, it is worth noting that such dependence on the labor force imposes significant restrictions on the number of workers within the country due to the share of migrants in reducing domestic production. This does not allow for an expansion of the production base and, consequently, an increase in the number of jobs. This is a result of the relationship between the production base (capital) and the amount of labor (including in a classic form such as the Cobb-Douglas function [23]). This restriction contributes to maintaining the traditional demographic model. Extensive reproduction of the population is necessary for further growth in labor exports, as migrant incomes grow slower than producer prices in the recipient country. This leads to a constant increase in the profitability of enterprises that employ migrants, while rising producer prices in key exporting countries[2] generate government spending in the donor countries, which are usually the countries that receive migrants [24].

Based on this pattern, we can see a "vicious circle of male labor migration, with its economic effects concentrated in the recipient countries. This is illustrated in *Fig. 1*. The concept of the "vicious circle of labor migration" was first proposed in the 1990s [25]. However, it has not been analyzed through the lens of migrant gender. Moreover, existing research on the topic has focused on both domestic and international migration. The interconnections described lead to the conclusion that the proposed idea primarily refers to men originating from countries reliant on remittances (such as Tajikistan). Additionally, the vicious circle of male labor migration proposed is found to be relevant to international migration and is considered to be vicious only in the long term.

Based on the above, it can be concluded that international male labor migration, which makes up the majority of male migration flows, does indeed generate positive economic effects for the Russian Federation. However, for donor countries, the outflow of migrants to Russia only provides short-term growth drivers and does not lead to a significant improvement in the well-being of their populations. A multiple increase in the well-being of migrants compared to individuals who choose not to migrate is leading to an expansion in the number of migrants, not just labor migrants.

Unlike men, migrant women do not have the ability to single out one primary factor in their decision-making process regarding migration. This is because the main reasons for female migration differ depending on the destination country [26]. For example, a significant number of migrant women come to the United States for personal reasons,

[2] Erhardt K., Lassmann A. Immigration and International Trade. 2023. URL: https://oxfordre.com/economics/view/10.1093/acrefore/9780190625979.001.0001/acrefore-9780190625979-e-901 (accessed on 31.01.2025).

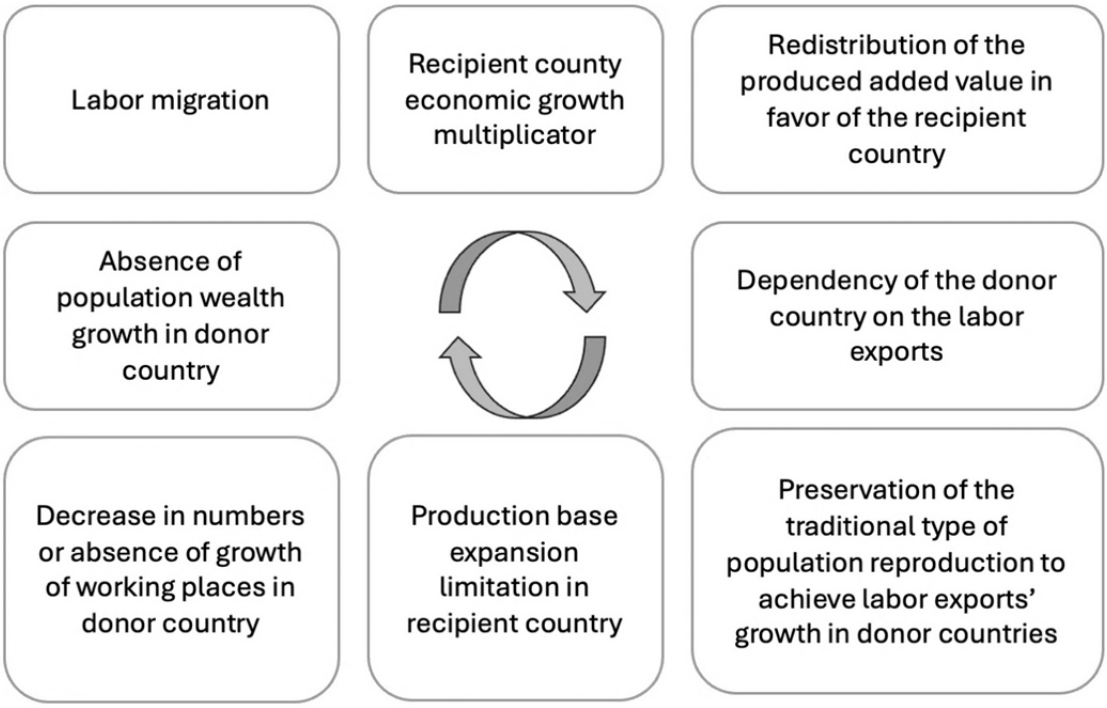

Fig. 1. **The "vicious circle of male labor migration" and the concentration of its economic effects in recipient countries**

Source: Developed by the authors.

such as obtaining citizenship for their child upon birth in the US [27]. In Europe, female migration is often motivated by the search for employment opportunities [28]. In Australia, it is often due to family reunification, where a woman joins a partner who has already established themselves in the country after receiving education and employment [29]. Therefore, it is difficult to identify the single most significant determinant of female migration globally. However, in countries with traditional population patterns, family circumstances and reunification remain essential factors. As *Fig. 1* illustrates, labor migration, primarily involving men, contributes to the continuation of the traditional form of reproduction, which in turn maintains gender-based interdependence in migration flows.

According to estimates by the international law firm IWORLD, the number of migrants worldwide in 2024 reached 281 million international migrants, with a gender ratio of 51.9% (men) to 48.1% (women).[3] The Russian Federation ranks 4th in the world in terms of the number of migrants — 11.6 million, whose ethnic composition is mainly represented by immigrants from post-Soviet states and the increasing migration of women from these countries. For example, in Azerbaijan, the proportion of female migrants in 2021 was a record 69%, followed by Kyrgyzstan (59%), Kazakhstan (57%), Uzbekistan (52%) and Tajikistan (41%). Such a high level of women's involvement in international migration is observed, in particular, among younger age groups, ranging from 20 to 29 years old [11].

In 1885, E. Ravenstein [30] observed in his writings that compared to men, women tended to migrate over shorter distances. However, the situation has since changed in the modern world, and it can now be confidently stated that women do indeed migrate long distances. This is especially true for highly qualified women who do not have families — there is a phenomenon of female labor migration.

Indeed, it is evident from the data that if a woman is able to become a highly skilled professional in her home country, she will migrate in search of work. If she is unable to do so (which is common in traditional societies and less de-

[3] Which country has the most migrants. IWORLD. URL: https://iworld.com/ru/blog/which-country-has-the-most-migrants#:~:text=%D0%A1%D0%BA%D0%BE%D0%BB%D1%8C%D0%BA%D0%BE%20%D0%BC%D0%B8%D0%B3%D1%80%D0%B0%D0%BD%D1%82%D0%BE%D0%B2%20%D0%B2%20%D0%BC%D0%B8%D1%80%D0%B5%20%D0%B2,%25%20%D0%BA%2048%2C1%20%25.

veloped countries), her migration may be due to family circumstances.

In Russia, women's international migration is driven by both the need to reunite families and the search for employment. This is a unique phenomenon, as the lower salaries in Russia compared to other developed countries make long-term employment an additional incentive to migrate. However, the country's well-developed and accessible social support systems make it an attractive destination for those seeking to reunite with their families or start a new life.

The international migration of women to Russia is driven by both the need for family reunification and job search. This is due to the fact that in Russia (especially in large metropolitan cities), salaries are higher than in the countries where migrant women come from.

Based on the analysis of the theoretical background of international migration, it is difficult to provide a clear answer about how and to what extent external international female in the Russian Federation occurs. At the same time, considering the rather conflicting statistics, the factors contributing to international male migration also need to be examined.

Results of the correlation and regression analysis of male and female migration in the Russian Federation

We collected data on external migration flows in the Russian Federation in terms of gender and age for the maximum available period (since 2001). The overall number of observations is 23; due to the yearly frequency of data, the data is available from 2001 to 2023. Statistics on the overall migration flow in the Russian Federation are based on data from population censuses, administrative data (cities, regions, districts), surveys, and statistics from relevant authorities (Federal Security Service, Federal Customs Service, Ministry of Internal Affairs, Federal Tax Service, etc.).

However, statistics on specific types of international migration in Russia, such as family migration, are highly inaccurate due to factors such as work permits and patents being issued only to those migrants who are officially in the country. This makes it difficult to accurately account for the number of arrivals. Secondly, people migrating for family reasons, such as spouses and children following the head of the household to the Russian Federation, distort statistics due to the complexity of family ties and the circumstances surrounding the move [12], making it difficult to accurately account for the number of arrivals.

Table 1

Reasons for moving to the Russian Federation indicated by those crossing the border in 2023 and gender and age composition, %

Reason for moving	
Work	28
Education	12
Family business	47
Other reasons	6
Not stated	5
Gender	
Male	55
Female	45

Source: Rosstat,* developed by the authors.

* Rosstat. Migration. 2024. URL: https://rosstat.gov.ru/folder/12781 (accessed on 31.01.2025).

Other factors that make it challenging to account for the number of arrivals in the country include fictitious declarations of kinship and simplified access to citizenship. This is a topic of discussion not only among scientific communities but also among the highest levels of government.

The lack of strict measures in the Russian Federation over a long period (from the 1990s until 2022) has led to an uncontrolled number of family members being brought in by migrants, including older disabled relatives. This indicates that the impact of migrants on the economy of the host country is controversial. This has led to public criticism of visa-free travel and increased social tensions. According to data from the Border Guard Service and Rosstat, 11% of arrivals in 2023 were elderly and 13% were children.[4]

At the same time, 31% of arrivals by country of origin are from Tajikistan, 10% from Kyrgyzstan,

[4] Entry of foreign citizens into the Russian Federation 2023. Fedstat. URL: https://www.fedstat.ru/indicator/38479

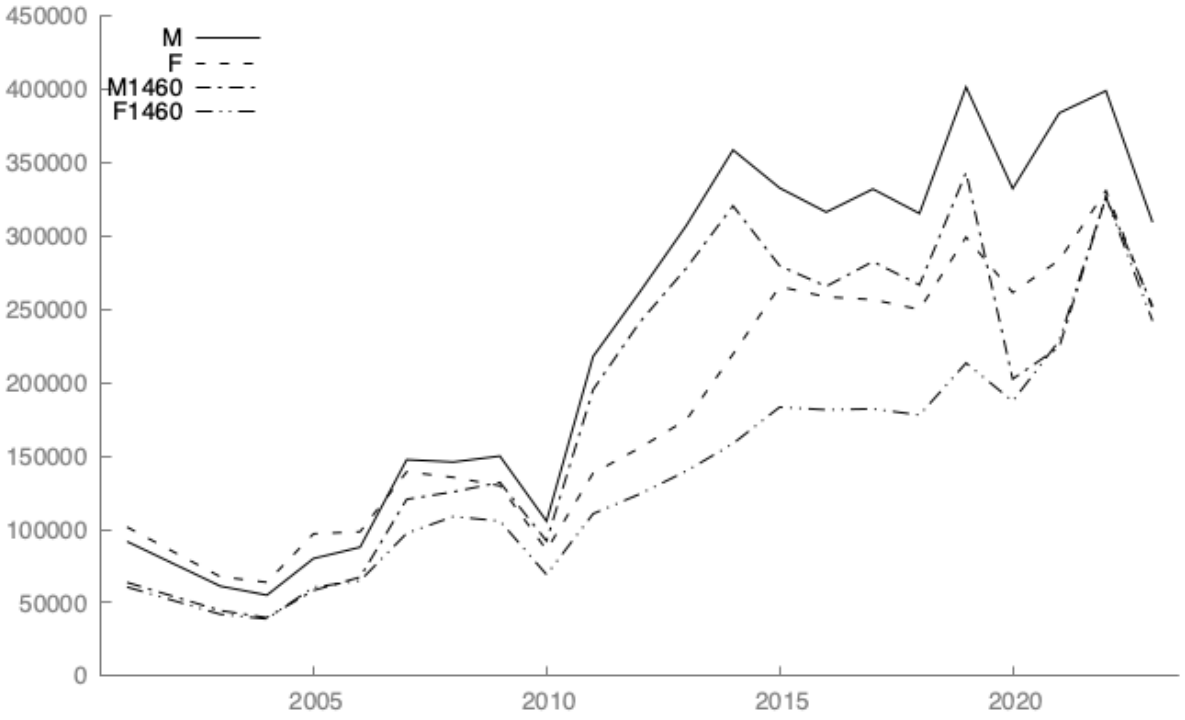

Fig. 2. **International migration dynamics in the Russian Federation**

Source: Compiled by the authors according to Rosstat data* in Gretl.

* Rosstat. Migration. 2024. URL: https://rosstat.gov.ru/folder/12781 (accessed on 31.01.2025).

9% from Armenia, 9% from Kazakhstan, 8% from Uzbekistan, 4% from Azerbaijan, 4% from Moldova, 2% from Turkmenistan, 2% from Belarus.[5]

It is widely known that the number of migrants in the Russian Federation has been growing in most periods since 1993, but the peaks occurred during the stages of active economic growth — in the late 2000s (it was significantly lower than the one in the 1990s) and after 2010 (recovery after the global economic crisis — *Fig. 2*). In other periods, there was a steady increase in migrant arrivals (except during the pandemic periods and the beginning of a special military operation). The dynamics of international migration by gender and by gender and working age are shown in *Fig. 2*.

Based on the collected data, we will model the international migration of men. Uploads of models and correlation analysis are presented in Annex 1 *Fig.1, 2.* Some of the studied series are non-stationary, as a result of which approaches to the construction of ARIMA and ARIMAX models were used to exclude the trend and elevation. *Fig. 3* in Annex 1 represents the real and modelled data, the latter closely follows the real data, proving the high explanatory power of models (along with the adjuster R^2, exceeding 0.91 in all models). The fits of the models used are presented in *Tables 1 to 4* in Annex 1. They allow to conduct the further analysis of the influence of independent variables and its character (positive or negative) on the dependent variable.

The autocorrelation of the M and M1460 series is slightly lower for the 6–8 lag than for the F and F1460 series, which proves a lower dependence on the international migration time of men from previous periods. In the simulation, the order of the AR component is 1 for all migrating men and 4 for M1460, which proves that the working male migrants, or the ones who are capable of work, affect the migration of the same-age males for a significantly longer period of time. For the next year and the 4th year after their arrival their influence is positive, for the 2nd and the 3rd — negative. While immigrating to Russia for working purposes, male migrants leave every year or two to visit their family in their country of origin. The model allows us to conclude that their migration has a specific pattern with a two-year cycle. The data obtained during the modeling process fully

[5] Rosstat revealed the "portrait" of a migrant in Russia. Who enters the country from abroad and for what purposes. RBC. 22.07.2024. URL: https://www.rbc.ru/economics/22/07/2024/669a2afd9a7947271d418486

confirm the theoretical results regarding the dependence of male international migration on the potential income level, regardless of age and whether it is necessary to provide for a family. For example, in the model for men of working age, there is no positive influence of having a family on international migration decision-making (the Family variable isn't a significant variable), while there is a positive influence of its absence (Single) on the international migration of working age men. The absence of lags for the variable F in the regression for male international migration (more precisely, the insignificance of their inclusion) and the much greater importance of cross-correlation for negative lags indicate that having a family for a man is an incentive to migrate (to become a labor migrant), rather than the reason for international migration. At the same time, international migration for family reasons reduces the number of working-age men migrating to some extent. This leads to the conclusion that these reasons act as a barrier to working-age male international migration. Typically, these kinds of reasons for international migration arise when family members face issues or difficulties, so the potential higher income of the male migrant may be less important than his presence with his family.

For the models of female international migration (F and F1460), the best results are demonstrated by the fits, which contain variables of the dynamics of male international migration and their lags. It's worth noting that for female international migration, the first lag has a negative impact on international migration, while the other two have a positive influence. This can be explained by the fact that women tend to migrate in family units less often due to strong family bonds. After a male migrant arrives in the country of employment, women may follow him later in the same year or the following year (the M and M1 variables, representing male international migration, are significant in the model and correspond to the first and second lags of the AR-component). This is supported by the positive influence of family-related reasons for women's international migration and the negative influence of work and single variables — single women migrate less frequently. Work-related reasons decrease female international migration, as do strong family ties among women and the traditional societal roles in the major countries of origin of migrants to Russia, where the role of family keeper is often assigned to women, while the role of breadwinner is reserved for men. Based on this, it can be concluded that the reasons for women's international migration to Russia mostly fit into the logic of international migration for family reasons (women migrate more actively in subsequent periods after the international migration of men).

Another important fact to note is the difference between female international migration in general and the international migration of working-age females. The latter is significantly affected by the first lag of male international migration and is significantly reduced by the first lag of international migration of working-age men. This can be explained by the fact that the aforementioned impacts on female international migration are more significant for younger females and older ones, who depend on male support within the family.

The current shift towards a more liberal society in Central Asian countries and the increase in income of migrants in Russia, which is greatly affected by changes in exchange rates, lead to the potential for one breadwinner within a family (in the narrow sense — husband, wife, parents, and children), who is usually male due to their higher income as working migrants. In this regard, if a working-age male migrant is already in the household, the working-age woman in the family may choose not to migrate, which is more common in traditional societies in the Central Asian region. At the same time, the impact of the migrating male on the family remains the same — he becomes a pull factor for other family members' international migration, which explains the positive effect of male international migration (M1) on female international migration with a one-year delay. The negative effect of female international migration in the previous year is similar to that of a woman.

Special attention should be paid to the fact that the inclusion of a variable characterizing marital status in the models of female international migration worsens not only the quality of the models themselves, but also their explanatory power. *Fig. 3* shows the dynamics of the additional regressors used in the model, which can clarify this situation.

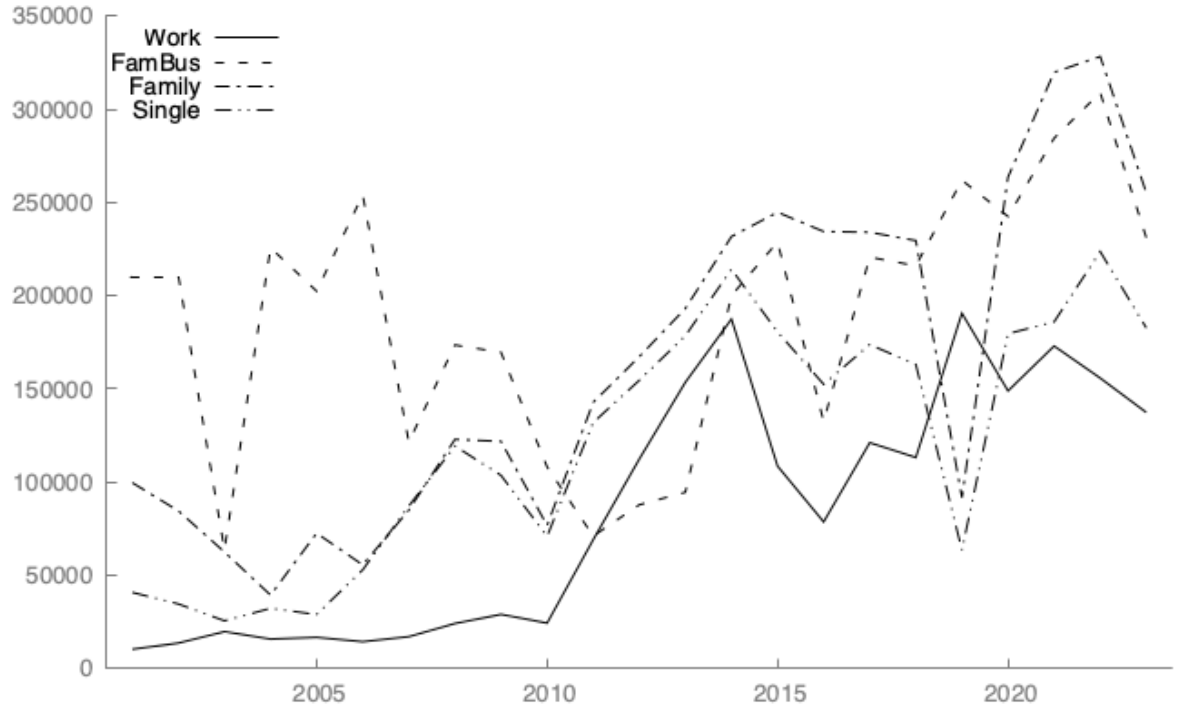

Fig. 3. **Dynamics of international migration flows in the Russian Federation by marital status and purpose of migration**

Source: Compiled by the authors according to Rosstat data* in Gretl.

* Rosstat. Migration. 2024. URL: https://rosstat.gov.ru/folder/12781 (accessed on 31.01.2025).

The steady increase in international migration for family reunification and the rather volatile and dynamic nature of international migration of married and unmarried people clearly indicate that, unlike international migration for work, where statistics are based on the number of work permits issued, statistics on marital status are either incomplete or, due to certain reasons, are distorted by migrants.

The results obtained on female international migration allow us to conclude that due to the traditional type of reproduction and the large size of family units and the prevalence of family ties in the countries from where the main international migration flow is formed in the Russian Federation, there is an influx of migrants who are not in a registered marriage, and then they live in the territory of the Russian Federation or running a joint household (that is why female international migration follows male international migration with a lag of 1 — established male migrants form an "attraction center" for both male international migration (as indicated by the presence of AR components in the male international migration model) and female international migration (for women coming from the same family unit as established male migrants, this is indicated by the importance of male international migration lags in the models for F and F1460).

Discussion

The patterns of international migration of men and women to Russia are characterized by differences between the sexes, which are determined by economic factors such as improving quality of life.

Most of the research on international migration to Russia in the foreign and Russian literature [31] focuses on the issue of accounting for migrants and establishing a migration database, as well as the territorial displacement of the workforce for employment purposes [32], resulting in a geographical redistribution of the workforce. Migration for educational purposes is also a significant aspect [33].

We believe that issues related to gender disproportionality in international migration to Russia, including labor and family international migration, require more detailed analysis. The specifics of gender-based international migration have been less studied than, for instance, age-related migration.

It is also worth noting that there is a rather weak level of elaboration on the topic of international migration to Russia for family reasons in the Russian literature. Unlike foreign practices, there are currently no studies in the Russian Federation that contain general data on this type of international migration. Specifically, there are no studies that can demonstrate the essence, scale, and dynamics of family international migration due to the lack of involvement of statistics in scientific research [12].

The conducted research, using the method of modeling international migration to Russia based on gender and family factors, allows us to:

— Confirm the theoretical results regarding the dependence of male international migration on potential income levels, regardless of age or whether it is necessary to support a family.

— Conclude that the reasons for female international migration to Russia are mostly related to family-based international migration (women are more active in migrating after the international migration of their partners).

The results of the study confirm the hypothesis about the incompleteness of Russian statistical data and show that statistics are distorted when additional variables are included. It is noteworthy that there are few scientific papers analyzing international migration and explaining its fluctuations over time.

It is also important to note that the formation of attraction centers for both male and female migrants makes the assimilation of these individuals in the Russian Federation more challenging. In fact, the influx of migrants can vary depending on the current working conditions, currency, and regulatory factors. However, the overall trend in international migration dynamics within the Russian Federation remains relatively stable.

Due to the existence of these attraction centers, closed migrant communities develop around individual leaders. This can lead to social risks, as these communities may not fully integrate into the local society. It also seems to be a significant concern that, in such circumstances, traditional migration control measures become ineffective. Either their drastic tightening is necessary, which would cause both social and economic unrest, or if the current regulation remains unchanged, the Russian Federation runs the risk of facing a migration crisis.

Social tensions and the growth of additional budget expenditures on medical care and education for family members, as well as subsidies to large migrant families in the Russian Federation, require proposals to mitigate the negative effects of international migration to Russia. In particular, the authors propose to revise Russian migration legislation in terms of: expanding the list of countries with which the Russian Federation has a visa regime; introducing compulsory medical insurance upon entry of migrants into Russia; as for labor international migration, to draw the attention of the legislative body to the experience of using the shift method in other countries for labor migrants, since today migrants move freely through the regions of Russia and their quantitative "concentration" is becoming too obvious in large cities with a higher standard of living; a mandatory column in the migration card, which will indicate the future location the work of a person entering the country for the purpose of employment; establish a ban on changing jobs in order to eliminate the shortage of personnel in the regions; To tighten the requirements for migrant families (especially low-skilled migrant workers) to obtain a residence permit and Russian citizenship.

Conclusion

The study formulates the main principles of the "vicious cycle of male migration" and its effects on the donor and receiving countries of migrants. It has been proven that the receiving country receives a long-term engine of economic growth, in contrast to the donor country, where such growth drivers are either non-existent or short-lived. Migrants make a decision to migrate primarily in order to improve their living standards.

Male migrants play a more significant role in the cycle, while women have a lesser impact on the effects on the receiving economy.

One of the main findings of the study is that the factors influencing male and female international migration to the Russian Federation differ. Male international migration is driven by factors such as improving living standards and labor international migration, whereas for women, labor international migration may be less significant compared to family international migration. In fact, in Russia, there is a

pattern of female international migration where a woman follows a man and only then obtains employment, if necessary, switching her migrant status from family to labor for work reasons.

Due to the international migration patterns identified in the regression analysis, we have found that there are "attractors" in the Russian Federation — individuals or groups who, regardless of economic and social circumstances, stimulate the influx of migrants into the country. This makes it difficult to control the process and can lead to social risks due to the inability of migrants to assimilate. At the same time, male migrants act as attractors for both male and female international migration into the Russian Federation.

ACKNOWLEDGEMENTS

The article was prepared on the account of the budget funds of the Research Institute for the state assignment of the Financial University.

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Annex 1

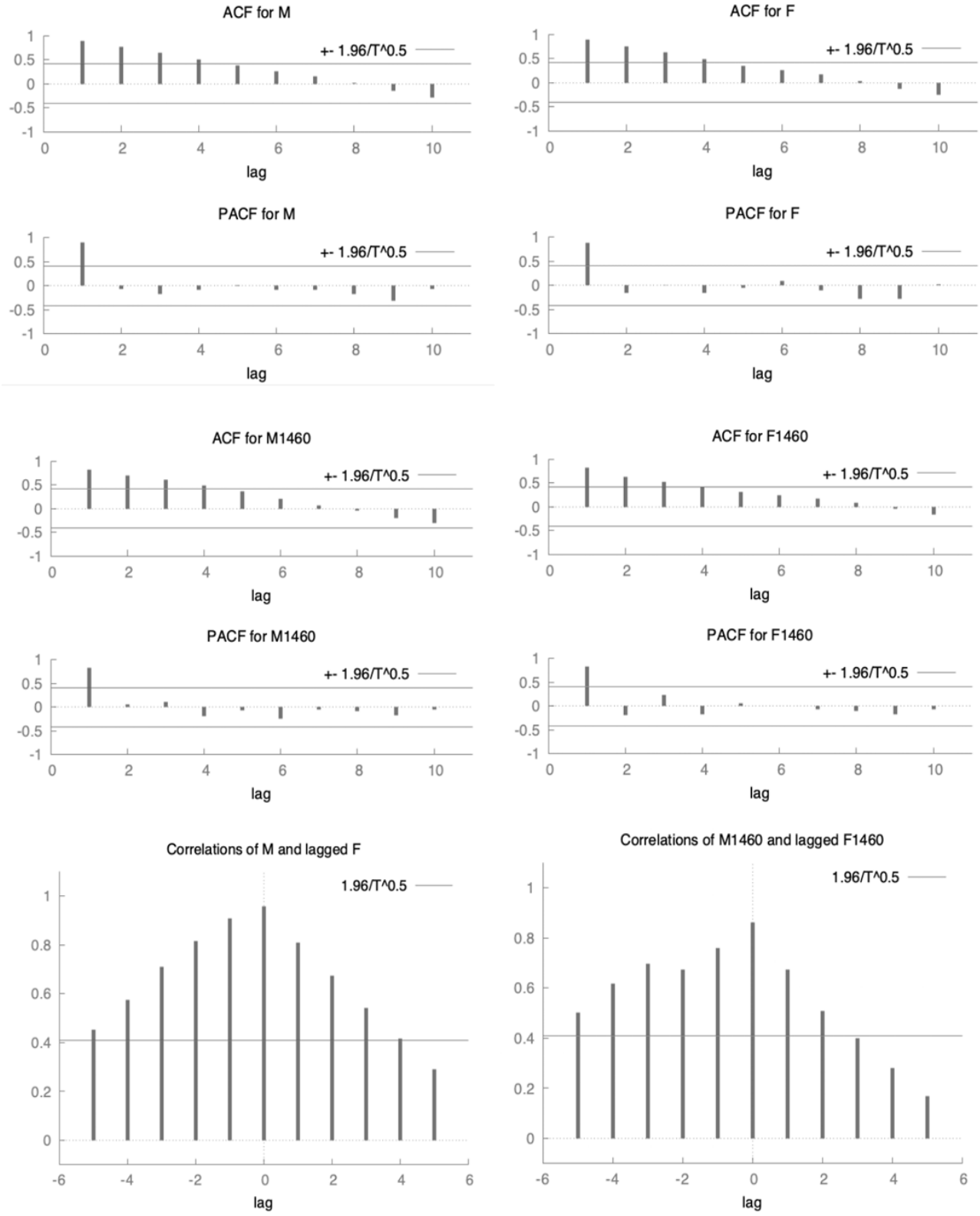

Fig. 1. **Correlograms for dependent variables and cross-correlograms for dependent variables F — M и F1460 — M1460**

Source: Developed by the authors in Gretl.

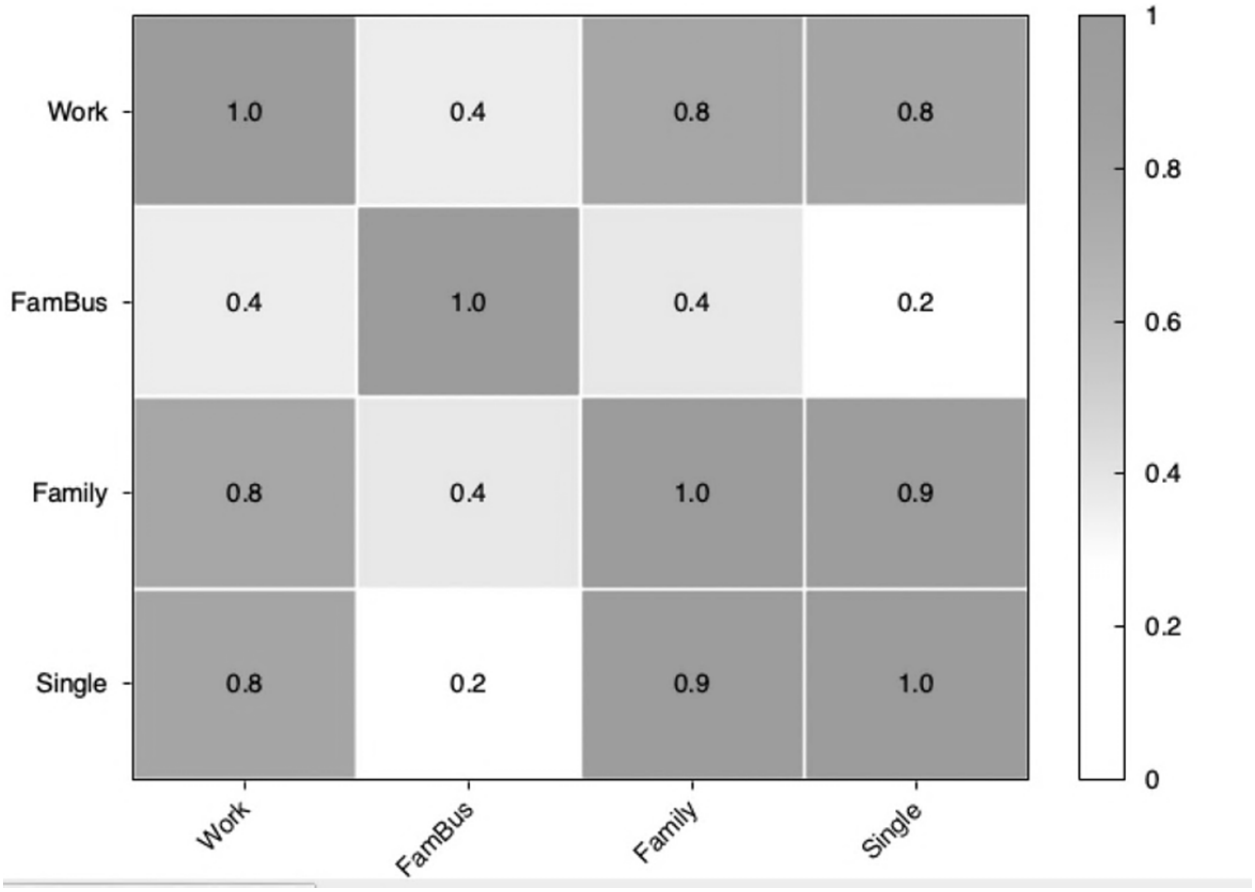

Fig. 2. **Correlogram for independent variables**

Source: Developed by the authors in Gretl.

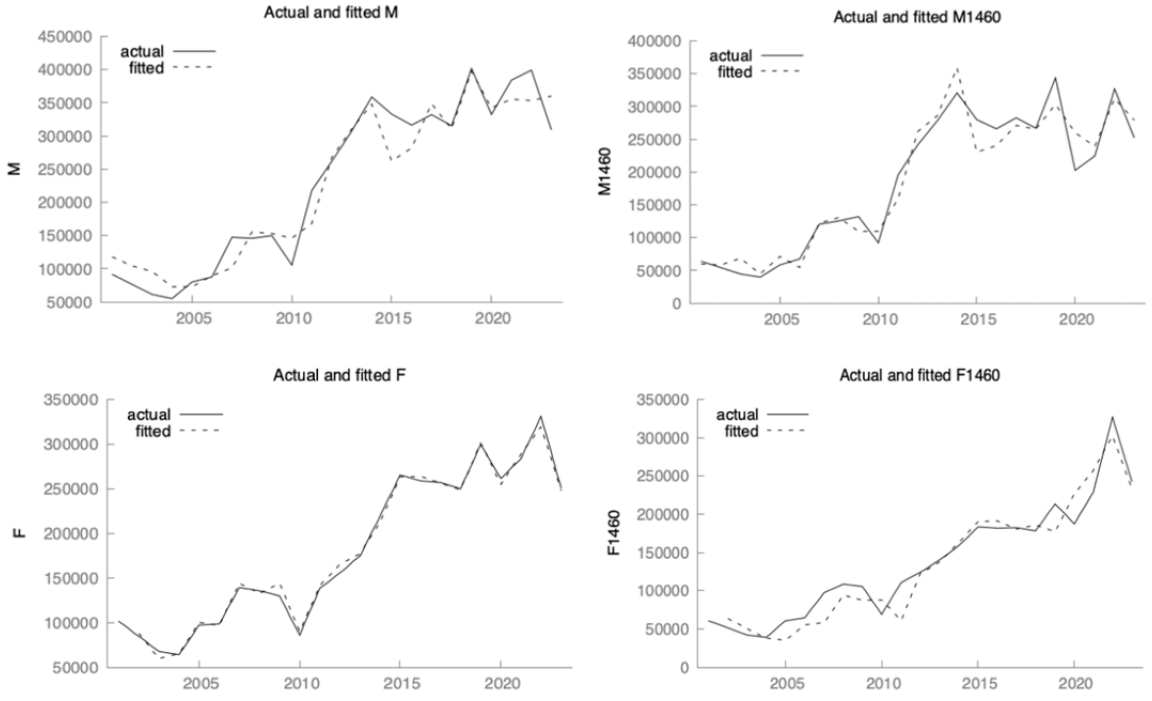

Fig. 3. **Real data and model results for M, F, M1460 and F1460 as dependent variables**

Source: Developed by the authors in Gretl.

Table 1

Model fit: dependent variable: M, observations 2001–2023 (T = 23)

	Coefficient	St. error	z	p-value	
const	123994	34186.1	3.627	0.0003	***
phi_1	0.808759	0.142088	5.692	<0.0001	***
Work	1.19870	0.251695	4.763	<0.0001	***
Mean dependent var	229273.5		S.D. dependent var	124015.6	
Mean innov.	2370.746		S.D. innov.	30646.67	
R-squared	0.938557		Adj. R-squared	0.935631	
Log-likelihood	−270.7628		Akaike crit.	549.5256	
Schwarz crit.	554.0676		Hannan-Quinn	550.6679	
	Re(z)	*Im(z)*	*Modulus*	*Frequency*	
AR					
Root 1	1.2365	0.0000	1.2365	0.0000	

Source: Developed by authors in Gretl.

Normal error distribution test null hypothesis: errors are normally distributed

Test statistic: Chi-square (2) = 1.17247.

p-value = 0.556418.

* – significant on 10% confidence level.

** – significant on 5% confidence level.

*** – significant on 1% confidence level.

Table 2

Model fit: dependent variable: M1460, observations 2001–2023 (T = 23)

	Coefficient	St. error	z	p-value	
const	58100.4	14281.8	4.068	<0.0001	***
phi_1	0.548228	0.178017	3.080	0.0021	***
phi_2	−0.661834	0.194760	−3.398	0.0007	***
phi_3	0.508919	0.198181	2.568	0.0102	**
phi_4	−0.753593	0.149435	−5.043	<0.0001	***
Work	1.37523	0.0991759	13.87	<0.0001	***
FamBus	−0.139990	0.0633199	−2.211	0.0270	**
Single	0.347311	0.0941104	3.690	0.0002	***
Mean dependent var	186102.8		S.D. dependent var	103413.1	
Mean innov.	−704.8029		S.D. innov.	24976.91	
R-squared	0.939209		Adj. R-squared	0.916412	
Log-likelihood	−267.4098		Akaike crit.	552.8196	
Schwarz crit.	563.0390		Hannan-Quinn	555.3898	
	Re(z)	*Im(z)*	*Modulus*	*Frequency*	
AR					
Root 1	0.7893	−-0.7413	1.0828	−0.1200	
Root 2	0.7893	0.7413	1.0828	0.1200	
Root 3	−0.4517	−0.9632	1.0638	−0.3198	
Root 4	−0.4517	0.9632	1.0638	0.3198	

Source: Developed by the authors in Gretl.

Normal error distribution test null hypothesis: errors are normally distributed.

Test statistic: Chi-square (2) = 0.674639.

p-value = 0.713681.

* – significant on 10% confidence level.

** – significant on 5% confidence level.

*** – significant on 1% confidence level.

Table 3

Model fit: dependent variable: F, observations 2002–2023 (T = 22)

	Coefficient	St. error	z	p-значение	
phi_1	−0.600891	0.214828	−2.797	0.0052	***
phi_2	0.651611	0.211227	3.085	0.0020	***
phi_3	0.402378	0.241368	1.667	0.0955	*
Work	−0.689583	0.0384655	−17.93	<0.0001	***
FamBus	0.132494	0.0180636	7.335	<0.0001	***
Single	−0.142023	0.0240191	−5.913	<0.0001	***
M	0.946787	0.0336382	28.15	<0.0001	***
M_1	0.123825	0.0251423	4.925	<0.0001	***
Mean dependent var	7909.095		S.D. dependent var	34923.63	
Mean innov.	954.0770		S.D. innov.	5774.622	
R-squared	0.995512		Adj. R-squared	0.993096	
Log-likelihood	−212.7127		Akaike crit.	443.4255	
Schwarz crit.	452.8262		Hannan-Quinn	445.4657	
	Re(z)	*Im(z)*	*Modulus*	*Frequency*	
AR					
Root 1	−1.3066	0.0000	1.3066	0.5000	
Root 2	1.2316	0.0000	1.2316	0.0000	
Root 3	−1.5444	0.0000	1.5444	0.5000	

Source: Developed by authors in Gretl.

Normal error distribution test null hypothesis: errors are normally distributed.

Test statistic: Chi-square (2) = 0.234801.

p-value = 0.889229.

* — significant on 10% confidence level.

** — significant on 5% confidence level.

*** — significant on 1% confidence level.

Table 4

Model fit: dependent variable: F1460, observations 2002–2023 (T = 22)

	Coefficient	St. error	z	p-value	
phi_1	0.803345	0.366529	2.192	0.0284	**
theta_1	−0.669077	0.396879	−1.686	0.0918	*
M_1	1.33722	0.150252	8.900	<0.0001	***
M1460_1	−0.917938	0.187615	−4.893	<0.0001	***
Mean dependent var	140806.0		S.D. dependent var	74884.53	
Mean innov.	4422.625		S.D. innov.	21793.77	
R-squared	0.923090		Adj. R-squared	0.910272	
Log-likelihood	−251.0270		Akaike crit.	512.0540	
Schwarz crit.	517.5093		Hannan-Quinn	513.3391	
	Re(z)	*Im(z)*	*Modulus*	*Frequency*	
AR					
Root 1	1.2448	0.0000	1.2448	0.0000	
MA					
Root 1	1.4946	0.0000	1.4946	0.0000	

Source: Developed by authors in Gretl.

Normal error distribution test null hypothesis: errors are normally distributed.

Test statistic: Chi-square (2) = 0.507.

p-value = 0.77589.

* — significant on 10% confidence level.

** — significant on 5% confidence level.

*** — significant on 1% confidence level.

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.
The article was submitted on 06.02.2025; revised on 28.02.2025 and accepted for publication on 10.03.2025.
The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2308-944X-2025-13-1-24-42
UDC 338,336(045)
JEL O11, O16, O55, C 33, O40, G10

The Relationship Between Financial Development and Economic Growth in Nigeria

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ABSTRACT

This study aims to investigate the complex relationship between financial development and economic growth in Nigeria, examining the short-run and long-run dynamics through a comprehensive time series analysis spanning 1981 to 2023. The research seeks to evaluate the impact of financial development on economic growth while considering critical macroeconomic factors. **The study employs** a robust methodological approach, utilising the autoregressive distributed lag (ARDL) model complemented by bounds testing. The investigation incorporates control variables, including government expenditures, investment, trade openness, oil prices, and labour force, to provide a comprehensive economic assessment. **The empirical results** reveal a subtle relationship between financial development and economic growth in Nigeria. Despite confirming long-run cointegration among variables, the financial development index does not demonstrate statistically significant impacts on economic growth in either short- or long-run scenarios. However, the labour force emerges as the primary catalyst for economic expansion, with a 1% increase associated with a substantial 16.77% increase in real Gross Domestic Product (GDP) in the short term and a 1.48% increase in the long run. The study **conclusion** challenges conventional wisdom regarding the finance-growth nexus in developing economies. The findings highlight the critical role of human capital in Nigeria's economic trajectory while revealing potential inefficiencies in financial sector development and capital allocation. **This research contributes** to the ongoing discourse on financial development and economic growth by providing a comprehensive, contemporary analysis of Nigeria's economic landscape.

Keywords: financial development; economic growth; ARDL; cointegration; development economics; developing economies; Nigeria; Africa

For citation: **Adebayo T.A. The relationship between financial development and economic growth in Nigeria.** ***Review of Business and Economics Studies*****. 2025;13(1):24-42. DOI: 10.26794/2308-944X-2025-13-1-24-42**

ОРИГИНАЛЬНАЯ СТАТЬЯ

Взаимосвязь финансового развития и экономического роста в Нигерии

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АННОТАЦИЯ

Целью данного исследования является изучение сложной взаимосвязи между финансовым развитием и экономическим ростом в Нигерии, основанное на анализе краткосрочной и долгосрочной динамики комплексных временных рядов за период 1981–2023 гг. Исследование направлено на оценку влияния финансового развития на экономический рост с учетом важнейших макроэкономических факторов. В исследовании используется надежный **методологический подход** с применением модели авторегрессионного распределенного лага (ARDL), дополненной тестированием границ. Для получения комплексной экономической оценки исследование включает ряд контрольных переменных, в том числе государственные расходы, инвестиции, открытость торговли, цены на нефть и численность рабочей силы. **Эмпирические результаты** показывают сложную взаимосвязь между финансовым развитием и экономическим ростом в Нигерии. Несмотря на подтверждение долгосрочной коинтеграции между переменными, индекс финан-

сового развития не демонстрирует статистически значимого влияния на экономический рост ни в краткосрочных, ни в долгосрочных сценариях. Тем не менее рабочая сила выступает в качестве основного катализатора экономического роста с ростом на 1%, связанным с существенным ростом реального валового внутреннего продукта (ВВП) на 16,77% в краткосрочной перспективе и ростом на 1,48% — в долгосрочной. **Выводы** исследования ставят под вопрос общепринятое представление о взаимосвязи финансов и экономического роста в развивающихся странах. **Полученные результаты** подчеркивают важную роль человеческого капитала в развитии экономики Нигерии, одновременно выявляя потенциальную неэффективность в развитии финансового сектора и распределении капитала. Данное исследование вносит **вклад** в научную дискуссию о финансовом развитии и экономическом росте, предоставляя всесторонний современный анализ экономического ландшафта Нигерии.
Ключевые слова: финансовое развитие; экономический рост; ARDL; коинтеграция; экономика развития; развивающиеся экономики; Нигерия; Африка

Для цитирования: **Adebayo T.A. The relationship between financial development and economic growth in Nigeria. *Review of Business and Economics Studies*. 2025;13(1):24-42. DOI: 10.26794/2308-944X-2025-13-1-24-42**

1. Introduction

In recent decades, the role of financial intermediaries in financing economic growth has received a lot of attention in the literature. Economic growth is a core macroeconomic policy goal for many less developed countries where policymakers frequently seek actions that promote economic growth because of the favourable effects on employment and labour earnings. Financial liberalisation and financial repression policies have been debated in the finance industry, with differing effects on growth. However, there has been no agreement on the significance of the finance-growth relationship. According to Ogun [1], the challenge in addressing this disagreement is due to the diverse meanings of financial development.

Economic growth is usually measured by the growth in the Gross Domestic Product (GDP) because GDP measures the value of all final goods and services in the economy in consideration. While financial deepening reflects enhancement in the roles of financial intermediaries, it depicts improvements in the efficiency of borrowers in obtaining funding that meets investment purposes [1, 2]. Financial development is beneficial in and of itself since it improves resource allocation efficiency and allows savings to be successfully mobilised and channelled into productive projects. Furthermore, better-functioning markets boost the effectiveness of economic interventions [3]. As a result, the study of the connection between financial development and economic growth has raised much interest.

Financial development is a dynamic, complex and idiosyncratic process of economic change that cannot be understood based on simplistic monetary measures. The phenomenon of financial development at its core is multidimensional and evolves as the capacity of an economy to mobilise, allocate, and use financial resources increases. This is not a quantitative increase in the size of financial institutions, but rather a sophisticated combinative process of structural, institutional, and technological changes that fundamentally change how economic interaction occurs. From Schumpeter's perspective, which highlighted the innovative role of financial intermediation, to the current Schumpeterian ideas of innovative financial intermediation and a growing corpus of institutional economics, the idea of financial intermediation has been widely accepted as a significant driver of economic modernisation. Financial systems play an active role, not only in response to economic growth but also in creating mechanisms that determine risk management and capital allocation in the realm of traditional banking functions [4].

The transformative nature of financial development in emerging economies such as Nigeria is clear, where financial systems have to simultaneously cope with historical infrastructural challenges and respond to swift technological innovations. Modern financial development encompasses a broad spectrum of elements, covering everything from the rollout of formal banking services to remote rural areas to the advent of digital financial technologies that democratise access to financial resources. This goes beyond the volume of transactions; it also entails the quality of financial intermediation, the sophistication of financial instruments, and robust frame-

works for regulation that can support economic dynamism [5].

Financial development has dramatically changed with the advancements in technology. Blockchain technologies, mobile banking platforms and intricate algorithms in finance have transformed how financial services have been conceived and delivered. Understanding the innovation behind these financial services has the potential to clear away traditional barriers to financial exclusion, paving the way for new pathways to economic participation that were out of the question just a few decades ago. This means moving out of the existing traditional banking models to build more inclusive, efficient and responsive financial ecosystems [6].

In developing economies with structural heterogeneity and historical economic constraints, it is a complex undertaking fraught with many trade-offs and challenges. Its effectiveness rides on a combination of how developed the institutional capabilities are, what type of regulatory frameworks are in place, what technological infrastructure is in place, and, of course, the human capital development. Financial development is important despite the narrow immediate economic metrics. It is a fundamental mechanism through which their adaptive capacities and possible resilient pathways into economic uncertainties can be enhanced to create more inclusive pathways of economic participation. Financial development is not only about financial institutions but also about creating more sophisticated, efficient, and equitable respondent systems that can navigate the complexity of contemporary global economic landscapes [7].

Some scholars align with Joseph Schumpeter that increased functionality of the financial institutions enhances real sector innovations that boost economic growth; however, others view financial development as a result of economic development [3]. Levine [8] observed that certain economists, particularly in the field of development economics, had not always seen finance as crucial to the actual economy. Nonetheless, with the increasing application of technology to finance via blockchains, internet banking, automated teller machines (ATM), bank verification numbers (BVN), the possibility of a link cannot be completely disregarded. This study follows suit in examining the nature of this link in the context of the Nigerian economy.

There are numerous financial restructuring experiments in less developed nations that have been occasioned by the belief that financial development leads to economic development [9]. In a bid to enhance the efficiency and stability of the financial sector in Nigeria, the following prudential and economic regulatory policies have been adopted. The Nigerian banking sector, after its independence, had been controlled under strict regulations until the liberalisation of the Structural Adjustment Program (SAP). The sector of regulated commercial banks grew rapidly, rising from 40 in 1986 to 120 in 1993. Regulations were then reinstated in 1994, and recapitalisation and consolidation in 2004 reduced the number of banks to 25 [10]. According to Vittas and Mundial [11], while regulations are frequently employed to remedy market failures in the financial system, financial restructuring could also be used to impact the macroeconomy through loan growth and price stability.

Consequently, the purpose of this paper is to establish the empirical link between financial system development and economic growth in Nigeria. The author aims to evaluate both the short-run and the long-run co-integration between economic growth and financial development in Nigeria. The result of the study will be relevant to the formulation of development policy in Nigeria. After estimating the ARDL model of financial development and economic growth, the author seeks the existence of cointegration. The following is the breakdown of this paper. Section 2 is a literature review that explores the theoretical and empirical literature on the role of financial development in economic growth. Section 3 explains the empirical methods and data employed when conducting the empirical study. The author offers the estimation results and analyses conclusions in the fourth section. Section 5 contains the final observations, policy recommendations, and research ideas for the future.

2. Review of the literature

2.1. Theoretical review

Several theoretical predictions on the relationship between financial development and economic growth have been mentioned in the literature on financial development. As such, there are arguments supporting and opposing the line of thought that holds that financial de-

velopment increases the long-run growth rate. This section reviews theories suggesting that financial development fosters economic growth, specifically the demand-following and supply-leading theories.

The demand-following hypothesis postulates that changes in the real economy have to lead to corresponding changes in the financial economy. The growth-finance hypothesis, otherwise known as 'supply response, in the growth of the financial system', argued by Patrick [12], states that growth creates more demands; hence, the supply side responds to the growth of the financial system. Complex economic growth requires the formation of many new financial institutions, as well as their products, securities, and contractual relations with genuine financial investors and savers. As such, the financial market answers such requests. The demand-following hypothesis assumes that there is high entrepreneurship sensitivity to the availabilities of financial services with respect to the perceived new opportunities to earn profits out of financial services, whereby sufficient numbers of new forms within financial service institutions appear.

The supply-leading hypothesis, on the other hand, argues that the financial sector's development leads to real sectors' development. To elaborate, the supply-leading theory can be explained using the finance-led hypothesis. It presumes the existence of "financial institutions and the supply of their financial assets, liabilities, and related financial services ahead of demand." This would effectively channel resources from the surplus units to the deficient ones, thereby leading the other economic sectors in their development process [12].

The supply-leading concept has been referred to as innovation financing by [13]. He noted that efficiency gains accompany innovations to ensure that quality banks can identify the most probable winners and source funding for these potential technological innovators who can convert these ideas into reality in the form of new and innovative products and improved production techniques [8]. There are other theories, such as Keynesian and monetary growth theories, as well as Mackinnon and Shaw models, that also depict supply-leading concepts. However, there are differences in their belief about the role of the government and the mechanism of interest rates in the money market. As Brenner [14] pointed out, history and nature all testify that real interest rates tend to go up to the full employment level and can only be cut by government intervention to spur economic growth.

On the growth advantages of finance, the money and growth model as proposed by Tobin [15] also supports low or regulated interest as beneficial to growth. Since families have two commodities: money and productive capital, he realised that with a higher ratio of return receivable on capital as compared to money, there would, of course, be a higher proportion of capital to money as held in the hands of households. This results in a higher capital/labour ratio, higher labour productivity, and thus higher economic growth. Therefore, an action that shrinks the interest rate or the rate of return on capital leads to a higher rate of economic expansion.

2.2. Empirical review

Some other empirical papers relating to financial development and economic growth can also be found in the literature. Various estimating techniques have also been applied across several countries to test the existence of a co-integration relation between the variables. These investigations likewise produced diverse results: evidence for the demand-following theory, evidence for the supply-leading hypothesis, and both positive and negative relations.

Alenoghena et al. [16] stressed the non-linear relationship between financial sector development and economic growth in the Nigerian context. In the paper, the proxies for financial development included broad money and credit to the private sector, while the Nonlinear Autoregressive Distributed Lag (NARDL) method was employed to determine whether the interaction between financial development and GDP growth was asymmetric. The authors applied the threshold regression to ascertain the turning point for the variables in the research. The co-integration test indicates that there is a co-integration between the variables representing financial development factors and economic growth with an asymmetrical 'U' shaped relationship.

Ayinde and Yinusa [17] used the quantile regression method and data covering 1980 to 2013 to dissect and analyse the dynamics of financial development and inclusiveness of growth in Ni-

geria. They assert that the ninety percentile is the critical level of financial development that impacts inclusive growth and that the impact of financial development on inclusive growth varies depending on the measure of financial development utilised. However, in their Granger causality studies, causality runs from inclusive growth to financial development.

Choong and Chan [18] argue that financial deepening facilitates the process of economic growth, while on the same note, economic growth facilitates the process of financial development. Thus, financial intermediation plays a significant role in the process of saving. Similarly, the study by Akpansung and Babalola [19] aligns with the findings of Hussain and Chakraborty [20] and Nasir et al. [21], which concluded that financial sector development positively impacted growth by promoting saving, increasing the efficiency of the funds available for borrowing, and accumulating capital. In the context of what drives growth, Beck and Levine [22] analysed the relationship between financial development and economic growth and the determinants of growth in terms of private savings rates, capital accumulation, and total factor productivity. To ensure that the variables were truly exogenous, generalised method of moments (GMM) and instrumental variables (IV) were used, and the study discovered that financial development contributed towards a higher growth rate of economic growth and total productive factor.

Moreover, Adusei [23] also presented confirmatory arguments that spoke to the line of reasoning in support of the evidence of the relationship between financial development and growth and the two-way interaction between the two after analysing the correlation between financial development and growth in the 24 selected African countries within the period 1981–2010. Chukwu and Agu [24] analysed the relationship between financial development and economic growth by applying a multivariate Vector Error Correction Model (VECM) in Nigeria for the period 1971–2008 and revealed a long but mixed dependence on the type of financial advancement measure used. This proves that the demand-following theory is correct when the banking sector, private sector credit, and real broad money supply are taken as financial depth indicators, and, at the same time, the supply-leading hypothesis is true when the loan deposit ratio and the bank deposit liability indicators are used.

Nonetheless, one might identify that the existing and relatively newer models of financial development and its impact on growth, together with the corresponding methods, appear to be influenced by these various researchers' viewpoints on the theoretical part of money and finance in the economy, embracing the new emerging methods. Therefore, based on the foregoing, it is only clear that what is never tied to money or finance has a predominant role in real sector growth and is therefore easily identifiable in less developed economies. Such economies are characterised by a relatively less developed institutional structure of the financial sector with many more innovations and a large informal economy based on barter and trade centres.

2.3. Institutional economics and economic development: A comprehensive theoretical and empirical exploration

The relationship between institutional structures and economic growth has been a dominant area of study, mainly in countries like Nigeria that are in the stages of development. The work of institutional economists, with recent Nobel laureates and leading scholars, did not just enrich our understanding of how institutions work in shaping economic trajectories but also provided us valuable guidance on how we might sustain the institutions for prosperity while also offering protection from the forces that deplete them. Fundamentally challenging the traditional neoclassical economic approach, the theoretical foundation of institutional economics foundation stresses the crucial role of formal and informal institutions in the development process. Conceived on the basis of the seminal work of North [25], institutions are understood as complex and multidimensional "game rules" including both explicit constraints (constitutional environments, legal frameworks, property rights) and implicit constraints (social norms, cultural practices, and behavioural stereotypes).

A more dynamic interpretation of the development of institutions is given by Acemoglu and Robinson [26] in "The Narrow Corridor," in which they place economic progress in a small corridor between state power and societal power to be achieved. This perspective in the Nigerian context

suggests a complex institutional space with an overlay of patrimonial governance models superimposed on inherited colonial administrative structures and emerging democratic institutional mechanisms. The postured picture of Nigeria's institutional development also makes a compelling case study on the institutions' history of transformation, and despite the existence of post-colonial frameworks to support their economic development, there have been much-needed changes to post-colonial economic structures that have alluded to the centralisation of economic resources and participation and the extensive expanse of governance inefficiencies.

Okonjo-Iweala [27] noted that these institutional constraints have systematically obstructed sustainable economic development, generating a highly unyielding economic environment for financial intermediation and economic growth. Rodrik [28] further explains the understanding of institutional effectiveness, stating there is no rhizome in institutional development. Instead, the institutional frameworks that succeed must be contextually adaptive, and responsive to specific local economic, social and cultural conditions. This means that for Nigeria, institutional reforms, as for any country, should be carefully calibrated and based on unique historical and cultural complexities. There is consistent empirical evidence that efficient financial intermediation requires high-quality institutions. The emergence of digital technologies, blockchain and artificial intelligence has both challenges and opportunities for institutional transformation. Tapscott and Tapscott [29] explored how these technologies can help bring greater institutional transparency, lower transaction costs, and promote greater adaptive governance mechanisms. The Nigerian economy encompasses some of the most challenging problems of institutional development. Regulatory inconsistency, systemic corruption, limited technological infrastructure and complex ethnic and regional economic disparities continue to be persistent challenges. In contrast, recent research also points to some emerging opportunities. Getachew and Fon [30] indicate that adaptive institutional design and strategic policy intervention may overcome these historical constraints.

However, comprehensive institutional analysis such as strengthening property rights protection, establishing robust, flexible and transparent regulatory frameworks, implementing mechanisms of transparency and accountability, contributing to developing digital infrastructure, developing financial education and supporting entrepreneurial ecosystems, provides policy implications with some strategic interventions. The understanding of this implies that institutional development in developing economies such as Nigeria will require adaptive, context-specific approaches that take into account the reciprocal dynamics between formal structures and informal social dynamics.

3. Data and methodology

3.1. Data

This paper analyses data collected from 1981 to 2023, using data from the International Monetary Fund (IMF), the British Petroleum (BP) Statistical Review of World Energy, and World Bank Development Indicators. Real GDP is used for economic growth, while the IMF uses an average financial development index to communicate many aspects of financial development, such as financial depth, access to finance, and financial efficiency. The following control variables are included to capture other important factors influencing Nigerian economic growth: crude oil price, which is the average world oil price per cubic meter based on current US dollar; government consumption, which is fiscal policy as a percentage of GDP; trade, which is the trade openness as a percentage of the GDP; total population, which represents the labour force; Gross fixed capital formation, which represents the net investment as a percentage of GDP. This helps mitigate the incidence of endogeneity in the model to remove the omitted variable bias [31].

3.2. Financial Development Index: Conceptualisation and measurement

This study employs the Financial Development Index (FDI) as a comprehensive measure of the multi-dimensional dimensionality of financial sector development, overcoming the narrowness of single-dimensional metrics and building on a sophisticated theoretical framework that considers financial development as a multifaceted and complex phenomenon beyond simple monetary indicators. The index is constructed through a rigorous methodological approach that synthesises three primary dimensions of

Table 1
Variables used in the model

Abbreviation	Full Meaning
LOG_RGDP	Log Real GDP (Naira)
LOG_FDI	Log Financial Development Index
LOG_GEXP	Log General Government Final Consumption Expenditure (% of GDP)
LOG_INV	Log Gross Capital Formation (% of GDP)
LOG_TRADE	Log Trade (% of GDP)
LOG_OIL	Log Oil — Crude Prices (US$)
LOG_LAB	Log Total Population

Source: Compiled by the author.

financial development: financial depth, financial access and financial efficiency. Financial access reflects people's and businesses' capacity to rely on financial services. While the traditional banking metrics are documented, this dimension extends the discussion to include broader indicators of financial inclusion. Researchers measured the penetration of financial services through regressions using the number of bank branches, the amount of digital financial service adoption, and credit availability to small and medium enterprises.

The efficiency dimension offers insights into productivity and performance among financial intermediaries. The index captures the operational effectiveness of the financial system by examining indicators such as bank overhead costs, net interest margins, return on assets and technological adoption. It suggests that the quality of financial intermediation is as important as its quantity. Several financial economists, such as Levine [32] and Tabash and Anagreh [33], have consistently found empirical evidence indicating that multidimensional measures of financial development have superior explanatory power. This rich scholarly tradition is built on the index used in this study, which capitalises on the theoretical soundness and empirical robustness of how to understand financial sector development.

In the econometric models employed, each variable represents a critical component of economic analysis, capturing different dimensions of economic and financial performance. The definitions that are given below provide a broad understanding of the role of each variable in the theoretical model as well as their mathematical formulations. LOG_RGDP (Dependent Variable — Real Gross Domestic Product): It's an indicator of economic growth in Naira represented as the natural logarithm of real gross domestic product. The research normalises the data using the logarithmic transformation, reducing the effect of extreme values and linearising potential nonlinear relationships. The logarithmic is beneficial for the interpretation of coefficients, as percentage changes help stabilise variance across the time series. LOG_FDI (Financial Development Index): This variable represents the natural logarithm of the International Monetary Fund's financial development index, the multidimensional nature of financial sector development. The index integrates three key dimensions: (i) financial depth (size and liquidity of markets); (ii) financial access (accessibility of financial services to individuals and firms); and (iii) financial efficiency (the cost and intermediation efficiency of financial institutions). The logarithmic transformation assures comparability and reduces the risk of heteroscedasticity in the model. LOG_GEXP (Government Expenditure): This variable (as the natural logarithm of general government final consumption expenditure as a percentage of GDP) is used as a proxy for fiscal policy. It incorporates the government expenditure's contribution to economic activity in terms of potential multipliers, public investment and the government's economic intervention strategies.

LOG_INV (Investment): The investment accumulated in the economy, represented by the natural logarithm of the gross capital formation as a percentage of GDP. It responds to the accumulation of physical capital, infrastructure development and potential productivity increase.

The investment variable indicates the improvement of economic prosperity achieved through capital agglomeration. LOG_TRADE (Trade Openness): This variable is defined as total trade (exports and imports) expressed as a percentage of GDP. The link of trade openness to potential knowledge spillovers, competitive pressures, and access to international resources is plausible for growth. LOG_OIL (Oil Prices): The external economic shock potential from global oil markets is represented by the natural logarithm of crude oil prices in US dollars. Nigeria, being an oil-driven economy, has government revenue sources and economic stability that are significantly driven by fluctuations in the oil price. LOG_LAB (Labour Force): This variable serves as a proxy for the labour force. It is human capital availability, portraying the availability of the potential productive capacity, workforce dynamics, and demographic factors having the potential to affect economic growth.

3.3. Methodology

3.3.1. Unit root test

Following the study goal, the augmented Dickey-Fully (ADF) test on the variables is performed to determine their order of integration, and the following equations are estimated to test for the presence of a unit root in the variables at levels and with intercept. Followed by the test for the significance of $\rho_1 \;\; i = 1,2,\ldots,6$. Specifically, I find a unit root to decide whether to reject the null hypothesis, $H_0 : \rho_i = 0$.

$$\Delta LOG\_RGDP_t = \alpha_1 + \rho_1 LOG\_RGDP_{t-1} + \sum_{j=1}^{n1} \gamma_{1j} \Delta LOG\_RGDP_{t-j} + \xi_{1t},$$

$$\Delta LOG\_FDI_t = \alpha_2 + \rho_2 LOG\_FDI_{t-1} + \sum_{j=1}^{n2} \gamma_{2j} \Delta LOG\_FDI_{t-j} + \xi_{2t},$$

$$\Delta LOG\_GEXP_t = \alpha_3 + \rho_3 LOG\_GEXP_{t-1} + \sum_{j=1}^{n3} \gamma_{3j} \Delta LOG\_GEXP_{t-j} + \xi_{3t},$$

$$\Delta LOG\_INV_t = \alpha_4 + \rho_4 LOG_{INV_{t-1}} + \sum_{j=1}^{n4} \gamma_{4j} \Delta LOG_{INV_{t-j}} + \xi_{4t},$$

$$\Delta LOG_{TRADE_t} = \alpha_5 + \rho_5 LOG_{TRADE_{t-1}} + \sum_{j=1}^{n5} \gamma_{5j} \Delta LOG_{TRADEt-j} + \xi_{5t},$$

$$\Delta LOG_{OIL_t} = \alpha_6 + \rho_6 LOG_{OIL_{t-1}} + \sum_{j=1}^{n6} \gamma_{6j} \Delta LOG_{OILt-j} + \xi_{6t},$$

$$\Delta LOG_{LAB_t} = \alpha_7 + \rho_7 LOG_{LABt-1} + \sum_{j=1}^{n7} \gamma_{7j} \Delta LOG_{LAB_{t-j}} + \xi_{7t}.$$

After first differencing, the author performs similar tests with and without trend and intercept. In addition, the non-parametric Philips-Perron (PP) tests for robustness in the unit root testing.

3.3.2. Autoregressive distributed lag model (ARDL)

Considering the focus of this study, a regression between financial development and economic growth was performed to try and identify if a long-run relationship exists between these two and, if so, whether it is positively or negatively related to the Nigerian economy.

$$LOG_{RGDP} = f(LOG_{FDI}, LOG_{GEXP}, LOG_{INV}, LOG_{TRADE}, LOG_{OIL}, LOG_{LAB}).$$

As identified by Pesaran and Shin [34], this paper chooses the auto-regressive distributed lag (ARDL) approach towards the modelling of a relationship, with the bounds testing approach towards

the checking of a long-run co-integrating relationship. This paper chooses ARDL because the application of this dynamic model enables the testing for cointegration when both I(0) and I(1) variables are to be modelled.

The ARDL model is generally specified as:

$$\Delta LOG\_RGDP_t = \beta_0 + \sum_{j=1}^{n}\beta_{1j}\Delta LOG\_RGDP_{t-j} + \sum_{j=0}^{n}\beta_{2j}\Delta LOG\_FDI_{t-j} + \sum_{j=0}^{n}\beta_{3j}\Delta LOG\_GEXP_{t-j} + \sum_{j=0}^{n}\beta_{4j}\Delta LOG\_INV_{t-j} + \sum_{j=0}^{n}\beta_{5j}\Delta LOG\_TRADE_{t-j} + \sum_{j=0}^{n}\beta_{6j}\Delta LOG\_OIL_{t-j} + \sum_{j=0}^{n}\beta_{7j}\Delta LOG\_LAB_{t-j} + \theta_1 LOG\_RGDP_{t-1} + \theta_1 LOG\_RGDP_{t-1} + \theta_2 LOG\_FDI_{t-1} + \theta_3 LOG\_GEXP_{t-1} + \theta_4 LOG\_INV_{t-1} + \theta_5 LOG\_TRADE_{t-1} + \theta_6 LOG\_OIL_{t-1} + \theta_7 LOG\_LAB_{t-1} + \varepsilon_t.$$

If a long-run co-integrating relationship exists, I specify the error-correction model (ECM):

$$\Delta LOG\_RGDP_t = \beta_0 + \sum_{j=1}^{n}\beta_{1j}\Delta LOG\_RGDP_{t-j} + \sum_{j=0}^{n}\beta_{2j}\Delta LOG\_FDI_{t-j} + \sum_{j=0}^{n}\beta_{3j}\Delta LOG\_GEXP_{t-j} + \sum_{j=0}^{n}\beta_{4j}\Delta LOG\_INV_{t-j} + \sum_{j=0}^{n}\beta_{5j}\Delta LOG\_TRADE_{t-j} + \sum_{j=0}^{n}\beta_{6j}\Delta LOG\_OIL_{t-j} + \sum_{j=0}^{n}\beta_{7j}\Delta LOG\_LAB_{t-j} + \lambda\widehat{ECT}_{t-1} + \varepsilon_t.$$

Where ECT is the error-correction term, and λ is the speed of adjustment parameter.

4. Results

4.1. Descriptive statistics

Table 2 shows the descriptive statistics of the data (in natural logarithmic form) used in this investigation. The sample size is 43 years, spanning the years 1981 through 2023. Real Gross Domestic Product (RGDP) averaged 31.111 in natural logarithmic form for the period, with a low and maximum value of 30.417 and 31.909, respectively. Similarly, the Financial Development Index (FDI) averaged 1.704, with a low of 1.309 and a high of 2.108.

The same analogy applies to the other control variables in the model, such as General Government Final Consumption Expenditure (% of GDP) (GEXP), Gross Capital Formation (% of GDP) (INV), Trade (% of GDP), Oil — Crude Prices (US$) (OIL), Total Population (LAB). The variables are observed to be skewed positively and negatively. Real Gross Domestic Product is also observed to be positively skewed, while the Financial Development Index is negatively skewed.

Fig. 1 illustrates the relationship between economic growth, represented by Real Gross Domestic Product (RGDP), and financial development, measured by the Financial Development Index (FDI), from 1980 to 2023. Over this period, both indicators show an overall upward trend, but with distinct patterns and volatilities. RGDP demonstrates a consistent and steady increase throughout

Table 2
Descriptive statistics of the variables

Statistic	LOG_RGDP	LOG_FDI	LOG_GEXP	LOG_INV	LOG_ TRADE	LOG_OIL	LOG_LAB
Mean	31.111	−1.704	1.056	3.462	3.362	5.394	18.646
Median	30.896	−1.715	0.741	3.481	3.523	5.213	18.640
Maximum	31.909	−1.309	2.246	4.493	3.976	6.554	19.155
Minimum	30.417	−2.108	−0.093	2.702	2.212	4.382	18.135
Std. Dev.	0.524	0.185	0.780	0.507	0.496	0.659	0.307
Skewness	0.314	−0.219	0.211	0.099	−1.014	0.326	0.018
Kurtosis	1.547	2.565	1.556	2.139	3.003	1.841	1.791
Jarque–Bera	4.176	0.635	3.773	1.301	6.861	2.947	2.440
	[0.124]	[0.728]	[0.152]	[0.522]	[0.032]	[0.229]	[0.295]
Observations	43	43	43	43	43	43	43

Source: Developed by the author.

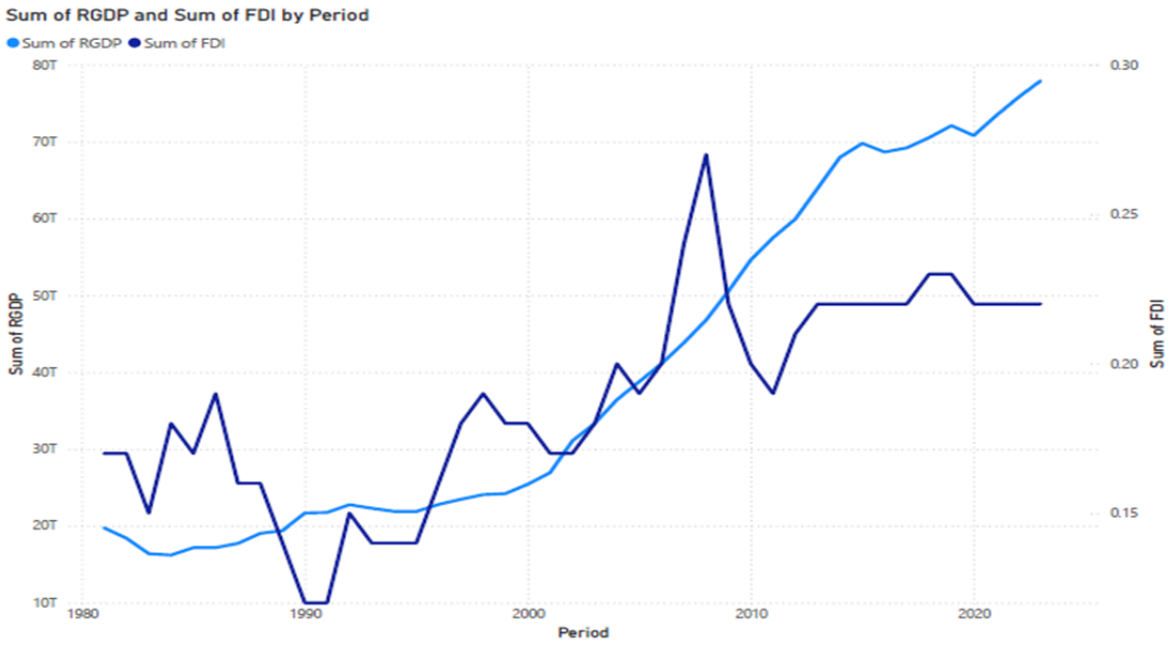

Fig. 1. **Trends in economic growth and financial development**

Source: Author's analysis using Power BI.

the timeframe, with the growth rate accelerating noticeably after 2000. This suggests a general improvement in economic output and living standards over time. The smooth, upward trajectory of RGDP indicates the relative stability of overall economic growth, even in the face of short-term fluctuations.

In contrast, the FDI exhibits significantly more volatility. It experienced several peaks and troughs, with a notable drop around 1990 and a sharp spike followed by a decline around 2008–2009, likely reflecting the global financial crisis. Despite these fluctuations, the FDI also shows a general upward trend, indicating long-term progress in finan-

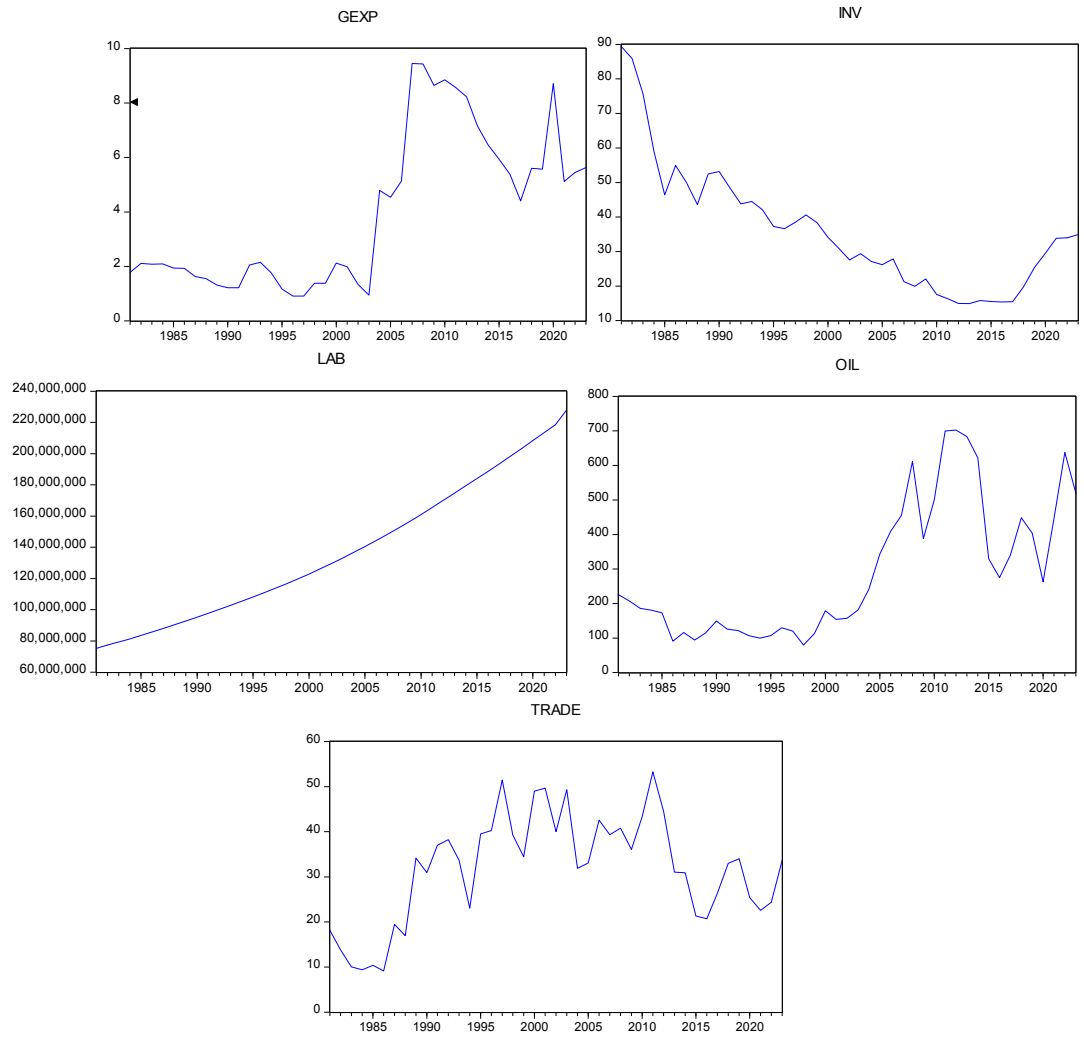

Fig. 2. **Trend analysis of all the variables**

Source: Developed by the author.

cial sector development. The divergence between RGDP and FDI trends, particularly during periods of financial stress, highlights the complex relationship between financial development and economic growth in Nigeria. While financial markets can experience rapid expansions and contractions, the broader economy tends to grow more steadily. This relationship underscores the importance of robust financial systems in supporting economic growth while also pointing to the potential risks of financial volatility on overall economic stability (*Fig. 2*).

4.2. Augmented Dickey-Fuller and Phillip-Perron test results

This section reports the probabilities of the null hypothesis, $H_0 : \rho_i = 0$ for all $i = 1,2,\ldots,6$ of the models specified in section 3.2.1, that is, at levels and when there is an intercept term. I also report the unit root results with and without trend and intercept at levels. I perform this at first difference also, and I carry out the non-parametric Philips-Perron (PP) test of unit root for robustness.

4.3. Autoregressive distributed lag model and bounds test

4.3.1. Cointegration analysis

Following the results from the unit root tests, I do not find any series integrated of order 2, that is I(2). All the variables are either stationary in their logged form or become stationary after differencing once. The ARDL model is, therefore, a suitable approach to modelling a scenario such as this where the series have mixed orders of integration.

Fig. 3 displays Akaike Information Criterion (AIC) values for the top 20 ARDL models, ranking them from best to worst fit. AIC values range from about –3.89 to –3.81, with lower values indicating

Table 3
Unit root test results

	LEVEL					
	Augmented Dickey-Fuller (ADF)			Phillip-Perron (PP)		
	Intercept	Trend & Intercept	None	Intercept	Trend & Intercept	None
LOG_RGDP	0.7301	0.7047	0.9993	0.9833	0.1301	0.9990
LOG_FDI	0.5764	0.1325	0.4276	0.6305	0.3830	0.2494
LOG_GEXP	0.7140	0.4853	0.6603	0.7140	0.4853	0.6973
LOG_INV	0.2042	0.9747	0.0626*	0.2224	0.9665	0.0846*
LOG_TRADE	0.3371	0.7865	0.5652	0.3586	0.8135	0.5776
LOG_OIL	0.6450	0.5285	0.6564	0.6249	0.4994	0.6619
LOG_LAB	0.9928	0.0060***	0.9943	0.9312	0.8069	0.9999
	FIRST DIFFERENCE					
LOG_RGDP	0.0066***	0.0473**	0.0243**	0.0066***	0.0473**	0.0104***
LOG_FDI	0.0004***	0.0031***	0.0000***	0.0000***	0.0000***	0.0000***
LOG_GEXP	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
LOG_INV	0.0002***	0.0003***	0.0000***	0.0002***	0.0003***	0.0000***
LOG_TRADE	0.0000***	0.0238**	0.0000***	0.0000***	0.0000***	0.0000***
LOG_OIL	0.0005***	0.0036***	0.0000***	0.0000***	0.0004***	0.0000***
LOG_LAB	0.4071	0.7484	0.3017	0.0059***	0.0271**	0.2253

, ** and * represent 10%, 5% and 1% levels of significance, respectively.*

Source: Developed by the author.

better models. The best-fitting model is ARDL (1,0,0,0,1), suggesting a simple lag structure performs well. Top models generally favour simpler structures with many zero lags. The small differences in AIC values among leading models imply several may perform similarly well. This analysis aids in selecting the optimal ARDL model for time series forecasting.

Table 5 presents the results of an ARDL (Autoregressive Distributed Lag) bounds test for cointegration. ARDL (1, 0, 0, 0, 0, 1) indicates the lag structure of the ARDL model and 6.7867 is the calculated F-statistic for the bounds test. This suggests that the test found evidence of a long-run relationship between the variables. The table shows critical values for the bounds test at three significance levels. 1% lower bound (I0) which is 3.15 and upper bound (I1) is 4.43, 5% lower bound (I0) is 2.45, upper bound (I1) is 3.61 and 10% lower bound (I0) is 2.12, upper bound (I1) is 3.23 The F-statistic (6.7867) is higher than the upper bound at all significance levels, which supports the conclusion of cointegration. This means there is strong evidence for a long-run relationship between the variables in the model. Following this result, an error correction model is estimated and the results are presented in the next section.

4.3.2. Long-run and short-run results

Tables 6 and 7 above present the long-run and short-run results where the Error Correction Model (ECM) indicates that approximately 31.05% of any disequilibrium is corrected annually, suggesting a moderate speed of adjustment towards long-run equilibrium. In the short run, the labour force (LOG_LAB) emerges as the most significant driver of economic growth as a 1% increase in the labour force is associated with a substantial 16.77% increase

Table 4
Summary of the unit root test results

	Augmented Dickey-Fuller (ADF)			Phillip-Perron (PP)		
	Level	**First Difference**	**I(d)**	**Level**	**First Difference**	**I(d)**
LOG_RGDP	0.7047	0.0066***	I(1)	0.1301	0.0066***	I(1)
LOG_FDI	0.1325	0.0000***	I(1)	0.2494	0.0000***	I(1)
LOG_GEXP	0.4853	0.0000***	I(1)	0.4853	0.0000***	I(1)
LOG_INV	0.0626*	-	I(0)	0.0846*	-	I(0)
LOG_TRADE	0.3371	0.0000***	I(1)	0.3586	0.0000***	I(1)
LOG_OIL	0.5285	0.0000***	I(1)	0.4994	0.0000***	I(1)
LOG_LAB	0.0060***	-	I(0)	0.8069	0.0059***	I(1)

*, ** and *** represent 10%, 5% and 1% levels of significance, respectively.

Source: Developed by the author.

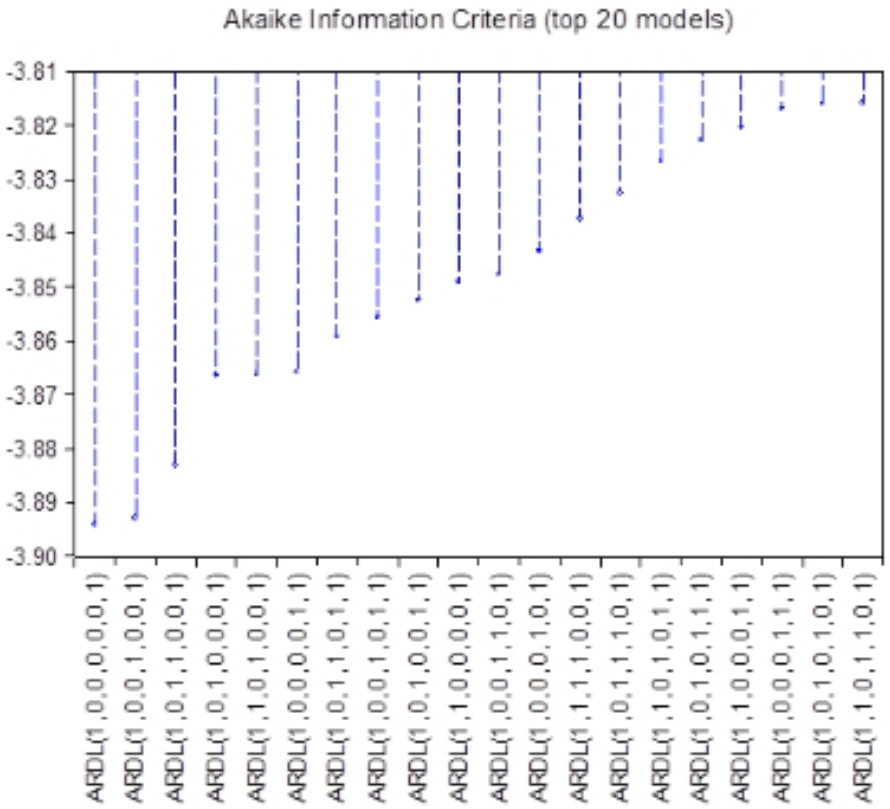

Fig. 3. **ARDL lag selection criteria (AIC)**

Source: Developed by the author.

in real GDP, highlighting the critical role of human capital in Nigeria's immediate economic expansion. Conversely, investment (LOG_INV) shows a slight negative impact, with a 1% increase in investment linked to a 0.0675% decrease in real GDP in the short term. The long-run analysis further emphasises the importance of labour as 1% increase in the labour force corresponds to a 1.48% increase in real GDP, indicating a strong positive relationship over time. However, investment continues to show a negative relationship, with a 1% increase in investment related to a 0.2175% decrease in real GDP in the long run.

Table 5
ARDL-bounds test result

Model		F-statistic	Result
ARDL(1, 0, 0, 0, 0, 0, 1)		6.7867	Cointegration
	1%	5%	10%
I0 Bound	3.15	2.45	2.12
I1 Bound	4.43	3.61	3.23

Source: Developed by the author.

Table 6
Error Correction Model [probability values of the coefficients]

	ΔLOG_RGDP (Dependent Variable)
ECT(−1)	−0.3105***
	[0.0004]
ΔLOG_FDI	−0.0653
	[0.2690]
ΔLOG_GEXP	−0.0008
	[0.9635]
ΔLOG_INV	−0.0675**
	[0.0386]
ΔLOG_TRADE	−0.0159
	[0.4054]
ΔLOG_OIL	0.0296
	[0.2119]
ΔLOG_LAB	16.7724**
	[0.0302]

*, ** and *** represent 10%, 5% and 1% levels of significance, respectively.

Source: Developed by the author.

Table 7
Long-run form [probability values of the coefficients]

	LOG_RGDP (Dependent Variable)
Constant	2.2536
	[0.6054]
LOG_FDI	−0.2101
	[0.2286]
LOG_GEXP	−0.0026
	[0.9636]
LOG_INV	−0.2175*
	[0.0787]
LOG_TRADE	−0.0511
	[0.3501]
LOG_OIL	0.0954
	[0.1605]
LOG_LAB	1.4803***
	[0.0000]

*, ** and *** represent 10%, 5% and 1% levels of significance, respectively.

Source: Developed by the author.

The financial development index (LOG_FDI) does not demonstrate statistically significant impacts in either the short or long run. In the short term, a 1% increase in the financial development index is associated with a 0.0653% decrease in real GDP, while in the long run; it corresponds to a 0.2101% decrease. However, these results are not statistically significant, challenging the expected positive relationship between financial development and economic growth in Nigeria. Other variables show minimal or statistically insignificant impacts. Government expenditure (LOG_GEXP) has a negligible effect, with a 1% increase associated with a 0.0008% decrease in real GDP in the short run and a 0.0026% decrease in the long run. Trade (LOG_TRADE) shows a slight negative relationship, with a 1% increase linked to a 0.0159% decrease in the short run and a 0.0511% decrease in the long run. Oil prices (LOG_OIL) demonstrate a small positive relationship, with a 1% increase corresponding to a 0.0296% increase in real GDP in the short run and a 0.0954% increase in the long run.

The absence of a statistically significant relationship between the financial development index and economic growth calls for some clarification. Although the IMF's financial development index is comprehensive, it may not precisely reflect the workable dynamics of the country's financial sector. The dual nature of Nigeria's financial system, with its formal financial institutions and a substantial array of informal financial mechanisms on the other hand, may not be adequately reflected in the index. In addition, the measurement may be more quantitative rather than qualitative factors such as institutional quality, financial innovation, or effectiveness of financial intermediation in specific sectors. Moreover, standard international financial development indicators might not be enough to capture Nigeria's specific economic structures, and regulatory environments that are highly complex with economic informality, which is very high. This puts the lack of statistical significance of the relationship into perspective such that its absence does not necessarily rule out the potential importance of financial sector development. Instead, it realigns thought towards more context-specific financial development measures that capture the distinct elements of Nigeria's economic characteristics.

4.4. Discussion

Comparative economic literature and empirical studies of similar developing economies provide considerable support for the significance of the labour force as one of the critical drivers of economic growth in Nigeria. According to Matashu and Skhephe [35], in their study on sub-Saharan African economies, human capital, predominantly represented by the labour force, accounted for a larger percentage of the economic growth variations observed in resource-dependent economies that have inherited comparable structures similar to Nigeria. Labour force expansion has proven to be a more reliable growth mechanism compared to financial sector interventions where predominant economies are characterised by large informal sectors and include an agricultural and service-oriented economic structure. Comparing the economies in West Africa with similar resource-rich developing nations, they find a consistent pattern. Countries such as Ghana, Côte d'Ivoire and Senegal have had similar economic trajectories, with economic expansion directly linked to labour force growth.

In support of this study, Yakubu and Akanegbu [36] study specifically on Nigeria observes that a 1% increase in the country's labour force participation increases the country's GDP. This pattern can be attributed to several structural factors prevalent in the economy with young demographic profiles, growing urbanisation, high educational attainment, and economic diversification attempts. Endogenous growth models, especially those provided by Lucas Jr. [37] and Romer [38] with human capital as a key stimulus to economic development, provide the theoretical underpinnings to the relationship identified in this study. When evaluating Nigeria, where traditional economic growth mechanisms including financial intermediation have not been showing enough efficacy, the labour force becomes much more energetic and responsive than previously envisioned. This result corroborates the structural transformation theories proposed by Arthur Lewis and subsequent development economists.

These research outcomes resonate with and challenge recent research on financial development in emerging economies. For instance, Appiah and Li [39] in their comprehensive study of financial development and economic growth in the Economic Community of West African States (ECOWAS) economies observe that the financial systems and economic growth relationship are not general but rather contingent on institutional quality and structural characteristics of the economy. These findings support the notion that financial development's effect is heterogeneous in the Nigerian context. Recent studies also align with the observation of the labour force as the primary cause of economic expansion in this study. According to Keji [40], human capital, more than anything else, is a more reliable driver of economic growth in developing economies, especially in resource-dependent nations, such as Nigeria. The strong positive relationship between the labour force and economic growth in either the short or long run highlights human capital development as a key part of future economic growth strategy.

The modest negative impact of investment supports recent critiques of conventional investment growth models. According to Mohamed Sghaier [41], since the institutional framework of an economy may be weak, more investment will not automati-

cally result in economic growth since resources are not used efficiently and inefficiencies and misallocations may occur. The counter-intuition investment growth relationship observed in this study analysis fits well with this perspective. The financial development index perspective does not mean that the supply-leading hypothesis offered by Patrick [12] and his successors in financial development theories has statistical significance. This study finding implies that the financial sector in Nigeria is likely not sophisticated or yet responsive enough to spur economic growth in the country. Similarly, Yusifzada and Mammadova [42] also revealed that the effectiveness of financial development depends upon the depth of financial intermediation, which may be inadequate in the Nigerian setting.

Additionally, the results confirm that government expenditure and trade openness have negligible effects as can be expected from complex macroeconomic settings in Nigeria. As corroborated by Awoa and Efogo [43], contexts of oil dependency economies often result in a non-linear and context-specific relationship of traditional growth determinants and these findings hence support the notion of the complex effects. The study's methodology of employing ARDL with bounds testing provides a robust approach to understanding these dynamic relationships. A broad examination that extends beyond the traditional static models, the study captures both short-run and long-run dynamics to provide insights into the temporal complexity of financial development and economic growth interactions.

Even though the variables fail to have any direct financial development impact, the result suggests an intriguing theoretical puzzle of why long-run cointegration exists between the variables. As Khan and Khan [44] discussed, the finance–growth relationship must be evaluated considering the transformation and institutional quality as mediating factors. The persistent disconnect between financial development and economic growth suggests potential structural inefficiency in the financial system such as insufficiency of credit to small and medium enterprises, excessive intermediation cost, or regulatory constraints that limit the instrumentality of capital allocation.

4.5. Limitations of the study

The study uses an aggregate Financial Development Index; while this is helpful for major studies, it conceals the influences of some components of the financial sector on economic growth. The composite nature of the index can obscure the sector-specific dynamics that would provide a more granular view of the finance growth relationship in Nigeria. This limitation does not diminish the contribution of the study but rather reveals the difficulty of studying financial development and economic growth in a developing economy. Moreover, they offer invaluable directions for future research that prompts further investigations into the finance-growth nexus in Nigeria and other emerging economies.

5. Conclusion

This research focused on the nexus between financial development and economic growth in Nigeria over the time frame of 1981 to 2023, employing time series data. The work aimed to analyse the relationship between financial development and economic growth. For this purpose, the augmented Dickey-Fully ADF and Philips-Perron (PP) were employed to test the stationarity characteristics of the variables, whereby ARDL was used to determine the long-run and short-run association between the dependent and the independent variables in the model. For the co-integration analysis of the variables, the Bounds test applied to the ARDL model was used. Furthermore, there is significant evidence of mean reversion in the model that includes the 31% ARDL-ECM adjustment rate because of the presence of the negative sign of the symbol and the absolute value of the coefficient of the error correction term.

The results reveal a convoluted interaction between financial development and economic growth in Nigeria. While long-run cointegration exists between these variables, indicating a stable long-term relationship, the nature of this relationship is not straightforward. The financial development index did not demonstrate statistically significant impacts on economic growth in either the short or long run. This challenges the conventional wisdom regarding the positive relationship between financial development and economic growth, at least in the Nigerian context. It raises important questions about the structure and functioning of Nigeria's financial sector and its ability to support real economic growth.

Government expenditures, trade, and oil prices showed statistically insignificant impacts on

economic growth, further emphasising the complexity of Nigeria's economic dynamics. These findings collectively suggest that while there is a long-run relationship between financial development and economic growth in Nigeria, the mechanisms through which this relationship operates may be more subtle than previously thought.

Policy recommendations

Following the findings presented in this study, the following policy recommendations are therefore provided.

Despite the lack of a significant positive impact from financial development in this study, continued efforts to reform and strengthen the financial sector remain important. This could include measures to enhance financial inclusion, diversify financial products and services, and strengthen regulatory frameworks to ensure stability and efficiency in the financial system.

Fiscal policy reforms should aim to enhance the impact of government expenditure on economic growth. This might include improving the efficiency of public spending, prioritising infrastructure and social services investments, and implementing tax reforms to increase revenue and reduce oil dependence.

Efforts should be made to improve the quality and efficiency of investments. This could involve implementing stricter project evaluation criteria, providing incentives for productive private sector investments, and enhancing transparency in investment processes. The goal should be to transform the currently negative relationship between investment and growth into a positive, productive one.

ACKNOWLEDGEMENT

The author is thankful to the anonymous reviewers for their great suggestions and comments which have further improved the quality of this work.

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Conflicts of Interest Statement: The author has no conflicts of interest to declare.
The article was submitted on 03.10.2024; revised on 06.12.2024 and accepted for publication on 07.02.2025.
The author read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2308-944X-2025-13-1-43-54
UDC 336.7,657.6(045)
JEL M40, M42, M48

Key Strategies for Improving the Standardization of Audit under Islamic Principles

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ABSTRACT

This article discusses the development of auditing standardization based on Islamic principles as formulated by AAOIFI (Accounting and Auditing Organization for Islamic Financial Institutions), headquartered in Bahrain. **The study aims** to critically analyze AAOIFI approaches and compare them with global audit standardization practices conducted by the International Auditing and Assurance Standards Board (IAASB) under the International Federation of Accountants (IFAC). Using **methods** such as comparison, analysis, and synthesis, as well as logical and systemic approaches, the authors examined two groups of auditing standards, IAASB and AAOIFI, highlighting their differences.

Findings reveal that current AAOIFI standards, such as Auditing Standard for Islamic Financial Institutions ASIFI 1 "Objectives and Principles of Audit" and ASIFI 2 "Audit Report," have been in use for about 25 years. These standards are outdated and require urgent transformation. The proposed AAOIFI Standard on Auditing (SOA) 1 "Audit Foundations" seeks to consolidate existing standards but risks being excessively bulky and less comprehensible compared to IAASB standards. The authors **recommend** leveraging IAASB's experience to adapt the AAOIFI standards, including the creation of an AAOIFI Assurance Tasks Concept akin to IAASB's international concept, enabling clarity and accessibility for global auditing professionals while adhering to Islamic principles.

Keywords: audit; standard; standardization; partnership financing; Islamic financing; Islamic banking; AAOIFI

For citation: **Akhmetshina A.R., Kharisova F.I., Derzayeva G.G., Aletkin P.A., Umarov Kh.S. Key strategies for improving the standardization of audit under Islamic principles.** ***Review of Business and Economics Studies*****. 2025;13(1):43-54. DOI: 10.26794/2308-944X-2025-13-1-43-54**

ОРИГИНАЛЬНАЯ СТАТЬЯ

Ключевые стратегии совершенствования стандартизации аудита по исламским принципам

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АННОТАЦИЯ

В статье раскрываются направления развития стандартизации аудиторской деятельности по исламским принципам, разрабатываемые Организацией по бухгалтерскому учету и аудиту для исламских финансовых учреждений (Accounting and Auditing Organization for Islamic Financial Institutions — AAOIFI) с центральным офисом в Бахрейне. **Целью** исследования является критический анализ подходов AAOIFI и сравнение их с мировой практикой стандартизации аудита, осуществляемой Советом по международным стандартам аудита и подтверждению достоверности информации (IAASB) при Международной федерации бухгалтеров (IFAC). Используя такие **методы**, как сравнение, анализ и синтез, а также логический и системный подходы, авторы рассмотрели две группы стандартов аудита — IAASB и AAOIFI, подчеркнув их различия. **Результаты** исследования показывают, что действующие стандарты AAOIFI, такие как Стан-

дарт аудита для исламских финансовых институтов ASIFI1 «Цели и принципы аудита» и ASIFI2 «Аудиторский отчет», используются уже около 25 лет. Эти стандарты устарели и требуют срочной трансформации. Предлагаемый документ AAOIFI SOA 1 «Основы аудита» направлен на консолидацию существующих стандартов, но может оказаться чрезмерно громоздким и менее понятным по сравнению со стандартами IAASB. Авторы **рекомендуют** использовать опыт IAASB для адаптации стандартов AAOIFI, включая создание концепции задач по обеспечению достоверности информации AAOIFI, аналогичной международной концепции IAASB, что обеспечит ясность и доступность для международных аудиторских специалистов, придерживаясь при этом исламских принципов.
Ключевые слова: аудит; стандарт; стандартизация; партнерское финансирование; исламское финансирование; исламский банкинг; AAOIFI

Для цитирования: **Akhmetshina A.R., Kharisova F.I., Derzayeva G.G., Aletkin P.A., Umarov Kh.S. Key strategies for improving the standardization of audit under Islamic principles. *Review of Business and Economics Studies*. 2025;13(1):43-54. DOI: 10.26794/2308-944X-2025-13-1-43-54**

Introduction

In the context of de-globalization and sanctions pressure from the US and Western countries, Russia has increased interest in economic cooperation with Islamic countries. Since September 2023, Russia has been conducting an experiment to regulate partnership financing, implemented as a pilot project in four regions: Tatarstan, Dagestan, Bashkiria, and the Chechen Republic.

As of January 2, 2025, the Central Bank of Russia (CBR) had registered 29 legal entities as participants in this experiment. These entities perform operations within the framework of partnership financing,[1] which include:

- 43%: Sale contracts with deferred payments (Murabaha)
- 27%: Loan agreements and similar financing contracts (Mudaraba)
- 18%: Equity financing (Diminishing Musharakah)
- 12%: Leasing agreements (Ijarah)

Geographical distribution: The majority of partnership financing operations occur in Tatarstan (84% of fund allocation transactions). Active fund placement operations are also conducted in Moscow and the Moscow region (5% of operations), the Chechen Republic (4%), the Republic of Bashkortostan (2%), the Nizhny Novgorod region (2%), and other regions of the Russian Federation.[2]

Legal entities can conduct the following types of fund placement transactions:

- Providing funds as loans to individuals and legal entities.
- Financing individuals and legal entities through the sale of goods (including real estate) with deferred or installment payments, accompanied by compensation for granting the deferred payment.
- Financing individuals and legal entities through financial leasing agreements, contributions to the authorized (charter) capital of legal entities, and joint activities under simple or investment partnership agreements.

On September 12, 2023, the Ministry of Finance of Russia published information notice No. IS-Accounting-45, titled "Accounting for Partnership Financing Activities." The Central Bank of Russia (CBR) has also issued several regulatory acts related to partnership financing.

One of the key quality control functions for managing partnership financing activities is auditing. In Russia, auditing activities have been carried out since 2017 in accordance with International Standards on Auditing (ISAs), developed by the International Auditing and Assurance Standards Board (IAASB) of the International Federation of Accountants (IFAC). To ensure proper auditing for partnership financing management, it is logical to extensively study and adopt the experiences accumulated in Islamic countries, adapting them to the specific national characteristics. This experience is examined in more detail below.

To date, the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI), headquartered in Bahrain, has developed and implemented six standards for independent auditing (ASIFIs). Furthermore, for audits covering annual periods starting on or after January 1, 2020, inde-

[1] The Bank of Russia has summed up the first results of the experiment on partnership financing. 2024. URL: https://cbr.ru/press/event/?id=23287

[2] Review of the partner financing market based on the results of the survey for 9 months of 2024. URL: https://cbr.ru/analytics/develop/2024_1/

pendent auditors of Islamic financial institutions are required to apply both auditing standard ASIFI No. 2 "Audit Report" and the public document "Auditing Guidance Note (AGN) No. 02: Audit Report." This guidance was issued by the "Professional Auditing Standards Committee" (PASC) of AAOIFI on December 18, 2018. The PASC is an authorized joint committee of the Governance and Ethics Board (AGEB) and the Accounting Board (AAB) of AAOIFI. It supports both boards in the development and updating of professional auditing standards and is authorized to issue guidance on auditing when necessary.

The first standard, ASIFI No. 1, "Objectives and Principles of Audit", stipulates that for issues not specifically regulated by the six auditing standards (ASIFIs), International Standards on Auditing (ISAs) by IAASB should be applied, provided they do not contradict the principles and rules of Shariah. Shariah (from Arabic "ash-shar'ah" — "law" or "straight path") encompasses the religious and legal norms that Muslims must follow. Additionally, AAOIFI has developed a governance standard for Islamic financial institutions called "Internal Shariah Audit" (Governance Standard 11 — GS 11), effective from internal Shariah audit reports covering periods starting July 1, 2021.

As of December 2024, there are 48 ISAs (ISA IAASB) in effect globally, which are mandatory for auditors and audit organizations in Russia. In contrast, AAOIFI has chosen to develop a limited set of standards based on ISAs. These standards emphasize specific aspects of auditing related to Shariah principles, the unique features of business models, and the organizational structures of institutions operating under Islamic principles. For elements not covered by these six standards, AAOIFI recommends applying other standards, primarily ISAs, under the strict condition that they do not contradict Islamic principles.

Literature review

The study of auditing activities in accordance with Islamic standards has a long history. The earliest academic publications on this topic date back to the 1980s, with works by M.A. Khan [1], T. Kuran [2], and R.A.A. Karim [3]. Their research initiated a broader academic interest in auditing practices based on Islamic financial principles. During the 1990s, their efforts were advanced by Archer et al. [4], and Rahman et al. [5]. These works were motivated by increasing dissatisfaction among users of financial statements regarding their alignment with Shariah principles and rules. Addressing this need became the focus of AAOIFI's efforts.

Over time, scholarly interest in auditing based on Islamic principles grew rapidly, driven by the regular practices of Islamic financial institutions. Notable contributions during this period include works by Binti Kasim et al. [6], Uddin et al. [7], Kasim et al. [8], Khalid et al. [9], and Isa et al. [10].

Among contemporary researchers focusing on auditing under Shariah principles, scholars such as Khatib et al. [11], Faza et al. [12], Uula [13], Sani and Abubakar [14], Mubtadi and Iswati [15] stand out.

International research on Islamic auditing standards is extensive, diverse, and highly relevant to Russia. A distinctive feature of these studies is the presence of practical experience in conducting audits in accordance with Shariah principles within Islamic financial institutions.

In contrast, research in Russia on auditing under Islamic principles is relatively limited. This is primarily due to the federal law on partnership financing being passed only in 2023, coupled with the lack of practical experience in conducting audits under Shariah principles and rules. Consequently, Russian studies often rely on translations of foreign works. Despite these challenges, Russian scholars are increasingly focusing on auditing under Islamic principles. Notable contributions include works by A.K. Dashin [16], A.R. Yusupova [17], I.G. Khairullin et al. [18], A.M. Yuldashev [19], I.V. Novikova [20], F.I. Kharisova et al. [21], N.M. Yartseva and A.A. Sander [22], G.N. Khadiullina [23], D.R. Sabitova, Y.V. Voskoboynik and E.E. Imamkulieva [24], A.A. Bisultanova [25], and R.I. Bekkin [26].

Methodology

Based on the findings from the analysis of academic literature and works addressing the regulation of auditing activities both internationally and in Russia, with a focus on audit standardization, this study aims to justify and develop recommendations for improving audit standardization in the area of partnership financing. This is achieved through a comprehensive critical analysis of the AAOIFI's proposed directions for developing auditing based on Islamic principles and their comparative evaluation with audit standardization efforts conducted by the International Auditing and Assurance Standards Board (ISA IAASB IFAC).

To achieve this goal, two main tasks were identified:

1. Critically examine the state and improvement plans for the standardization of auditing activities based on Islamic principles as regulated by AAOIFI.

2. Conduct a comparative critical evaluation of the audit standardization processes carried out by the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) and the International Auditing and Assurance Standards Board of the International Federation of Accountants (IAASB IFAC), as well as their application in Russia.

The results of this evaluation are expected to form the basis for conclusions and justification of specific directions for improving audit standardization to be applied in partnership financing activities in Russia.

To accomplish these tasks, the following methods were utilized:

- Analysis of academic literature to study the current state of the research problem.
- Monitoring and evaluating the dynamic changes in auditing standards developed by AAOIFI and IAASB IFAC for their subsequent improvement.
- Synthesis of approaches to improving audit standardization based on Islamic principles.

Results

A comparative assessment of the audit standardization conducted by the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) and the International Auditing and Assurance Standards Board (IAASB) is summarized in *Table 1*.

Comparison of AAOIFI and IAASB approaches to audit standardization. AAOIFI and IAASB pursue distinct objectives and employ different approaches to the standardization of auditing activities. AAOIFI focuses on developing standards aligned with Shariah principles, exclusively applicable to Islamic financial institutions. In contrast, IAASB aims to create universal standards suitable for any country or economic sector. Both organizations play significant roles in their respective domains, but their influence and scope of application differ substantially.[3]

Development of AAOIFI Standards. To improve the standardization of auditing activities, AAOIFI initiated a project in 2019 to revise auditing standards in light of Shariah principles and modern practices. The auditing standards for Islamic financial institutions, currently known as "ASIFIs," are proposed to be renamed to "Standards on Auditing (SOAs)" under AAOIFI. In 2023, the regulator's website published a draft of SOA AAOIFI 1, "Foundations of Auditing." According to the project, this standard aims to consolidate and replace existing auditing standards, including:

- ASIFI 1: "Objectives and Principles of Auditing"
- ASIFI 2: "Audit Report"
- ASIFI 3: "Terms of Audit Engagements"
- ASIFI 5: "Auditor Responsibilities in Reviewing Fraud and Errors in Financial Statements"
- Audit Guidance Note (AGN) No. 02 issued by AAOIFI's Professional Auditing Standards Committee (PASC), "Audit Report."

The purpose of SOA AAOIFI 1 is to provide auditors with a comprehensive foundation for auditing financial statements of institutions that comply with Shariah principles and rules.

Scope of Application. The draft standard clarifies its scope, specifying its application to auditing the financial statements of institutions reporting in accordance with Shariah principles. While primarily intended for Islamic financial institutions (IFIs), the standard may also apply to other entities, such as social financial institutions and organizations practicing Islamic financial structures and operations.

Exclusions. The draft standard does not apply to:

- Business operations or structures offered by conventional financial organizations, as outlined in AAOIFI's Financial Accounting Standard (FAS 40), "Financial Reporting for Organizations Using Islamic Financing Mechanisms."
- Organizations engaging in traditional economic activities without adherence to Shariah principles or governance structures.

Glossary and Objectives of the Proposed SOA AAOIFI 1 Standard

In line with ISA IAASB, the proposed SOA AAOIFI 1 standard contains a concise glossary of definitions.[4] Alongside terms present in ISA IAASB 200 ("Overall

[3] AAOIFI issues Financial Accounting Standard (FAS) 40 "Financial Reporting for Islamic Finance Windows". URL: https://aaoifi.com/announcement/aaoifi-issues-financial-accounting-standard-fas-40-financial-reporting-for-islamic-finance-windows/?lang=en

[4] International standard on auditing 200 "primary objectives of the independent auditor and conducting an audit in accordance with international standards on auditing". URL: https://www.consultant.ru/document/cons_doc_LAW_317258/

Table 1
Comparative evaluation of audit standardization by AAOIFI and IAASB

Comparison Parameter	AAOIFI	IAASB
Goals and Objectives	AAOIFI focuses on developing standards for auditing, accounting, ethics, corporate governance, and Shariah compliance in the context of Islamic finance. These standards aim to ensure that Islamic financial institutions adhere to Shariah principles. Specific requirements for Islamic institutions are a priority[1]	IAASB develops international auditing standards and related services like review engagements and agreed-upon procedures. The goal is to ensure high-quality audits and enhance global trust in financial reporting. The standards aim for harmonization across jurisdictions
Scope of Application	AAOIFI standards apply exclusively to Islamic financial institutions such as banks, Takaful companies, and investment funds. They account for Islamic business principles, including prohibitions on usury (riba), uncertainty (gharar), and speculative transactions (maysir)	IAASB standards are universal and apply to all organizations regardless of religious or geographical affiliation. Their purpose is to create a unified approach to auditing and increase financial transparency worldwide
Standard Development Methodology	AAOIFI develops standards through consultations with Islamic finance experts, Shariah board representatives, and other stakeholders. Religious scholars' views are essential to ensure Shariah compliance. Collaboration with national regulators and international organizations is also emphasized[2]	IAASB employs a formalized approach, including public consultations, discussions with professional communities, and analysis of best practices. The development process considers input from global audit firms and regulatory bodies
Principles and Approaches to Auditing	AAOIFI standards emphasize adherence to Shariah principles in audits, including compliance with the prohibition of interest and speculative transactions. Islamic financial products like Murabaha, Musharaka, and Sukuk are key considerations	IAASB standards focus on auditor independence, objectivity, and ethical conduct. Auditors are guided by principles like integrity, professionalism, and confidentiality. The standards cover a broad spectrum of auditing and assurance services
Role and Impact on International Markets	While AAOIFI's influence is limited to regions with significant Islamic finance, the standards are pivotal in developing Islamic financial instruments and enhancing investor trust	IAASB standards are globally recognized and foster trust in financial reporting. They are widely supported by leading audit firms and regulators worldwide
Auditor Qualifications	Auditors following AAOIFI standards must understand accounting, auditing, and Islamic law (Fiqh). Specialized training and certification are required	Auditors under IAASB must hold professional qualifications like Certified Professional Accountant (CPA) or equivalent. Continuing education is mandatory, but specialization in Islamic law is not required
Certification and Accreditation Process	AAOIFI offers certification services, emphasizing institutional capacity-building and professional development programs to align with its goals. Certification requires compliance audits by internal or external auditors accredited by AAOIFI[3]	Certification is managed at the national level by professional bodies (e.g., AICPA in the U.S., ICAEW in the U.K., and SRO in Russia)[4]. IAASB does not certify auditors but provides the foundation for national systems[5]

Table 1 (continued)

Comparison Parameter	AAOIFI	IASB
Compliance Monitoring Mechanism	Compliance with AAOIFI standards is ensured through internal and external audits. Regular reviews and monitoring are conducted to uphold standards[6]	Compliance with IAASB standards is monitored through national regulatory systems, with oversight bodies in each country ensuring adherence to international standards[7]
Promotion and Development of Standards	AAOIFI promotes its standards among Islamic financial institutions and regulators. It collaborates with global organizations like the World Bank to integrate its standards[8]	IAASB promotes its standards through partnerships with national organizations and international financial institutions. It provides guidance materials and training for stakeholders

Source: Compiled by the authors.

[1] Ordinary capital resources financial statements and independent auditor's report for the year ended 31 December 2023. Islamic development bank. URL: https://2023.ar.isdb.org/wp-content/uploads/2024/04/IsDB_Financial-Statments-2023_EN.pdf

[2] Ordinary capital resources financial statements and independent auditor's report for the year ended 31 December 2023. Islamic development bank.URL: https://2023.ar.isdb.org/wp-content/uploads/2024/04/IsDB_Financial-Statments-2023_EN.pdf

[3] Financial Accounting Standard No. (1) General Presentation and Disclosure in the Financial Statements of Islamic Banks and Financial Institutions. URL: https://aaoifi.com/financial-accounting-standard-no-1-general-presentation-and-disclosure-in-the-financial-statements-of-islamic-banks-and-financial-institutions/?lang=en

[4] Objectives and Principles of Auditing. URL: https://aaoifi.com/themencode-pdf-viewer-sc/?lang=en&tnc_pvfw=ZmlsZT1odHRwczovL2Fhb2lmaS5jb20vd3AtY29udGVudC91cGxvYWRzLzIwMjMvMDIvQXVkaXRpbmctc3RhbmRhcmQtTm8uLTEtT2JqZWN0aXZlLWFuZC1QcmluY2lwbGVzLW9mLUF1ZGl0aW5nLnBkZiZzZXR0aW5ncz0wMDEwMDAxMTEwMDAwMDExMTAwJmxhbmc9ZW4tVVM=#page=&zoom=&pagemode=none

[5] Objectives and Principles of Auditing. URL: https://aaoifi.com/themencode-pdf-viewer-sc/?lang=en&tnc_pvfw=ZmlsZT1odHRwczovL2Fhb2lmaS5jb20vd3AtY29udGVudC91cGxvYWRzLzIwMjMvMDIvQXVkaXRpbmctc3RhbmRhcmQtTm8uLTEtT2JqZWN0aXZlLWFuZC1QcmluY2lwbGVzLW9mLUF1ZGl0aW5nLnBkZiZzZXR0aW5ncz0wMDEwMDAxMTEwMDAwMDExMTAwJmxhbmc9ZW4tVVM=#page=&zoom=&pagemode=none

[6] Auditors Report. URL: https://aaoifi.com/themencode-pdf-viewer-sc/?lang=en&tnc_pvfw=ZmlsZT1odHRwczovL2Fhb2lmaS5jb20vd3AtY29udGVudC91cGxvYWRzLzIwMjMvMDIvQXVkaXRpbmctc3RhbmRhcmQtTm8uLTItQXVkaXRvcnMtUmVwb3J0LnBkZiZzZXR0aW5ncz0wMDEwMDAxMTEwMDAwMDExMTAwJmxhbmc9ZW4tVVM=#page=&zoom=&pagemode=none

[7] Terms and Audit Engagement. URL: https://aaoifi.com/themencode-pdf-viewer-sc/?lang=en&tnc_pvfw=ZmlsZT1odHRwczovL2Fhb2lmaS5jb20vd3AtY29udGVudC91cGxvYWRzLzIwMjMvMDIvQXVkaXRpbmctc3RhbmRhcmQtTm8uLTMtVGVybXMtb2YtQXVkaXQtRW5nYWdlbWVudC5wZGYmc2V0dGluZ3M9MDAxMDAwMTExMDAwMDAxMTEwMCZsYW5nPWVuLVVT#page=&zoom=&pagemode=none

[8] Auditors Responsibility to Consider Fraud and Error in an Audit of Financial Statements. URL: https://aaoifi.com/themencode-pdf-viewer-sc/?lang=en&tnc_pvfw=ZmlsZT1odHRwczovL2Fhb2lmaS5jb20vd3AtY29udGVudC91cGxvYWRzLzIwMjMvMDIvQXVkaXRpbmctc3RhbmRhcmQtTm8uLTUtQXVkaXRvcnMtUmVzcG9uc2liaWxpdHktdG8tQ29uc2lkZXItRnJhdWQtYW5kLUVycm9yLWluLWFuLUF1ZGl0LW9mLUZpbmFuY2lhbC1TdGF0ZW1lbnRzLTIucGRmJnNldHRpbmdzPTAwMTAwMDExMTAwMDAwMTExMDAwMDAwMTExMDAmbGFuZz1lbi1VUw==#page=&zoom=&pagemode=none

Objectives of the Independent Auditor and the Conduct of an Audit in Accordance with International Standards on Auditing"), the proposed standard includes specific terms such as "Shariah principles and rules," "external Shariah auditor," "internal Shariah auditor," "Shariah Supervisory Board," "primary opinion," "supplementary opinion," and others.

The primary objectives of the auditor under the SOA AAOIFI 1 project are:

1. To obtain "reasonable assurance" that the institution's financial statements as a whole are free from material misstatement, whether due to fraud or error. This enables the auditor to express an opinion on whether the financial statements are prepared, in all material respects, in accordance with applicable financial reporting standards (i.e., AAOIFI Financial Accounting Standards and the "AAOIFI Conceptual Framework for Financial Reporting").[5]

2. To obtain "reasonable assurance" that the organization has, in all material respects, adhered

[5] Conceptual Framework for Financial Reporting. URL: https://minfin.gov.ru/common/upload/library/2015/01/main/conceptual.pdf

to Shariah principles and rules regarding financial contracts and transactions during the period covered by the audited financial statements.

3. To present an Audit Report on the financial statements.

For comparison, ISA IAASB 200 (on which the SOA AAOIFI 1 project is based) outlines the key objectives of the auditor as:

- Obtaining "reasonable assurance" that the financial statements as a whole are free from material misstatement, whether due to fraud or error.
- Preparing and issuing an opinion on the financial statements in accordance with the requirements of ISA.

Requirements of SOA AAOIFI 1. The proposed standard, "Foundations of Auditing," includes an extensive list of requirements related to:

- Initiating and preparing for the audit.
- Ethical principles.
- Quality management.
- Conducting the audit.
- Planning and risk assessment.
- Audit sampling.
- Fraud and error review.
- Other critical issues during the audit.
- Documentation and archiving.
- Audit completion.
- Communication with those charged with governance.
- Communication with representatives of the Shariah Supervisory Board.
- Evaluation of the auditee's going concern status.
- Review of subsequent events.
- Audit opinion, its components, and presentation.
- Modifications to the audit opinion and its types.

These comprehensive requirements are detailed in the proposed standard, covering a wide range of topics. For instance, regarding the audit opinion, SOA AAOIFI 1 obliges the auditor to examine key and detailed questions concerning compliance with Shariah principles and rules from two perspectives: the primary opinion and the supplementary opinion.

Directions for Audit Standardization in Russia. The implementation and application of AAOIFI and IAASB standards in Russia are summarized in *Table 2*, focusing on their respective roles in enhancing audit practices and financial reporting in the context of partnership financing and international integration.

Harmonization with International AAOIFI Standards Leveraging AAOIFI's experience in accounting, control, and audit standardization within Islamic financial institutions as a basis for creating Russia's legal and regulatory framework for partnership financing. This will enhance trust among investors from Islamic countries and expand geoeconomic relations. Harmonization with International IAASB Standards Russia aims to integrate into the global economy and improve its investment appeal. Implementing IAASB standards allows Russian companies to meet international audit and reporting requirements, increasing foreign investor trust and facilitating access to global capital markets.

Attracting Investments from the Persian Gulf and Southeast Asia Russia increasingly attracts foreign investments from the Middle East and Southeast Asia, where Islamic finance plays a significant role. Applying AAOIFI standards will enhance investor trust from these regions in Russian projects and companies, boosting capital inflow. Improving Financial Reporting Quality IAASB standards focus on improving financial reporting quality and transparency. Introducing these standards into Russian practices reduces fraud and accounting errors, positively affecting the reputation of Russian companies.

Enhancing Collaboration with International Partners from the Middle East and Southeast Asia Applying AAOIFI standards will expand interactions with foreign counterparts, as accounting, control, and auditing are based on unified principles and rules of ethical, responsible business conduct. Enhancing Collaboration with International Partners in Traditional Economies Many Russian companies work with foreign partners, particularly in exporting and importing goods and services. IAASB standards simplify interactions with foreign counterparts, as they are based on unified principles and approaches to auditing and reporting.

Training Specialists in Partnership Financing in Russia, training specialists in accounting, control, and auditing within partnership financing management systems is critical. Preparations must begin promptly. The Institute of Management, Economics, and Finance at Kazan Federal University has developed relevant programs, including a master's program accredited by AAOIFI in 2024, titled "Audit

Table 2
Directions for audit standardization by AAOIFI and IAASB in Russia

Directions for Applying AAOIFI Standards in Russia	Directions for Applying IAASB Standards in Russia
Harmonization with International AAOIFI Standards. Leveraging AAOIFI's experience in accounting, control, and audit standardization within Islamic financial institutions as a basis for creating Russia's legal and regulatory framework for partnership financing. This will enhance trust among investors from Islamic countries and expand geo-economic relations	Harmonization with International IAASB Standards. Russia aims to integrate into the global economy and improve its investment appeal. Implementing IAASB standards allows Russian companies to meet international audit and reporting requirements, increasing foreign investor trust and facilitating access to global capital markets
Attracting Investments from the Persian Gulf and Southeast Asia. Russia increasingly attracts foreign investments from the Middle East and Southeast Asia, where Islamic finance plays a significant role. Applying AAOIFI standards will enhance investor trust from these regions in Russian projects and companies, boosting capital inflow	Improving Financial Reporting Quality. IAASB standards focus on improving financial reporting quality and transparency. Introducing these standards into Russian practices reduces fraud and accounting errors, positively affecting the reputation of Russian companies
Enhancing Collaboration with International Partners from the Middle East and Southeast Asia. Applying AAOIFI standards will expand interactions with foreign counterparts, as accounting, control, and auditing are based on unified principles and rules of ethical, responsible business conduct	Enhancing Collaboration with International Partners in Traditional Economies. Many Russian companies work with foreign partners, particularly in exporting and importing goods and services. IAASB standards simplify interactions with foreign counterparts, as they are based on unified principles and approaches to auditing and reporting
Training Specialists in Partnership Financing. In Russia, training specialists in accounting, control, and auditing within partnership financing management systems is critical. Preparations must begin promptly. The Institute of Management, Economics, and Finance at Kazan Federal University has developed relevant programs, including a master's program accredited by AAOIFI in 2024, titled "Audit and Financial Management".	Training Specialists. Implementing IAASB standards required retraining and skill enhancement for Russian auditors. This created new opportunities for professional growth and strengthened the position of Russian specialists in the labor market.

Source: Compiled by the authors.

and Financial Management."[6] Training Specialists Implementing IAASB standards required retraining and skill enhancement for Russian auditors. This created new opportunities for professional growth and strengthened the position of Russian specialists in the labor market.

Challenges in implementing AAOIFI standards in Russia

1. Regulatory barriers: Russian legislation and regulatory systems are not yet adapted to meet the needs of Islamic partnership financing. Developing an appropriate legal framework will require significant effort and time.

2. Cultural differences: When developing partnership financing standards in Russia, challenges may arise due to cultural differences and the population's lack of awareness about Islamic partnership financing principles. Educational programs and awareness campaigns are needed to address this.

3. Lack of qualified specialists: Russia currently has few specialists with the necessary expertise in accounting, control, and auditing within partnership financing management systems. Developing this sector will require training a new generation of professionals.

4. Competition with traditional financial products: Islamic financial processes and products will compete with traditional, well-established ones

[6] Federal Law dated 02.07.2021 No. 359-FZ "On Amendments to Certain Legislative Acts of the Russian Federation and Recognition as Invalid of Certain Provisions of Legislative Acts of the Russian Federation". URL: https://www.consultant.ru/document/cons_doc_LAW_389138/

in the Russian market. The success of partnership financing and its standards' development will depend largely on the ability to offer competitive processes and products.

Discussion

Recommendations for improving the SOA AAOIFI 1 Standard and Audit Standardization in partnership financing:

1. Streamlining the SOA AAOIFI 1 Structure. The proposed SOA AAOIFI 1 standard includes an excessive number of categories of auditing activities, making it unnecessarily complex and difficult to comprehend. Its structure requires improvement, modeled after the widely used ISA IAASB standards, which have been effectively implemented globally, including in Russia.

2. Introducing the "AAOIFI Assurance Task Concept". The authors recommend presenting the categories of auditing activities in SOA AAOIFI 1 as an "AAOIFI Assurance Task Concept." This concept should be developed based on the "International Assurance Framework" by IAASB, which is already applied in numerous countries and is periodically updated to ensure relevance.

3. Phasing Out-Outdated AAOIFI Audit Standards. Given their obsolescence, it is critical to promptly discontinue the current AAOIFI audit standards (ASIFI 1, ASIFI 2, ASIFI 3, and ASIFI 5) in favor of a more streamlined and modernized approach.

4. Developing specialized training programs in Russia. To ensure proper auditing support for organizations offering partnership financing services in Russia, it is essential to establish specialized educational and retraining programs in relevant universities. These programs should focus on preparing qualified professionals in accounting and auditing within the management system of this sector.

5. Adopting AAOIFI's expertise in standardization. There is a pressing need to develop auditing standardization for partnership financing in Russia. This process should critically, extensively, and promptly leverage AAOIFI's valuable and long-standing experience in standardizing management functions within this domain.

Conclusions

Analysis and recommendations for the proposed SOA AAOIFI 1 Standard. The requirements of the proposed AAOIFI standard are methodologically analogous to those outlined in several ISAs (International Standards on Auditing by IAASB), with the exception of the conceptual focus on the prioritization of compliance with Shariah principles and related issues, as illustrated through the example of the audit opinion. However, the proposed SOA AAOIFI 1 standard, encompassing an excessive number of significantly varied categories, is difficult to comprehend. The complexity is further exacerbated by the standard's structure, which fails to incorporate the improved format of ISAs (IAS IAASB). The ISAs are designed to facilitate information assimilation with a structure divided into two parts: the first part includes an introduction, objectives, definitions, and a summary of requirements, while the second part provides application guidance and additional explanatory material.

Comparative evaluation and suggested improvements. A comparative evaluation of the existing AAOIFI audit standards (ASIFI), the proposed SOA AAOIFI 1 standard, the "International Framework for Assurance Engagements," and ISAs (IAS IAASB) suggests that it is advisable to present most of the SOA AAOIFI 1 requirements in the form of an "AAOIFI Assurance Framework." Similar to the IAASB's International Framework, this AAOIFI framework would allow auditors to first study fundamental concepts as guiding principles, including:

- Ethical principles
- Principles of professional conduct
- Quality management principles in auditing
- Types and objectives of assurance engagements
- Preconditions for accepting audit engagements
- Audit reports or assurance engagement reports
- Audit sampling
- Materiality
- Audit risks
- Auditor and management responsibilities.

This framework could then move into specific details for application. Combining multiple standards into a single standard complicates the understanding of audit categories, such as those related to the audit opinion. For instance, the audit opinion concept is addressed across four distinct ISAs (IAS IAASB). Thus, there is a pressing need to urgently

revise outdated AAOIFI audit standards, such as ASIFI 1 ("Objectives and Principles of Audit") and ASIFI 2 ("Audit Report"), which have been in use for over 25 years.

Certification and qualifications for Russian auditors. To ensure proper auditing for organizations providing partnership financing services in Russia, it is necessary for Russian auditors to study and pass exams to obtain the international CIPA qualification. This requires candidates to pass examinations under AAOIFI requirements. Starting this year, these exams are available not only in English and Arabic but also in Russian and can be taken online.

Leveraging experience from IAASB and AAOIFI. Considering the long history of auditing in market economies, the extensive experience in standardization, and the relatively short period of standardization based on Islamic principles by AAOIFI, it is constructive to develop audit standardization by leveraging IAASB's achievements while prioritizing the positive experience accumulated by AAOIFI in standardizing management functions for partnership financing.

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Umarov Kh.S.— review, editing and preparation of a list of sources.

Conflicts of Interest Statement: The authors have no conflicts of interest to declare.
The article was submitted on 22.10.2024; revised on 06.03.2025 and accepted for publication on 09.03.2025.
The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2308-944X-2025-13-1-55-72
UDC 336.02,336.221,330.356(045)
JEL H21, G18, O47, O55, E42

Tax Revenue, Inflation, and Economic Growth: A Ghanaian Perspective

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ABSTRACT

Over the years, Ghana's macroeconomic frameworks have led to slow economic growth. This necessitates the revision of policies for macroeconomic control and the pursuit of pragmatic policies that enhance economic growth, which policymakers should prioritize when framing economic plans. **This paper aim**s to explore the impact of key economic growth factors, such as tax revenue on economic growth in Ghana and the interactive effect of inflation on economic growth. We have used **the methods** of explanatory research and quantitative approaches to analyze the historical economic data for Ghana. This study examines the nexus between tax revenue and economic growth. In addition, it examines the multiplicative role of inflation in the relationship between tax revenue and economic growth in Ghana. The study uses secondary time series data collected for 19 years from 2005–2023 and employs the autoregressive distributed lag testing to cointegration estimation technique to analyze tax revenue growth, economic growth, foreign direct investment, policy rate, inflation, and government expenditure. **The results** showed that the tax revenue growth rate has a statistically significant positive relationship with economic growth in both the short and long run. In addition, the study revealed a statistically significant negative moderating effect of inflation in the relationship between tax revenue growth and economic growth in both the interim period and the long run. It was revealed that the impact of tax revenue on economic growth is more intense in the short run than in the long run. **The key conclusion** of the paper is that a rise in tax revenue facilitates economic growth more in the short run than in the long run in Ghana. Additionally, the rising cost of goods and services dampens economic growth, and inflation diminishes the enhancing effect of tax revenue on economic growth.

Keywords: ARDL; Ghana; economic growth; tax revenue; foreign direct investment; inflation

For citation: **Bosomtwe E., Omane-Adjekum C., Nyame J., Agyapong E.K., Adegbedzi K.D., Forson J.A., Gadzo S.G., Botwe E. Tax revenue, inflation, and economic growth: A Ghanaian perspective.** ***Review of Business and Economics Studies*****. 2025;13(1):55-72. DOI: 10.26794/2308-944X-2025-13-1-55-72**

ОРИГИНАЛЬНАЯ СТАТЬЯ

Налоговые поступления, инфляция и экономический рост: взгляд из Ганы

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АННОТАЦИЯ

Макроэкономическая политика Ганы на протяжении многих лет приводила к медленному экономическому росту страны. Необходимы пересмотр политики макроэкономического контроля и проведение прагматичной политики, способствующей экономическому росту, что должно стать приоритетом для полити-

ков при разработке экономических планов. **Цель** данной статьи — изучить влияние ключевых факторов, таких как налоговые поступления, на экономический рост в Гане и интерактивное влияние инфляции на экономику. Авторы использовали **методы** объяснительного исследования и количественные подходы для анализа исторических экономических данных по Гане. В данном исследовании рассматривается связь между налоговыми поступлениями и экономическим ростом. Кроме того, в нем анализируется мультипликативная роль инфляции во взаимосвязи между налоговыми поступлениями и экономическим ростом в Гане. В исследовании используются вторичные данные временных рядов, собранные за 19 лет, с 2005 по 2023 г., и применяется авторегрессионное тестирование с распределенным лагом и коинтеграционной оценкой для анализа роста налоговых поступлений, экономического роста, прямых иностранных инвестиций, учетной ставки, инфляции и государственных расходов. **Результаты** показали, что темпы роста налоговых поступлений имеют статистически значимую положительную связь с экономическим ростом как в краткосрочной, так и в долгосрочной перспективе. Кроме того, исследование выявило статистически значимый отрицательный сдерживающий эффект инфляции на взаимосвязь между ростом налоговых поступлений и экономическим ростом как в среднесрочной, так и в долгосрочной перспективе. Было показано, что влияние налоговых поступлений на экономический рост более интенсивно в краткосрочной перспективе, чем в долгосрочной. Основной **вывод** статьи заключается в том, что рост налоговых поступлений в Гане больше способствует экономическому росту в краткосрочной перспективе, чем в долгосрочной. Кроме того, рост стоимости товаров и услуг сдерживает экономический рост, а инфляция снижает усиливающий эффект налоговых поступлений на экономический рост.
Ключевые слова: ARDL; Гана; экономический рост; налоговые поступления; прямые иностранные инвестиции; инфляция

Для цитирования: **Bosomtwe E., Omane-Adjekum C., Nyame J., Agyapong E.K., Adegbedzi K.D., Forson J.A., Gadzo S.G., Botwe E. Tax revenue, inflation, and economic growth: A Ghanaian perspective.** ***Review of Business and Economics Studies*****. 2025;13(1):55-72. DOI: 10.26794/2308-944X-2025-13-1-55-72**

Introduction

Tax revenue is the total amount of money collected by the government to run a country's administration [1, 2]. Inflation is ascribed to the rise in the general price of goods and services in a defined economy within a specific period [3, 4]. Economic growth, on the other hand, measures the expansion in the size of a country's economy within a specified accounting year [5]. Over the years, policymakers and researchers alike have endeavored to unravel the factors that can facilitate economic expansion, especially by assessing the impact of macroeconomic variables on economic growth. For instance, [1] examining the case in South Asian countries proved that tax revenue hurts economic growth. Similarly, a study on how statutory taxes on corporate income and personal income affect economic growth revealed that both taxes have an inverse relationship with economic growth in 25 wealthy OECD (Organisation for Economic Co-operation and Development) countries [6]. Notwithstanding, [7, 8] suggest that more tax revenue improves economic advancement. This demonstrates that a rise in tax revenue should propel economic growth. However, this has been an economic mirage in the Ghanaian narrative. For instance, Ghana's tax revenue grew from 6.9% to 7.1%, 7.4%, and 8% for the fiscal years 2017, 2018 and 2019. Notwithstanding, economic growth for the same periods was 8%, 6%, 6%, and 0.5%, respectively, contradicting the literature that supports growth in times of rising revenue [9, 10] but supports [11]. This shows that there is a problem that warrants empirical investigation.

We acknowledge that few studies have been conducted on the concepts; notwithstanding, these studies revealed inconsistent results. While some studies documented a negative relationship between tax revenue and economic growth [12, 7, 8], the opposing literature empirically adduced evidence of a positive association between tax revenue and economic growth [13, 9, 10]. Some of the existing studies concentrated outside Ghana [10, 1, 12, 8]. In addition, the dataset used in all the existing studies predates the inception of COVID-19, which can alter the known narrative. Moreover, since the concept is economically delicate as each country pursues different tax policies, for reliable results the concept must be explored from a specific country's perspective. Furthermore, no known study has explored the multiplicative role of inflation in the examined nexus. Addition-

ally, existing studies used mixed units to measure the concepts, such as the Ghana cedi to measure tax revenue, while the rate was used to measure economic growth. Examining the nexus among these measures does not intuitively reflect economic reality. This makes the use of a relative approach to assessing tax revenue growth and interacting inflation in the tax revenue-economic growth nexus in the literature using ARDL generally scarce on the global scene and non-existent in the Ghanaian narrative, which leaves a lacuna in literature and incites research.

The objectives for the study are:

1. To examine the effect of tax revenue growth on economic growth.

2. To examine the multiplicative role of inflation in the tax revenue growth-economic growth nexus in Ghana.

The paper focused on Ghana because the country has, over the years, experienced an upsurge in tax revenue through the introduction of new taxes such as the electronic transaction tax (E-Levy) without commensurate economic growth [14]. Also, we focused on Ghana because the country has, over the years, resorted to credit facilities from the International Monetary Fund (IMF), which have implications for its tax revenue since a portion of its revenue will be used to service debt interest, which dampens its growth strength. Moreover, the study focused on Ghana because the country is plagued with perennial vices such as illegal mining that has destroyed its vegetation and requires the government to implement an eminent initiative by employing youth to plant trees to restore its ecology dubbed youth in afforestation. This initiative takes a chunk of money from the country's consolidated fund that could have been used to finance development projects. The findings of the study will serve as a guide to the Ministry of Finance as a policymaker as to what pragmatic fiscal policies to pursue to ensure effective mobilization of tax revenue and its utilization while taxpayers would know the essence of paying tax to increase compliance. Again, the actual role of inflation in the examined nexus will direct policymakers like the central bank as to the kind of inflation-oriented policy to be pursued to put inflation under control while ensuring economic growth. Finally, the findings of the study will enrich literature.

The remaining part of the study is structured as follows: Section two is a literature review; Section three describes methodology; Sections four and five present results and discussion and conclusion and recommendation, respectively.

Literature review

Theoretical underpinning

The study draws its motivation from the public choice theory and the institutional economics theory.

Public choice theory. This theory elucidates how political dynamics and incentives impact the government's decisions regarding revenue mobilization and expenditure distribution [15]. Therefore, policies that increase government spending on the productive sectors of the economy along with taxation policies that lessen the tax burden on consumers and businesses to boost consumption and excite economic growth would be implemented by public officials who anticipate receiving incentives when the economy grows [16]. The theory is pertinent to the current topic since it emphasizes government expenditure and taxation, which are the notions used to measure fiscal policy in this study; therefore, the theory is relevant to the present discussion. Empirical studies [17, 16] have applied theory.

Institutional economic theory. This theory contends that an efficient legal system, along with the appropriate frameworks and structures, can carry out its supervisory function of keeping an eye on how companies and agencies behave, guaranteeing ethical business practices that support sustainable development [18]. According to the theory, the existence of strong institutions would result in the industry sectors being protected by suitable laws and regulations, which would increase investor confidence and draw in foreign companies to support the economy [18–20]. The theory considers institutional quality's role in sustainable growth as investigated by the study, making it pertinent to the current conversation. Existing studies [21, 20] applied this theoretical framework.

Economic growth theory. This theory suggests that expansion in an economy is mostly driven by capital injection, labor, and technological advancement in an economy over a period [22, 23]. The economic growth framework emphasizes that tax revenue can be pushed into infrastructure

development, human capital enhancement, and stimulating economic growth [24]. Nevertheless, overburdening the taxpayer with excessive tax can be a counterproductive and demeaning investment in the short and long run. On the other hand, if inflationary pressures are not put under control, it will reduce the purchasing power and distort economic stability in both runs [25, 21, 22]. In the Ghanaian case, striking the balance between tax revenue mobilization and calming inflation while ensuring growth is paramount for ensuring economic growth. Revenue from effective tax policies can finance developmental projects, whereas inflation can hamper these efforts. Therefore, Ghana's economic advancement depends on these dynamics. Studies [25, 26] have applied this theory.

Empirical review

On the empirical ground, diverse empirical studies have investigated the effects of taxes on economic growth. Results are far from being conclusive, varying across countries, methodologies, and fiscal variables involved. This study considers prior empirical works in this context. [21] investigated the relationship between taxation and economic growth in African countries using a dataset from 2004 to 2013. After subjecting the data to regression tests, it was revealed that tax revenue is positively related to gross domestic product (GDP) and promotes economic growth in Africa. The weakness of the study lies in its use of only a few African countries, neglecting Asia and other parts of the world. Also, the study failed to consider events after 2013. In a similar vein, an empirical investigation conducted by [10] that used multiple regression as a tool to analyze the effect of tax revenue on economic growth in Nigeria reported that tax revenues impact gross domestic product positively. This finding is consistent with the result of [21], who also reported a positive effect. The study is entangled with the limited dataset, which can lead to spurious results. In addition, [27] employed the least squares technique and recorded a positive relationship between tax revenue and economic growth. The study examined the impact of tax revenue on Nigeria's economic growth using Company Income Tax (CIT), value added tax (VAT), and petroleum profit tax (PPT) as referents for tax revenue and GDP for economic growth for 11 years.

Conversely, [7] employed the robust least-squares estimation method to explore how statutory tax on corporate income and personal income affects economic growth in 25 oil-wealthy OECD countries. The result showed that both taxes adversely affect economic growth, which contradicts the results of [21] and [9], who provided positive findings. Also, using a 20-year dataset from nine different countries in the Association of Southeast Asian Nations (ASEAN) and panel data estimation techniques to inquire about the relationship between an increase in taxes and economic growth, [10] discovered a positive relationship. The empirical findings showed that higher tax revenue could reduce the disadvantages of tax impacts to boost economic growth. However, due to a lack of data collection, the study is confined to examining the tax revenue ratio overview, which overlooks the tax structure. The negative result misaligns with the positive result adduced by [22, 10]. The weakness of the study is the use of limited scope making it lack generalizability. Similarly, a study by [28] on the effect of the value-added tax on economic growth in Kenya and [29] research using the auxiliary approach and the ordinary least squares estimation technique found a significant and negative relationship between value-added tax and economic growth. Similarly, [30] applied a dynamic panel threshold regression to examine the nonlinearities in the inflation-growth nexus in Africa and recorded the existence of significant nonlinearities in the inflation-growth nexus, which is opposed by the positive impact of inflation on economic growth [31].

Hypothesis development and priori

As reported by [21], there is a positive significant relationship between government expenditure, government revenue, and sustainable development. Findings indicated that tax revenue is positively related to GDP and promotes economic growth in Africa. It was significant at the 5% level. The study concluded that tax revenue has a significant positive relationship with gross domestic product. This study is supported by the account of [10], whose empirical study unveiled that both government expenditure and revenue positively affect sustainable economic growth. The study finds a positive impact of tax revenue on the gross domestic product of Nigeria and Ghana. Several studies have [21, 9, 7]

provided evidence that tax revenue positively affects economic growth. In contrast to the aforementioned findings, [5] discovered that there is a negative relationship between tax revenue and economic growth. The empirical findings showed that higher tax revenue could reduce the disadvantages of tax impacts to boost economic growth. A similar negative relationship between the tax burden and the rate of economic growth in Nigeria and South Africa was reported by [1]. [31] posited from their empirical inquiry that inflation positively impacts economic growth.

Therefore, based on the above discourse, the following hypotheses were formulated.

H_1: *Tax revenue growth significantly and positively affects economic growth.*

H_2: *Inflation significantly and negatively moderates the tax revenue growth-economic growth nexus.*

Methodology

The study used time series secondary data spanning from 2005 to 2023. The use of only secondary data in the research is a result of its accuracy, reliability, and standardized nature, other than primary data, as supported by [32–36]. This 18-year data period was considered appropriate based on the assertion by [37] that using a data period of ten years and above for statistical research is sufficient to yield reliable results, as confirmed by [38–41], who used a data period of ten years and above in their respective studies and reported reliable results. The adoption of the quantitative technique by the study was motivated by the approach's advantage of generalizing results to a larger population and its empirical use by studies [42, 43]. The data for the variables were extracted from the World Development Indicators (WDI) published in 2023). The reliance on WDI for data is anchored on the source's credibility in providing accurate data for several variables, as attested by studies [44, 45].

Model specification

The study employed the linear model with motivation from [46, 47]. Three models are spelled out for the study in three equations. Equation (1) is a functional form relating the regressors to the regressand in the model. Equation (2) is a vector form of the regressand and the regressors expressing the objective one of the study, the model incorporates the first lag of economic growth to know its impact on the current year's economic growth along with tax revenue and control variables. Equation (3) is a vector form expressing objective two, in this model the study multiplies inflation and tax revenue to serve as the interactive term together with control variables to examine its impact on the dependent variable.

$$GDPG_t = TRG_t, PR_t, GEG_t, FDII_t, IF_t, \quad (1)$$

$$GDPG_t = \alpha + \gamma_1 GDPG_{t-1} + \gamma_2 TRG_t + \gamma_3 PR_t + \\ + \gamma_4 GEG_t + \gamma_5 FDII_t + \gamma_6 IF_t + \mu_t, \quad (2)$$

$$GDPG_t = \alpha + \gamma_1 TRG_t * IF_t + \gamma_2 PR_t + \\ + \gamma_3 GEG_t + \gamma_4 FDII_t + \mu_t, \quad (3)$$

where *GDP* — Economic growth; *TRG* — Tax revenue growth; *PR* — Policy rate; GEG — Government expenditure growth; Foreign direct investment index, *IF* — Inflation; α — intercept; γ — elasticities; μ — stochastic error term; t — time series factor; *TRG*IF* — moderating factor. The notion behind exposited Models 2 and 3 is that variations in the tax revenue growth rate and inflation would impact economic growth.

Estimation technique

The study employed the Autoregressive Distributed Lag (ARDL) to the cointegration estimation approach, which is a time series estimation technique that alludes to the fact that both the lag of the dependent and the independent variables are contemporaneously related in the model [49]. The application of the ARDL is a result of certain peculiar strengths associated with the technique, which are that the ARDL is efficient in both small and large datasets, as confirmed by [5, 50]. Again, the ARDL can produce both long-run and short-run estimates of explanatory variables on the explained variable by substituting the lag and the error lag terms as supported by [51]. Also, the ARDL does not require a specific order of variables, making it applicable to variables with a mixed order of I (0 and 1). Moreover, the ARDL is efficient in addressing data's inherent problems, such as serial or autocorrelation, as confirmed [52]. Furthermore, the technique can estimate the error correction term through a linear transformation. Additionally, the appli-

cation of the technique by existing studies motivated its adoption by the study [37]. In inference, the study found the variables under consideration are of order I (0) and I (1), which serve as empirical justification. Mathematically, the assumptions of the technique are expressed as follows.

$$GDPG_t = \theta_1 \sum_{i=0}^{\rho} GDPG_{t-1} + \theta_2 \sum_{i=1}^{K} TRG_{t-1} + \theta_3 \sum_{i=1}^{K} PR_{t-1} + \theta_4 \sum_{i=1}^{K} GEG_{t-1} + \theta_5 \sum_{i=1}^{K} FDII_{t-1} + \theta_6 \sum_{i=1}^{K} IF_{t-1} + \\ + \sigma_1 GDPG_{t-1} + \sigma_2 TRG_{t-1} + \sigma_3 PR_{t-1} + \sigma_4 GEG_{t-1} + \sigma_5 FDII_{t-1} + \sigma_6 IF_{t-1} + \varphi. \quad (4)$$

Equation (4) gives the unrestricted lad estimation posited by the ARDL technique. The acronyms used are θ — elasticities of the lag variables estimating short-term effect whilst $\sigma_1 - \sigma_6$ is the slope long-run effect, $t - 1$ — lags. The ARDL posits long-run cointegration among the explained and the explanatory variables tested at a 5% level with the null of no cointegration expressed as $\boldsymbol{H_0}$: $P = K = K = K = K = K = K = K = K = 0$.

Error correction model

The error correction term can be used to measure the long-run variations in the model, while the elasticities of the lag variables measure the short-term effect of the variables (*Table 1*) [36], expressed as:

$$GDPG_t = \theta_1 \sum_{i=0}^{\rho} GDPG_{t-1} + \theta_2 \sum_{i=1}^{K} TRG_{t-1} + \theta_3 \sum_{i=1}^{K} PR_{t-1} + \\ + \theta_4 \sum_{i=1}^{K} GEG_{t-1} + \theta_4 \sum_{i=1}^{K} FDII_{t-1} + \theta_5 \sum_{i=1}^{K} IF_{t-1} + \omega ECT_{t-1} + \varepsilon t, \quad (5)$$

where ECT — Error correction term; εt — error term; θ — slope of the regressors; ω — slope of the ECT.

The inclusion of foreign direct investment as a control in the study is justified on the basis that foreign capital inflows boost economic growth through employment creation, which increases direct taxes such as pay-as-you-earn and corporate tax [53]. Government expenditure was incorporated in the study because rising government spending means an expansionary policy that pumps more money into productive and auxiliary sectors of the economy, such as paying contractors. When workers are paid, they get enough to spend, save, and invest, which stimulates economic activities and increases economic growth when inflation is controlled [5, 54]. The basis for incorporating policy rates in the study is that when policy rates are low, more businessmen can contract loans to expand their production capacities, which increases employment and consequently economic growth with ceteris paribus [55]. Inflation was incorporated in the study because rising prices of goods and services increased the cost of production and cost of living, dampened sales, and limited consumption which can adversely impact government revenue targets [56, 57].

Results

This section of the study presents and discusses the results obtained from the statistical tests.

Descriptive analysis

Per the descriptive results in *Table 2*, GDP recorded an average of 6.11%, depicting a steady expansion in the economy; nevertheless, a standard deviation of 3.0 indicates moderate dispersion from the average, and the positive skewness of 0.57 indicates a few periods of robust economic growth, while the probability of 0.37 shows a normal distribution. Tax revenue averaged approximately 8.81%, which shows a healthy revenue mobilization against a deviation of 2.30, indicating a minor variability around the average; a skewness of 1.85 demonstrates occasional surges in tax revenue. With a mean of approximately 39.32%, government spending has shot up significantly; on the other hand, a deviation of 10.73 indicates a moderate variability from the center of its distribution. A pos-

Table 1
Measurement and source of the variables

Variable	Measurement	Source
GDPG	Increase in the total production of goods and services	WDI (2023)[1]
TRG	Percentage growth of tax revenue for a fiscal year	WDI (2023)
PR	Benchmark interest rate	Bank of Ghana (2023)[2]
GEG	Percentage growth in government expenditure for a fiscal year	WDI (2023)
FDII	Net of foreign capital flows	WDI (2023)
IF	Consumer price index	WDI (2023)

Source: Author's construct (2025).

[1] *World bank (2023). World Development Indicators. URL: https//: www.databank.worldbank.org*

[2] *Bank of Ghana (2023). Monetary policy committee. URL: www.bog.gov.gh*

Table 2
Descriptive statistics

Variables	GDPG	TRG	GEG	IF	PR	FDII
Mean	6.1115	8.8053	39.3226	13.1542	18.8421	5.4184
Median	5.9735	8.0100	32.8000	11.6800	18.5000	5.5700
Maximum	14.0471	15.3100	58.3900	19.2500	27.0000	9.4700
Minimum	0.5139	6.9600	31.9000	7.1400	12.5000	1.3500
Std. Dev.	3.0003	2.3022	10.7333	3.9016	4.4129	2.4205
Skewness	0.5786	1.8504	1.0227	0.1493	0.4032	0.0471
Kurtosis	4.0515	5.2829	2.1424	1.6514	2.0569	1.9190
Jarque-Bera	1.9356	14.9685	3.8941	1.5104	1.2191	0.9322
Probability	0.3799	0.0806	0.1427	0.4699	0.5436	0.6275
Sum	116.1177	167.3000	747.1300	249.9300	358.0000	102.9500
S. Sq. Dev.	162.0371	95.4023	2073.6780	273.9985	350.5263	105.4553
Observation	19	19	19	19	19	19

Source: E-views estimate (2025).

Note. The acronyms have the following meanings: GDPG — Gross Domestic Product Growth; TRG — Tax Revenue growth; GEG — Government Expenditure Growth; IF — Inflation; PR — Policy Rate and FDII — Foreign Direct Investment Index.

itive skewness of 1.02 shows occasional surges in government spending with a non-normality of 0.14 over the years. The mean for inflation shows that prices of goods and services have been moderately high with a dispersion of 13.15 against a positive skewness and normal distribution. The policy rate and FDI index, on the other hand, registered moderate averages depicting a soar in the lending benchmark rate and foreign capital flows into Ghana alongside minor deviations and positive skewness for the policy rate, but FDI was skewed negatively. Data for PR and FDI were normally distributed.

Correlation analysis

The inquiry performed a pairwise correlation test to assess the presence of multicollinearity which previous studies adjudged is present if

Table 3
Pairwise correlation

Variable	GDPG	TRG	GEG	IF	PR	FDII
GDPG	1.0000					
TRG	0.4509	1.0000				
GEG	−0.2509	−0.1629	1.0000			
IF	−0.2971	−0.0281	−0.0146	1.0000		
PR	−0.2683	−0.4124	0.3217	0.2702	1.0000	
FDII	0.3944	−0.0618	−0.6338	0.0470	−0.3729	1.0000

Source: E-views estimate (2025).

Table 4
VIF test

Variable	VIF	1/VIF
GEG	1.79	0.487
FDII	2.05	0.557
PR	1.68	0.593
TRG	1.39	0.717
IF	1.13	0.882
Mean VIF		1.61

Source: E-views (2025).

there is a correlation coefficient of 0.7 and above [58]. Meanwhile, another strand of literature asserts that a correlation coefficient of above 8.0 indicates the presence of multicollinearity [59]. Per the correlation result in *Tables 3, 4* which shows the highest correlation of 0.451 recorded between TRG and GDPG, the investigation concludes the absence of multicollinearity in the series. This conclusion supports the account of [60] and [43] whose study reported a correlation coefficient of below 0.8 and concluded the absence of multicollinearity.

As a confirmatory measure, the study conducted a Variance Inflation Factor (VIF) test which assesses the correlation between a variable and the series. Per existing studies, a VIF value of 8 and above shows the presence of multicollinearity [5]. According to the test results, the highest VIF was 1.77 with an associated mean VIF of 1.54, since these values are less than the benchmark of 8.0 as asserted [60], we conclude the absence of severe multicollinearity which confirms the result of the pairwise correlation.

Stationarity analysis

To examine the presence of unit root in the series, the null hypothesis of the unit root was rejected at the level for IF and TRG while the null for the remaining variables was rejected at 1st difference. Based on this result as presented in *Table 5*, the study concludes the absence of random walk in the series with mixed order of I (0) and I (1) which justifies the use of ARDL estimation.

Lag length criteria and cointegration analysis

The paper conducted the bound testing to cointegration with the null hypothesis of no cointegration expressed as H_0: P = K = K = K = K = K. The F-statistics at 5% of the bound test for the two models were above the upper bound values, therefore we reject the null and conclude there is long-run cointegration, results are presented in *Table 6*. To determine the optimal lag length for the ARDL estimation the study based on the Akaike infor-

Table 5
Stationarity test

Variable	t-Statistic	Prob.	t-Statistic	Prob.	Order
d(GDPG)	−2.432	0.2324	−3.2301	0.0214**	(1)
d(TRG)	−3.2381	0.0317**	−4.8321	0.0133**	(0)
d(FDII)	−2.8361	0.324	−3.8371	0.2451**	(1)
d(GEG)	−1.0923	0.635	−4.8362	0.009**	(1)
d(IF)	−3.9280	0.032**	−1.2921	0.0232**	(0)
d(PR)	−1.2258	0.6112	−2.3216	0.0123**	(1)

Source: E-views (2025).

Note: ** denotes significance at 5%.

Table 6
Lag length criteria and long run bound testing to cointegration

Model	Bound Test F-statistics	5% Critical Value	Remarks
GDPG=f (TRG, IF, GEG, PR, FDII)	6	Upper (3.41) Lower (2.42)	Cointegration Exist
GDPG=f(TRG, TRG_IF, GEG, PR, FDII)	5	Upper (3.28) Lower (2.37)	Cointegration Exist

$H_{0:}$ no cointegration, accept if F< critical value for lower bound.

Source: E-views (2025).

mation criterion, Schwarzman information criterion, and final prediction error with the result demonstrating that the appropriate previous observation to be included in the estimation based on the selection criteria is lag 1.

Models 1 and 2 registered R-squares of 74.3% and 75.8% associated with Adjusted R-squares of 72.7% and 75.5% respectively. Based on this result, the regressors explained 74.3% and 75.8% variations in the regressand which is above the acceptable benchmark of 70% as shown in *Table 7*.

Error correction model

The error correction term shows the variations in the series in the short-run period and also represents the rate of adjustment to equilibrium when there are distortions in the series that empirically fall within −1 and 0. The estimations as represented in *Table 7* recorded ECT of (−0.243) significant at 0.0002*** for Model 1 and (−0.263) significant at 0.004*** for Model 2. This shows that distortions in economic growth are significantly restored to equilibrium at a moderate rate.

Discussion

Through the ARDL test results as presented in *Table 7*, a year lag of economic growth has a positive significant effect on economic growth in both models. This demonstrates that the previous year's economic expansion encourages growth in subsequent years. On objective one, which was to assess the effect of the rate of increase in taxes on economic growth, tax revenue growth registered a statistically significant positive relationship with economic growth for Model 1 and Model 2 in the short run and long run. Per this result, the study fails to reject $\mathbf{H_1}$ and concludes the existence of positive tax revenue on economic advancement. This implies that a rise in government revenue exerts a positive effect on economic growth both in the short and the long run. The positive result means that taxes mobilized by the government are invested in productive sectors of the Ghanaian economy which facilitates the production of goods and services for locals which expands the economy and for export which yields foreign exchange.

Table 7
ARDL result for economic growth

Variables	Long run		Short run	
	Model 1 gdpg=if≠trg_if	**Model 2 gdpg=trg_if≠if**	**Model 1 gdpg=if≠trg_if**	**Model 2 gdpg=trg_if≠if**
GDPG (–1)			1.432 (0.001***)	0.564 (0.014**)
TRG	0.072 (0.017**)	0.123 (0.041**)	0.342 (0.034**)	0.248 (0.034**)
GEG	–0.085 (0.051**)	–0.061 (0.033**)	–0.053 (0.234)	–0.074 (0.031**)
PR	0.043 (0.221)	0.024 (0.643)	0.053 (0.216)	0.062 (0.524)
FDII	0.814 (0.011**)	0.831 (0.024**)	0.847 (0.042**)	0.453 (0.022**)
IF	–0.292 (0.013***)		–0.847 (0.004***)	
TRG_IF		0.081 (0.061*)		0.082 (0.071*)
ECT			–0.243 (0.002***)	–0.263 (0.004***)
R-Squared			0.743	0.758
Adj. R-Squared			0.727	0.755
Durbin. W.			2.531	2.221
Prob(F-Stat)			0.009***	0.044**

Source: E-views estimate (2025).

Note: *, **, and *** denote significance at 10%, 5%, and 1%. NB: Figures in parenthesis are probabilities whilst those without are coefficients.

The ascertained result implies that when the government invests mobilized taxes in public infrastructure, education, healthcare, and other areas, it directly contributes to economic growth through job creation and improvement in productivity. The result is intuitional because when the government invests in productive sectors of the economy to create jobs, more laborers would be employed, which increases production, consumption, and savings. The positive result aligns with the public choice theory in that, in anticipation of incentive and response to taxpayers' preferences, mobilized taxes are invested in public goods and services that create an enabling environment for economic growth [14, 15]. Again, the finding sides with the institutional theory because effective supervision of revenue allocation would ensure taxes are allocated judiciously to areas needed to promote economic growth [17]. Similarly, the positive effect aligns with the classical economic growth theory [22, 23]; this is true in the sense that investing the mobilized taxes in infrastructure and technological investment can improve the business environment, which boosts revenue and increases the tax net [24]. Supporting traders and businessmen with capital encourages business expansion and consequently increases tax revenue [24, 26]. The positive result is consist-

ent with the findings of [12], who discovered a significant positive effect of tax revenue on economic growth in Nigeria. Again, [7] found that tax revenue exerts a positive impact on economic advancement. Conversely, the finding deviated from the account of [11], who unveiled that tax revenue harms economic growth in South Asian countries. Also, the positive result contradicts the negative effect found by [6] in OECD countries and [8], who found short-term taxes impede economic expansion.

Government expenditure recorded a significant inverse relationship with economic growth in the long run for Model 1 and Model 2, but insignificant in the short run for Model 2, which shows that a rise in government spending adversely impacts economic growth. The inverse finding means that rising government expenditures are not geared toward investment in productive sectors of the economy for the studied period. This result, though counterintuitive, is not surprising because in Ghana, a chunk of the government's annual appropriation bills are geared toward payment of emoluments and interest on debt. The policy rate, on the other hand, registered a positive yet insignificant impact on economic growth both in the short and long run for Model 1 and Model 2. This finding though counter-intuitional, can be ascribed to the fact that a chunk of businesses in Ghana do not seek loans from mainstream banks due to throat-cutting interest but rather resort to loans from non-bank financial institutions such as cooperative credit unions and microfinance with moderate interest. Foreign direct investment recorded a statistically significant positive effect on economic growth in the long and short-run periods in all models tested. The positive result implies that multinational corporations' investment in Ghana leads to expansion in the economy as a result of job creation and a rise in the production of goods and services for local consumption and export. This finding is intuitional in the Ghanaian case because the country has experienced a surge in foreign investment in the last decade, which includes the arrival of renowned automobile firms such as Nissan, Toyota, Sino Truck, and Renault, among others. Inflation hurt economic growth in both the long and short runs, respectively. The plausible reason is that a rise in prices of goods and services increases the cost of living, reduces consumption, and discourages saving for investment, which in turn contracts the economic expansion.

On objective two, which was to assess the moderating role of inflation in the nexus between tax revenue and economic growth, the study discovered inflation significantly and negatively moderates the relationship between tax revenue and economic growth in the interim and the long run; based on this result, the research fails to reject the $\mathbf{H}_2$. The reason for the ascertained result is that inflation erodes the real value of tax revenues and reduces the government's ability to finance essential services and projects. Also, high inflation creates uncertainty, contracts private investment, and impedes overall economic growth. This inverse moderating role of inflation in the examined nexus is in line with the institutional theory because rising inflation can interrupt the stableness and predictability of state economic institutions, which makes it daunting for businesses and households to plan and invest, hampering economic advancement [17, 19]. Moreover, in the context of institutional theory, eroded tax revenue may limit the ability of state institutions to extend essential services and ensure regulatory measures, further dampening economic growth [24]. This result agrees with the finding of [30] who concluded that there is a non-linear effect of inflation on economic growth. The non-linear findings imply inflation impedes economic advancement which is consistent with the ascertained negative moderation role. However, the negative moderating role does not support the positive impact of inflation on economic growth as adduced by [31].

Post estimation diagnostics

To ensure the robustness of the estimations, we performed diagnostics checks.

Heteroskedasticity check

To examine the presence of heteroskedasticity through the Breusch Pagan test which tests the null that the series is homoscedastic, the test result as presented in *Table 8* shows a p-value above 0.05 as failure to reject the null and concludes that the series is homoscedastic.

Autocorrelation

The paper assessed the possibility of autocorrelation through the Durbin-Watson test with

Table 8
Heteroskedasticity test: Breusch-Pagan-Godfrey

F-statistic	0.62544	Prob. F (5,11)	0.2510
Obs*R-squared	4.4179	Prob. Chi-Square (5)	0.5219
Scaled explained SS	0.7743	Prob. Chi-Square (5)	0.7743

Source: E-views estimate (2025).

results presented in *Table 7*. Since the Durbin-Watson statistics for the two models are above the threshold of 1.5 and above, we conclude that errors in the series are not carried on to the present year.

Model stability analysis

To assess the stableness of the Model used in estimating the results, the paper conducted a recursive estimate test through the CUSUM and CUSUMSQ tests. According to the recursive estimate tests, a stable model should have the series lying in between the 5% critical margin. The result presented in *Figure* shows that the series lies in between the 5% critical margins for both tests, we, therefore, conclude that the models are stable.

Conclusion

In most countries, especially in Africa and, for that matter, Ghana, tax revenue is the main source of income for the government to run its administration and undertake developmental projects to facilitate economic growth. Over the years, developing countries have recorded success stories in increments in tax revenue; however, economic growth has not moved in tandem with this rise in revenue, which challenges the narrative about the nexus between taxes and economic growth, which leaves a gap in literature. This study examined the nexus between tax revenue growth and economic growth and examined the multiplicative role of inflation in the tax revenue growth-economic growth nexus. The paper used secondary time series data collected over 19 years and employed the ARDL testing as a cointegration technique. First, the results revealed a statistically significant positive relationship between tax revenue growth rate and economic growth in the long and short run. It is therefore concluded that investing tax revenue in productive sectors of an economy significantly facilitates economic growth. This conclusion is intuitional and aligns with the public choice theory, economic growth theory, and institutional economic theory in that prudent allocation of tax revenue encourages economic expansion. The positive relationship is consistent with the literature that supports a positive significant relationship between tax revenue and economic growth. Second, the paper found a negative significant moderating role of inflation in the tax revenue growth and economic growth relationship. Based on this finding, the paper concludes that inflation exacerbates the cost of running business and contracting businesses, which erodes tax revenue and consequently dampens the positive impact of tax revenue in promoting economic growth. The conclusion is in agreement with the institutional economic theory because the rising cost of doing business reduces tax revenue and limits the capacity of state institutions in implementing robust policies which in turn undermine economic growth.

Our paper is the first of its kind to use tax revenue growth rate percentage estimates to assess its impact on economic growth, which has not been explored in tax and economic growth literature in Africa nor on the global scene.

We acknowledge the following limitations in our study. First, the data used for the study did not capture events that preceded 2005, which could have been included to increase the period. Second, the study used only Ghana for the analysis, which may limit the generalizability of the findings to other African countries. Third, the research dwelled solely on secondary data that were collected over different periods and may be subjected to differences in standard measures used over the years.

Based on the ascertained results in conjunction with appropriate interpretations, we recommend the following. To sustain the positive impact of the tax revenue growth rate on eco-

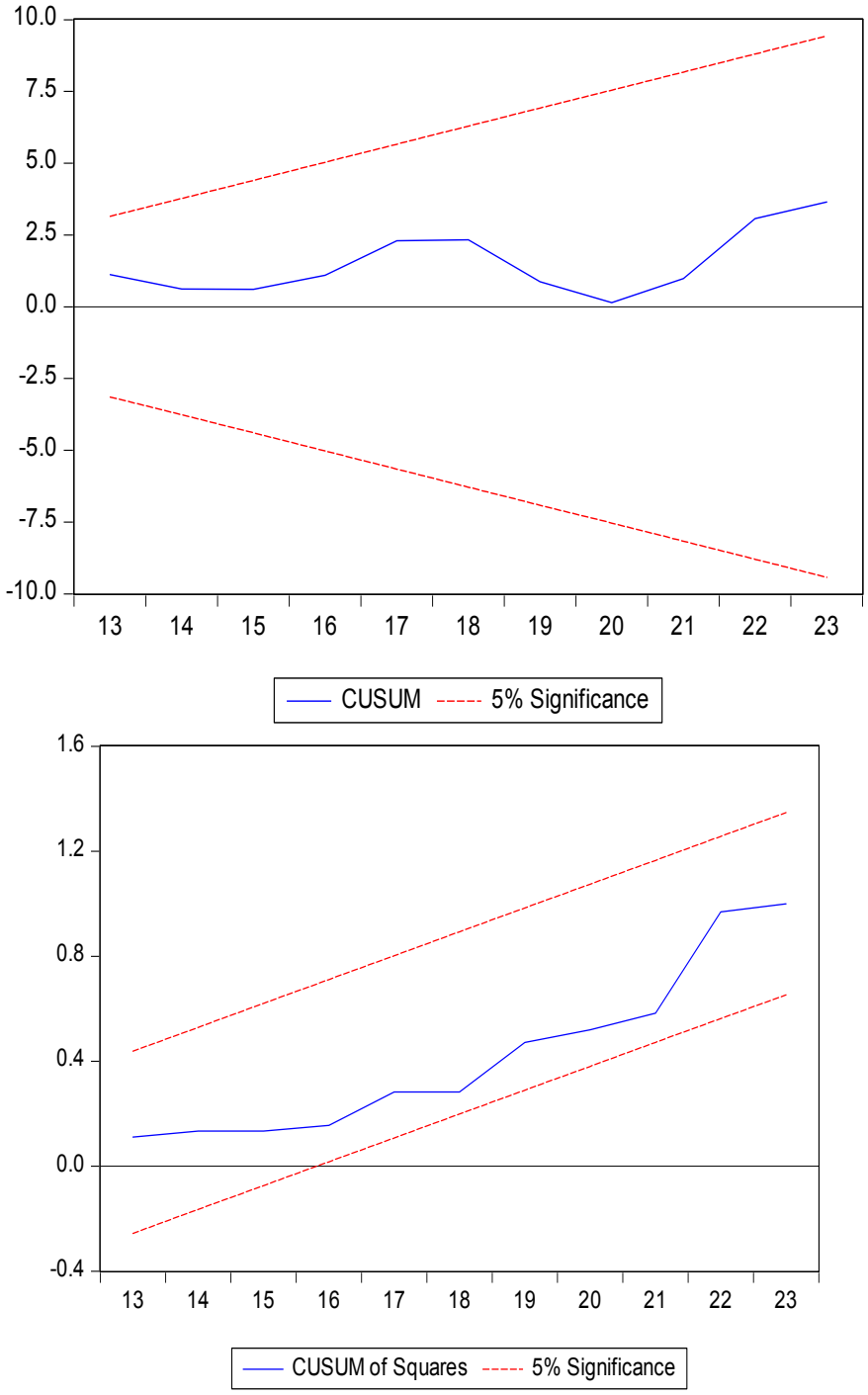

Fig. **Model stability**

Source: Developed by the authors.

nomic growth, the government should widen the tax net to involve more taxpayers to generate additional revenue to finance developmental projects. In addition, policymakers such as the Ghana Revenue Authority should close all loopholes to minimize tax evasion and tax avoidance to mobilize more tax revenue for the government. Also, policymakers should ensure that mobilized tax revenue is allocated to productive sectors of the economy to expand the economy through job creation. Moreover, to alter the negative moderating effect of inflation, policymakers should pursue inflation-mitigating strategies to reduce inflation. Finally, state institutions are implored to perform effective supervision to ensure allotted funds are properly utilized for the purpose allocated for. The study implores researchers to replicate the study in other neighboring countries, in Anglophone countries as well as Francophone countries in West Africa.

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D.K. Adegbdzi — Methodology.
E. Botwe — Validation and visualization.
J.A. Forson — Review and editing.
S.G. Gadzo — Validation and visualization.

Conflicts of Interest Statement: The authors have no conflicts of interest to declare.
The article was submitted on 22.10.2024; revised on 13.02.2025 and accepted for publication on 03.03.2025.
The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2308-944X-2025-13-1-73-83
UDC 330,334,338.339(045)
JEL F02, F10, F19, F50, F52, F62, F68

Specificity of the Bipartisan Consensus on Innovation Policy in the USA

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ABSTRACT

The purpose of this study is to assess the prospects for the development of US innovation policy at the present stage. **The methods** of statistical and comparative analysis, deductive analysis, as well as analysis of historical data and the current state of the problem, are used. The paper considers the evolution of the bipartisan consensus of the Republican and Democratic parties of the United States on innovation policy issues. The current study presents an analysis of the system of state regulation of innovation policy in the United States, the specifics of the approaches of the Republican and Democratic parties to the problem of ensuring leadership in the global innovation sphere in the context of intense competition with China. **The results** show that innovation policy is considered by both system-forming parties of the United States as a priority for ensuring national security and maintaining the leadership of the United States in the global economy, the international technological ecosystem, which necessitates revising approaches to its state regulation and developing key drivers for accelerating scientific and technological progress, which the state intends to focus on in matters of stimulating innovative activity in the country computing, technological competition between the United States and China.

Keywords: Republican Party; Democratic Party; USA; innovation policy; R&D; advanced technologies; artificial intelligence; skilled immigration; quantum computing; US technological competition with China

For citation: **Menshikov P.V., Menshikova A.M. Specificity of the bipartisan consensus on innovation policy in the USA.** ***Review of Business and Economics Studies.*** **2025;13(1):73-83. DOI: 10.26794/2308-944X-2025-13-1-73-83**

ОРИГИНАЛЬНАЯ СТАТЬЯ

Специфика двухпартийного консенсуса по инновационной политике в США

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АННОТАЦИЯ

Целью исследования является оценка перспектив развития инновационной политика США на современном этапе. Использованы **методы** статистического и сравнительного анализа, дедуктивного анализа, а также анализ исторических данных и текущего состояния проблемы. В работе рассматривается эволюция двухпартийного консенсуса республиканской и демократической партий США в вопросах инновационной политики. В исследовании представлен анализ системы государственного регулирования инновационной политики в Соединенных Штатах, особенности подходов республиканской и демократической партий к проблематике обеспечения лидерства в мировой инновационной сфере в контексте острой конкуренции с КНР. **Результаты** исследования показывают, что инновационная политика рассматривается обеими системообразующими партиями США как приоритет обеспечения национальной безопасности и сохра-

нения лидерства Соединенных Штатов в мировой экономике и международной технологической экосистеме, что обусловливает необходимость пересмотра подходов к ее государственному регулированию и выработке ключевых драйверов ускорения научно-технического прогресса, на которые государство намерено делать акцент в вопросах стимулирования инновационной активности в стране.
Ключевые слова: республиканская партия; демократическая партия; США; инновационная политика; НИОКР; передовые технологии; искусственный интеллект; квалифицированная иммиграция; квантовые вычисления; технологическая конкуренция США с Китаем

Для цитирования: **Menshikov P.V., Menshikova A.M. Specificity of the bipartisan consensus on innovation policy in the USA. *Review of Business and Economics Studies*. 2025;13(1):73-83. DOI: 10.26794/2308-944X-2025-13-1-73-83**

Introduction

Research and innovation policies in the United States are defined by both federal and state authorities. The president and administration of the White House act as the central executive body, determining the priorities of the state innovation policy [1–3]. However, as a rule, the president alone does not make appropriate political decisions. The Office of Science and Technology Policy (OSTP) acts in this regard as an advisory council to the president of the country on science, research and development. J. Biden was the first president to appoint a science adviser to his cabinet. The Congress, in its capacity as a legislature, plays a critical role in shaping policy principles for national research and innovation. Legislative work takes place in the context of ongoing congressional consultations and debates with The Committee on Science, Space, and Technology, The United States Senate Committee on Commerce, Science, and Transportation, and The Congressional Research Service. The president and Congress jointly determine the federal budget, including R&D allocations. At the state level, financing is mainly accomplished through public-commercial partnerships involving scientific, educational, public organizations and private spending. U.S. national high-tech competitiveness has become a bipartisan priority because of China's growing innovation potential, as well as pandemic-related disruptions in the country's economy-critical supply chains. This consensus has led to restrictions on access to advanced American technologies from abroad and priority investments in the development and implementation of innovations within the country in the field of improving data privacy, cyberspace security and artificial intelligence (AI) [4–6, 7].

Overview of the literature on the specifics of the bipartisan consensus on US innovation policy

Official strategic documents adopted by both Democratic and Republican administrations over the past decade consider innovative policies as one of the decisive tools for ensuring US national security.[1] Democratic policy documents claim that in recent years the United States has become one of the few major countries in the world to reduce investment in R&D. The challenges of the current moment require a significant review of this situation and increased government spending in new sources of American global leadership.[2] Republicans call for reducing the state's regulatory functions in the economy and tax system, ensuring fair trade deals, increasing the production of reliable and abundant cheap energy by removing market-distorting restrictions on oil, natural gas and coal, supporting innovation, prioritizing American producers over all other foreign counterparties, and returning critical supply chains to the United States.[3] The US innovation strategy's policy nature is provided by both parties at the federal level. Its implementation is a response to economic, technological and military challenges from China, including China's desire to become a high-tech power and modernize its armed forces by 2035, which will turn China into a world-class military

[1] National Security Strategy. October 12, 2022. URL: https://www.whitehouse.gov/wp-content/uploads/2022/10/Biden-Harris-Administrations-National-Security-Strategy-10.2022.pdf/ (accessed on 03.11.2024).

[2] Annual growth rate of expenditure on research and development (R&D) in China from 2000 to 2024. URL: https://www.statista.com/statistics/1465710/research-and-development-expenditure-growth-in-china/ (accessed on 15.01.2024).

[3] The Republican Party Platform, 2024. URL: https://www.presidency.ucsb.edu/documents/2024-republican-party-platform (accessed on 22.12.2024).

power. Between 1991 and 2016, China increased its R&D spending 30 times. The US share of global R&D spending decreased from 41% in 2000 to 28% in 2018, while China's share in the same period increased from 4.5% to more than 25%. Recently, the total costs in China for R&D are approximately equal to the US indicator and significantly exceed the level of the European Union (EU). In 2009, China surpassed Japan as the second-largest R&D investor in the world. In 2018, China spent $ 554.3 billion on R&D, only slightly below the US level. China's share of global R&D of 26.3% approached the US share of 27.6%. Over the next years, China plans to invest an additional $ 1.4 trillion in public and private funds in so-called next-generation technologies.

Although the United States has always competed with other innovative countries, technological rivalry with China has a fundamental difference. Countries with the highest technological level of national economies, are to one degree or another, the closest allies and partners of the United States [8–10]. The political efforts of the United States to selectively update its production base and promote the development of new systemic solutions in the field of innovation policy are now crucial [7, 9]. The Republican and Democratic parties share the view that the United States should significantly increase investment in maintaining its competitive advantage as a global leader in innovation and take large-scale measures to address the risks to competition posed by technology platforms [1–3, 11].

Findings and discussion: the priorities of the innovative policies of the Democratic and Republican parties

The US continues to be the world's leading country in R&D spending, but this dominance is highly volatile amid China's tremendous success in building innovation capacity, identified by the People's Republic of China (PRC) leadership as the top political national priority.[4] The ranking of the Global Innovation Index 2024, which classifies world economies by their innovative capabilities according to 80 indicators, grouped by input and output innovative resources and covering multidimensional aspects of innovation, shows that the United States ranks third among 133 countries, 4th in innovative resources, and 5th in terms of innovation performance and leads in nine indicators (four less than in 2023) — in global corporate investments in R&D, the assessment of unicorns and the intensity of intangible assets, ranked lowest in infrastructure (30th), institutions (17th) and human capital and research (12th).[5] The United States is the world leader in funding for research in absolute terms, but only tenth in terms of appropriations for basic research. In 2000, they fell from the fifth position among OECD countries in terms of R&D costs in GDP to the eighth in 2019, when the federal government spent only $ 83.4 billion on basic and applied research. About 16.3% of came from computer science, mathematics and physical sciences. Federal support for R&D relative to GDP has been steadily declining since the early 1960s. The lowest level was reached in 2018 at 0.61% of GDP. To restore federal funding for R&D in the ratio of GDP to levels averaged nationally in the 1980s, it should increase funding by about 80%, or 100 billion dollars a year. Total federal spending on research and development should be increased from 0.7 to 1.4% of GDP over five years from about $ 150 billion to $ 230 billion annually. The most realistic is the increase in the level of federal funding for R&D to the average after 1976, which amounted to 1% of GDP. The presidency of B. Obama was also set, but the goal of 3% of GDP was never achieved.[6] The main advantages of innovation in the United States are software spending, as a percentage of GDP (rank 1) and intangible asset intensity (rank 1).

China, the largest non-OECD economy, financed 27% of R&D investments globally in 2021, representing 98% of non-OECD investments. The US funded 32% of global R&D in 2021. China shows the largest increase in R&D spending, followed by Korea and Taiwan. The US remains in 5th place, with an average annual growth in

[4] China's 14th Five-Year Plan, English-translated outline. URL: https://en.ndrc.gov.cn/policies/202203/P020220315511326748336.pdf (accessed on 22.01.2025).

[5] U.S. R&D and Innovation in a Global Context: The 2024 Data Update. URL: https://www.aaas.org/news/us-rd-and-innovation-global-context-2024-data-update; OECD Data Portal. URL: https://data-explorer.oecd.org/ (accessed on 12.02.2025).

[6] Donald Trump Says U.S. Never Hit 3% GDP Growth Under Obama — But It's Misleading. fortune.com. August 31, 2017. URL: https://fortune.com/2017/08/30/donald-trump-springfield-mo-3-gdp/ (accessed on 14.11.2024).

R&D spending of 3.8%. In 2022, the United States retained fourth place in the world in terms of R&D intensity, behind the leadership of Israel, South Korea and Taiwan, but ahead of Germany in 2019, as well as subsequently Japan and Sweden.[7] A common indicator of scientific results and performance is the publication of original peer-reviewed research articles in scientific journals. The US maintains leadership on this indicator in the world, although its level as a whole fell in 2022 and 2023 for the first time in decades. In second place is China. The second most common proxy for measuring innovation is patents, where the United States in total is significantly inferior to the patent activity of the PRC — in 2022, the largest number of existing patents in the world was registered in China — about 4.2 million against 3.3 million in the United States.[8]

Under the presidency of J. Biden, overall R&D funding was increased in the field of breakthrough technologies transforming the country's economy — artificial intelligence, biotechnology, quantum computing, as well as the modernization of next-generation weapons systems. One of the priorities of strategic innovation policy development in the overall context of economic progress measures has been to maximize the return to the United States of the production needed to provide critical supply chains, primarily semiconductors, to develop and apply less costly advanced resource-intensive energy generation technologies, and to achieve global leadership in addressing the impact of the growing global climate crisis [12]. Increased attention was paid to the creation of a US-controlled international regulatory system that would prevent the transfer of advanced technologies to unfriendly countries, mainly to China. The EU-US Trade and Technology Council was established. The Council developed a so-called roadmap on global economic and technological issues. An agreement was reached between the U.S. Artificial Intelligence Safety Institute and the relevant structures of England on a common approach to the safe development of AI. Measures were taken to integrate R&D into the structure of bilateral cooperation with India. The United States — India Initiative on Critical and Emerging Technology (iCET) program was launched. Initiatives were implemented with Singapore, South Korea and other partners of the United States.

The Democrats, considering the PRC as the most important strategic competitor in the United States, proceeded from the fact that vigorous competition with China, however, does not mean a desire for conflict. A firm commitment to a tough, but smart, attitude towards China is based on the persistent promotion of American interests and values, while ensuring the so-called bottom of stability in relations with China. Minimizing the risk of the flow of advanced technologies from the United States to China, "displacing" China from the innovative global economy of the 21st century, should be carried out through diversification of economic relations between the two countries, but not through the "separation" of their economies. China's ban on access in the United States to most innovations, primarily in the development of chips for AI technologies, the production of next-generation semiconductors, and developments in the field of quantum computing, should take place in parallel with cooperation where it is in the interests of the United States. In particular, in the creation of technologies to combat climate change and trade in fentanyl, as well as the safe use of AI.[9] Further unwinding the spiral of conflict with China is expensive and not in the interests of the United States. The United States House Select Committee on Strategic Competition between the United States and China adopted more than 150 policy recommendations to fundamentally reset the US economic and technological rivalry with China.

The programmatic position of the Republicans comes from the statement of the serious decline of the United States as a nation as a whole, when the future of the country, its identity, and the way of life itself are threatened more than ever before. As a party of industry, production, infrastructure and workers, resolutely distancing themselves from the "blind faith in the song of the sirens of

[7] The State of Sate Technology Policy 2024 Report. URL: https://csmapnyu.org/impact/policy/the-state-of-state-technology-policy-2024-report (accessed on 17.01.2025).

[8] WIPO Patent Search by Region. URL: https://www3.wipo.int/ipstats/ips-search/patent; How to Use the US Patents Database for Tech Inventions. URL: https://www.wipo.int›ipstats›news›news_0004 (accessed on 02.02.2025).

[9] The China Challenge: A New American Strategy for Technology Competition by the Working Group on Science and Technology in U.S.-China Relations. Project of the 21st Century China Center under the auspices of the Task Force on U.S.-China Policy. November 16, 2020. URL: https://china.ucsd.edu/_files/meeting-the-china-challenge_2020_report.pdf (accessed on 29.10.2024).

globalism", Republicans see economic progress in a decisive way in measures to halt inflation and return jobs to the country's industry.[10] Achieving global leadership in developing advanced high-tech industries, in particular, provides for the lifting of restrictions on the development of AI technologies introduced by J. Biden, the revival of the domestic industrial base, priority attention to critical defense industries and investments in advanced R&D. Including technologies for the creation of the Iron Dome missile shield, a developed production industry in Earth orbit, orbiting the Moon, and further to Mars, as well as strengthening partnerships with the rapidly expanding commercial space sector in order to develop assets in Space.

Continuity of consensus on innovation policies

Over the past few years, two presidential administrations — Republican and Democratic — and a bipartisan majority in Congress have taken a series of actions to improve US technological competitiveness. Their primary target was China. In 2021, the Frontiers in Science and Innovation Policy (FSIP) program was launched to activate the organization of basic research and innovation in the face of growing competition with China for leadership in high-tech industries. The three main priorities of the US strategic approach to science and technology policy are as follows: maximizing the extraction of advantages from the global research system in the field of innovative technologies, clearly defining the boundaries where the United States should lead in high-tech areas to ensure the country's national security, and where it is permissible for this to increase the participation of the United States in global innovative cooperation. In 2021, the Law on Innovation and Competition was adopted.[11] The Democratic administration of J. Biden imposed export controls, limiting China's access to advanced semiconductor technologies. In October 2022, the first set of these controls was announced, and in 2023, additional restrictions were announced to close vulnerabilities in earlier measures. Also in 2023, the Democratic president issued a decree restricting US investment in several Chinese sectors, without ruling out extending these investment restrictions to additional sectors of the Chinese economy. The US Congress passed The Infrastructure Investment and Jobs Act, IIJA and The CHIPS and Science Act by bipartisan consensus. China has retaliated by imposing export restrictions on certain materials used in semiconductor manufacturing. Through grants, subsidies, and tax credits, bills have earmarked billions of dollars in areas considered critical to the economic future of the United States, including semiconductor manufacturing, clean energy, AI, and quantum computing. In particular, the allotments reinforce the concept of "local policy" by sending about $ 80 billion to cities and counties throughout the country. The U.S. Department of Commerce and the National Science Foundation (NSF) programs are specifically aimed at improving technological competitiveness by investing in certain geographical areas of the country. The field delegation of technology policies, a geographically oriented investment approach, includes focused efforts to improve economic performance in specific areas. Despite its popularity after World War II, in the 1980s, this approach yielded to more cost-effective national and regional strategies. However, to date, geographical economic differences have increased, partly due to the fact that highly educated workers are concentrating in an increasing number of American cities.

Despite bipartisan support in the US Congress, the laws did not remove political differences between Republicans and Democrats over the future of US innovation policy. Many programs have indeed received funding, but far from in full, the size of which will continue to be discussed in a broader debate in Congress about general federal spending and the ceiling of public debt.

The bipartisan consensus of the US Congress, however, does not always take place on the issue of highly professional immigration. In the past, proposals for a "startup visa" enjoyed bipartisan support; politicians of both parties recognized the economic advantages associated with attracting entrepreneurs from other countries to the United States. Nearly two thirds of the leading AI

[10] The Republican Party Platform, 2024. URL: https://www.presidency.ucsb.edu/documents/2024-republican-party-platform (accessed on 22.12.2024).

[11] United States Innovation and Competition Act of 2021. URL: https://www.congress.gov/bill/117th-congress/senate-bill/1260 (accessed on 16.12.2024).

companies in the United States have immigrant founders or co-founders. In the foreseeable future, the development of AI technologies will largely depend on immigrants: their 70% among graduate students studying in the field of AI at the country's universities and more than 80% among doctoral students performing R&D in the field of computer and information sciences, electrical and computer engineering. Although immigrants account for 16% of all US inventors, they account for 23% of total innovation. Known interparty contradictions in the approach to the issue of highly skilled immigration to a certain extent prompted the federal authorities to delegate solutions to this problem to the state level, rightly believing that local immigration policies could better contribute to more effective investments, in particular in regional technology and innovation centers.

Prospects for a bipartisan approach to US innovation policy

On May 21, 2024, the US Senate unveiled a bipartisan roadmap laying the foundation for AI legislation. On May 15, 2024, the Bipartisan Senate Artificial Intelligence Working Group released the Bipartisan Senate AI Policy Roadmap document to identify bipartisan solutions to address the potentially profound effects of AI on the US economy and national security of the country.[12] Eight sections of the document — innovation in the field of AI in the USA; AI and labor; high-efficiency use of AI; elections and democracy; confidentiality and liability; transparency, explainability, intellectual property and copyright; protection against AI risks; national security and AI. The roadmap identifies key areas that will allow the United States to maximize AI benefits and minimize risks, while keeping pace with its strategic competitors, such as China — from promoting a national system of autonomous vehicles to significant new federal investments in AI [13].

It is recommended to support federal investments in AI, including an increase to $ 32 billion for annual research and development in the field of non-defense AI. It is proposed to allocate emergency allocations to fill the deficit, as well as to conduct a coordinated interdepartmental policy to support research and development in the field of AI with the participation of standing committees of the US Congress, including those conducted by small businesses. A concern was expressed that AI could affect jobs throughout the economy. A proposal has been made to develop legislation to promote the training, retraining and development of private sector employees, as well as to improve US immigration legislation for highly qualified workers in science, technology, engineering, and mathematics (STEM). The opportunities for AI to improve the delivery of public services are emphasized; a recommendation is made to congressional committees to look for ways to use federal hiring programs to attract AI talent to the federal service, as well as record the impact of automation on the workforce and monitor these trends over time. It is noted that AI may not allow companies using advanced technologies to properly comply with existing laws in areas such as transparency, explainability, testing and evaluation of R&D, including risks of direct or accidental violation of constitutional rights by AI, threats to public safety or anti-discrimination legislation.

There is also a bipartisan consensus on expanding the funding and portfolio capabilities of the National Science Foundation. Linking investment to regional competitiveness policies, as in the case of technology hubs, can contribute to a more equitable distribution of economic benefits. There is a common approach to understanding the importance of greater investment in science, infrastructure and partnerships with universities, firms and other stakeholders, with increased emphasis on expanding the country's geographical research base and establishing a network of new regional technology hubs.

Key areas of bipartisan consensus have been identified for additional decisions in the area of AI legislation. The roadmap does not call for comprehensive AI regulation, like The EU Artificial Intelligence Act, or for the creation of new federal AI regulators. Rather, the paper encourages the relevant committees to address selected AI policy issues with the clear intention of promoting more fragmented legislation that addresses its various aspects. The roadmap reflects the understanding that the AI value chain includes many participants and that responsibilities and responsibilities must be carefully considered (and distributed) in ac-

[12] U.S. Senate releases roadmap on artificial intelligence. URL: https://www.naco.org/news/us-senate-releases-roadmap-artificial-intelligence (accessed on 28.12.2024).

cordance with the role of the organization in the value chain. The document supports compliance with the "Artificial Intelligence Risk Management Framework (AI RMF)". The National Institute of Standards and Technology (NIST) is a means of ensuring more efficient AI management processes and assumes that suppliers in the process of public procurement should receive a more favorable attitude if they comply with the requirements of this concept. The roadmap does not provide for new federal and local laws governing AI, leaving open issues of priority and other actions of the US central executive authorities in matters of AI administrative regulation.

The US federal government spends nearly $ 200 billion annually on research and development. Presidents and Congress, however, rarely agree on how and how much money should be spent on science [14]. In fact, there are two different approaches to funding science — Republicans and Democrats. US science and technology policy can be assessed through the annual R&D budgeting process. In his first congressional budget request in 2017, D. Trump proposed historical cuts in almost every federal science agency, mainly targeting cutting programs related to climate and environmental protection. D. Trump's fiscal policies resembled the conservative orthodoxy of the R. Reagan era, prioritizing military spending over social programs, including R&D [15–19]. However, unlike R. Reagan, D. Trump sought to cut funding for basic research. Congress then rejected almost all of the Republican administration's intentions, deciding on one of the largest increases in federal R&D programs in US history, even without taking into account emergency spending packages funded by government measures to combat the pandemic.

The J. Biden administration has made science and innovation central to its early policy agenda — with appropriate budgets. Relying on a slim democratic majority in Congress, the White House conducted the cited landmark bills that contain important R&D provisions focused on environmental projects, clean energy, and semiconductor manufacturing. Ambitious funding targets for federal science agencies have been announced, with the US National Science Foundation (NSF) doubling its budget from $ 9 billion to more than $ 18 billion over five years. Despite the initial push for research and development, the last two budget proposals of the J. Biden administration offered much less to science. Years of scarce spending and a new Republican majority in the House of Representatives have led to fiscal austerity in Congress. Instead of going for a doubling of the NSF budget, the agency faced an 8% cut in FY 2024, the biggest cut in more than three decades. For fiscal year 2025, which runs from October 1, 2024, to September 30, 2025, the J. Biden administration requested a meager 3% increase in NSF spending, which is billions of dollars less than the level of spending envisaged by the Democratic administration earlier.[13]

The administration of D. Biden has strengthened technological security measures aimed at protecting American innovation [20]. In his first presidency, D. Trump launched The China Initiative, program by the United States Department of Justice in an attempt to prevent China from adopting the results of advanced American R&D. The administration of J. Biden formally ended this Republican program in 2022, but scientific cooperation between the United States and China continued to decline. D. Trump's policy to strengthen America's leadership in the "industries of the future" was continued. The term, coined by the then chief adviser to the Republican President for Science K. Drohemeier, refers to five new technological areas: artificial intelligence, quantum science, advanced production, innovative communications and biotechnology. This approach remained a key element of Democrats innovation policy throughout K. Harris's 2024 presidential campaign, including during her debate with D. Trump.

The authors of the article believe that the new Republican administration of D. Trump in order to increase the country's competitiveness in the field of AI will emphasize the asymmetric advantages of the United States — their status as a center of human capital in the development of AI; the effective use of targeted risk reduction strategies to protect sensitive uses of AI; the benefits of AI

[13] Fact Sheet: Biden-Harris Administration Announces Innovation Engines Awards, Catalyzing More Than $ 530 Million to Boost Economic Growth and Innovation in Communities Across America Home. The White House. Briefing Room. Statements and Releases. January 29, 2024. URL: https://www.whitehouse.gov/briefing-room/statements-releases/2024/01/29/fact-sheet-biden-harris-administration-announces-innovation-engines-awards-catalyzing-more-than-530-million-to-boost-economic-growth-and-innovation-in-communities-across-america/ (accessed on 30.10.2024).

technologies in big data processing; building a large-scale AI ecosystem, including through standards and platforms. With the main emphasis on breakthrough technologies in the field of AI, the course that took shape in the first presidency of D. Trump will continue. The Republican administration of D. Trump became the first in the history of the United States, which in 2018 in Washington at the summit "Artificial Intelligence for American Industry" identified artificial intelligence as a national priority [21, 22]. It is predicted that the bipartisan consensus in the US Congress on innovation policy will remain as a means of ensuring the country's national security. D. Trump, in his first presidency, strengthened the cybersecurity of federal networks and critical infrastructure, upgraded the status of the US Cyber Command to the Joint Combat Command to strengthen cyber operations in cyberspace, which streamlined governance processes and provided funding for expanded cyber operations, identified China as a central threat to cybersecurity, took measures to protect the supply chains of information and communication technologies and services", authorized the Commerce Department to limit the use of technologies that are considered a threat to US national security.

In 2018, the White House issued a memorandum specifically dedicated to cybersecurity in space. The document emphasizes the critical role that space systems play in national security, economic prosperity and technological progress. It recognizes the growing threat of cyberattacks on systems such as communications, navigation and weather monitoring. The memorandum, in line with the administration's emphasis on industrial empowerment, encourages cooperation between government and industry to share information, develop best practices and ensure a coordinated response to cyberattacks. On December 20, 2019, D. Trump approved the US Space Force as the sixth type of armed forces, which became recognition of space as a critical area for national security and maintaining US dominance in space technology. The status of the Space Command was upgraded to a single combat command as part of the creation of the Space Force. In 2019, D. Trump passed a decree "On maintaining American leadership in the field of artificial intelligence", formulating a national AI strategy in the interests of ensuring US dominance in this area. In 2020, a decree was signed "Promoting the use of reliable AI in the federal government". The Cybersecurity and Infrastructure Security Agency (CISA) is being established as the central body for coordinating federal AI research and development efforts with broad powers to protect critical infrastructure, ensure cyberspace security and improve communications in emergencies.

Conclusion

The bipartisan consensus of the Republican and Democratic parties on innovation policy takes place against a general background of generally constructive interaction between Congress and the White House administration, regardless of the specific alignment of the political forces represented in them. The authors of the study concluded that such a political phenomenon is due to objective reasons for the attitude of the US leadership to technological innovation as one of the key elements in ensuring the country's national security by maintaining leading positions in the global geopolitical competition of the 21st century. Both parties proceed from the priority of the tasks of the legislative and executive branches to create conditions for building up the national dual-use innovation system, involving government as an active partner with industry in support of R&D and domestic production, tighter regulation of many technological areas, and advocating the development of a new prohibitive and inherently restrictive approach to global high-tech cooperation with the aim of strategically deterring China in this direction. At the same time, significant differences remain in the positions of both parties, in particular, regarding high-tech immigration to the United States.

Objective analysis of the evolution of US innovation policy in recent decades [23–26] makes it reasonable to assert that that the re-election of D. Trump as president of the United States, combined with Republican control over both houses of Congress within the framework of the "America First" philosophy in the near term, could lead to a significant acceleration in the pace of technological progress in the United States, with a focus on AI R&D and further cybersecurity measures, even considering the well-known bureaucratic nature of many programs, which prevents, in particular, the implementation of projects to move chip

production to the United States. The Republican administration will prioritize accelerating AI innovations that could hamper U.S. competitiveness by removing regulatory barriers imposed by the previous Democratic administration by J. Biden largely because of ethical considerations.[14]

Given the complexity and urgency of China's problem, the strategy of sound risk management will continue. To remain truly competitive, American firms will operate globally, localize R&D to meet the needs of various fast-growing markets, and hire the best talents wherever they are available [27–29]. Global operations, including in China, will support economic activity and job creation in the United States. National security innovations, especially dual-use technologies, funding for basic scientific research, as well as R&D in three areas of technological innovation: 5G, AI and biotechnology, will receive further expansion. The idea of creating an international consortium with US allies and partners to determine technological policies toward China, as well as establish common ethical principles for conducting research, will receive advancement. The work on risk management of international cooperation in the field of advanced technologies is intensified [30–33].

In the future, the expansion of the bipartisan consensus of the Republican and Democratic parties of the United States is seen precisely within the framework of innovative policies in the development of advanced dual-use and AI technologies, protecting data privacy, cybersecurity and strengthening the digital infrastructure of the country as a whole, quantum computers, 6G technologies, high-capacity batteries. Several initiatives are being studied in Congress, supported by both parties, which may be considered as a matter of priority as soon as possible, including digital identification measures to combat Internet fraud, support for next-generation cybersecurity and digital supply chain security training.

[14] Fact Sheet: President Biden Issues Executive Order on Safe, Secure, and Trustworthy Artificial Intelligence. The White House. Briefing Room. Statements and Releases. October 30, 2023. URL: https://www.whitehouse.gov/briefing-room/statements-releases/2023/10/30/fact-sheet-president-biden-issues-executive-order-on-safe-secure-and-trustworthy-artificial-intelligence/ (accessed on 01.11.2024).

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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.
The article was submitted on 09.01.2025; revised on 25.02.2025 and accepted for publication on 05.03.2025.
The authors read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2308-944X-2025-13-1-84-92
UDC 330.133,336.743(045)
JEL E42, P18, Q54

Cryptocurrencies: Increased Anthropogenic Impact

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ABSTRACT

The emergence of cryptocurrencies is a response of technological development to the loss of trust in fiat money and the global banking settlement system. **The aim** of this study is to review existing ideas about the essence and anthropogenic impact of cryptocurrencies and determine the feasibility of their further use. **Methods** of contextual selection, system analysis, and general scientific methods were employed. **The results** show that the politico-economic contradiction of cryptocurrencies is their unreliability to preserve value concurrently with the high value of their production and use. Cryptocurrencies, having not yet become a mass phenomenon, already have a significant impact on nature, and their mass use conflicts with the transition to a green economy. **The key conclusion** is that increased use of cryptocurrencies will lead to an exponential rise in the use of limited resources. The production and use of cryptocurrencies as goods are associated with both obvious costs and significant negative external effects. Most importantly, governments view cryptocurrency as a threat to public finances rather than an environmental one. A possible solution to these contradictions may be the synthesis of centralized and decentralized currencies.

Keywords: green economy; fiat money; decentralized finance; cryptocurrency; value; carbon footprint; water footprint; regulation; central bank digital currency

For citation: **Bogomolov E.V. Cryptocurrencies: Increased anthropogenic impact. *Review of Business and Economics Studies*. 2025;13(1):84-92. DOI: 10.26794/2308-944X-2025-13-1-84-92**

ОРИГИНАЛЬНАЯ СТАТЬЯ

Криптовалюты: усиление антропогенного воздействия

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АННОТАЦИЯ

Появление криптовалют стало результатом реакции технического развития на потерю доверия к фиатным деньгам и глобальной банковской системе расчетов. **Целью** данного исследования является обзор существующих представлений о сущности и антропогенном воздействии криптовалют и определение целесообразности их дальнейшего использования. Были использовали **методы** контекстуального отбора, системного анализа и общенаучные методы. **Результаты** показывают, что политико-экономическое противоречие криптовалют заключается в их ненадежности для сохранения ценности одновременно с высокой стоимостью их производства и использования. Криптовалюты, еще не ставшие массовым явлением, уже оказывают значительное влияние на природу, и их массовое использование противоречит переходу к зеленой экономике. **Основной вывод** заключается в том, что более широкое использование криптовалют приведет к экспоненциальному росту использования ограниченных ресурсов. Производство и использование криптовалют в качестве товаров сопряжено как с очевидными издержками, так и со значительными негативными внешними эффектами. Прежде всего правительства считают криптовалюты серьезной опасностью для государственных финансов и не столько угрозой окружающей среде. Возможным решением этих противоречий может стать синтез централизованных и децентрализованных валют.

Ключевые слова: зеленая экономика; фиатные деньги; децентрализованные финансы; криптовалюта; ценность; углеродный след; водный след; регулирование; цифровая валюта центрального банка

Для цитирования: **Bogomolov E.V. Cryptocurrencies: Increased anthropogenic impact. *Review of Business and Economics Studies*. 2025;13(1):84-92. DOI: 10.26794/2308-944X-2025-13-1-84-92**

Introduction

"Green economy" has been proposed as a means for catalyzing renewed national policy development and international cooperation and support for sustainable development.[1] Negative externalities [1], such as a market failure, lead to the fact that the transition to an environmentally friendly economy is carried out politically, not economically. At the same time, the global contradiction of the green economy is that economically developed countries have taken care of the problem of long-term survival, while poor countries, the so-called "Global South," solve the problems of short-term survival.

Another contradiction of the green economy is the reduction of emissions into the atmosphere due to the increased consumption of limited earth fossil resources and the environmental burden associated with the disposal of elements necessary for green energy: batteries, solar panels, wind turbines, electric vehicles, etc.

In parallel with the process of finding solutions to reduce the global impact on nature, the process of deglobalization and deregulation of global settlements based on the US dollar is underway. The world community is looking for effective tools to preserve value and make payments [2–6] in the face of compromising the centralized global payment system [7–9] and the falling value of the US dollar. There is a process of building not only geopolitical but also financial multipolarity: the dichotomy of centralized (CeFi) and decentralized finance (DeFi) [10].

This led to the emergence of currencies based on the functioning of computer programs — digital or cryptocurrencies. Their value content is determined by their limitations, which are caused by the complexity and cost of their production process. The main difference between digital and cryptocurrencies is designated as the sign of the presence or absence of centralization of the management of their emission and use.

The digital currencies of central banks and private currencies, by accelerating interaction, reducing transaction costs, and facilitating cross-border transactions, can ensure the transition to a more diversified multicurrency system [11, p. 16].

Like any human activity, cryptocurrency production and use impact the world around them. The purpose of this study is to review existing ideas about the essence and anthropogenic impact of cryptocurrencies and determine the feasibility of their further production and use.

Literature review

Cryptocurrency researchers can be subdivided into supporters and opponents of cryptocurrencies. Supporters of cryptocurrencies are usually journalists and business researchers, while opponents or cautious supporters are usually economists conducting basic research.

Works that substantiate the economic opportunities and positive prospects for the development of cryptocurrencies [12–13] are opposed by studies that assert the negative consequences and critical economic dangers of cryptocurrencies for society [2–4; 14–16].

A particular area of cryptocurrency research is represented by works that explore the natural and social consequences [17–26].

Methods

This study was based on a systematic approach to economic phenomena analysis. The first step was to analyze the value of a cryptocurrency. This analysis used classical principles of production costs and neo-institutional principles of transaction costs. In the second step, the social costs of cryptocurrencies were defined as anthropogenic impact. Finally, the regulation of cryptocurrencies was analyzed.

The methods used in this study include contextual selection of research and review articles, system analysis, and general scientific methods. Legislative acts and periodical articles were used as sources as well.

Results

Politico-economic contradictions of decentralized currencies

Friedrich Hayek laid the foundations of the decentralized or private money theory and justified the possibility of money competition. Hayek pointed out that the advocates of "Free Banking" in the early 19th century and the agitators for "Free Money" — Silvio Gesell, Heinrich Rittershausen, Henry Meulen, and others — supported free issue because they wanted more money and did not recognize that government, more often than any private enterprise, had provided us with the "Schwundgeld" (shrinking money) that S. Gesell had recommended.

[1] Green Economy. The United Nations Department of Economic and Social Affairs. URL: https://sdgs.un.org/topics/green-economy (accessed on 11.04.2024).

He also criticized a single international currency, saying that if it is not adequately managed, it is worse than a national currency [27, p. 14].

Hayek advocated allowing private companies to issue fiat money, mainly on the basis that a system of competitive issuers would be more effective at ensuring price stability than a central bank. Thus, his theory of private money is relevant in relation to cryptocurrencies [28].

Cryptocurrencies have neither the properties of a tangible commodity nor the inherent guarantee of the money issued by central banks. At the same time, their competitive advantages are anonymity and lack of credit expansion (in some cases, it is technically feasible with regard to cryptocurrencies). Cryptocurrencies are becoming a savings tool in the face of constant global inflation and growing distrust of fiat money. The rarity of cryptocurrencies is due to the complex mechanism of their issuance as compared to fiat money. The halving, as a process that limits the issuance of new units of a cryptocurrency, creates scarcity and can influence its price, occurs at regular intervals, determined by the number of blocks created. Thus, unlike fiat currencies, cryptocurrencies are not regulated by the need for growth or decrease in commodity value.

However, this is a relative rarity because there are many types of cryptocurrencies, and their diversity is constantly increasing. V.P. Bauer and V.V. Smirnov [29] examined in detail the logic of blockchain consensus algorithms, which makes one of the main contributions to ensuring the competitiveness of cryptocurrencies. Historically, the first consensus algorithm was the Proof of Work (PoW), a proof of network algorithm. It is implemented in a variety of cryptocurrencies that are in the top 10 of the cryptocurrency rating. Its competitor, the Proof of Stake (PoS) algorithm for proof of ownership in the common pool of cryptocurrencies, which requires fewer computing expenses but is less reliable, is already gaining its share among cryptocurrencies. Hybrid algorithms are promising.

Another feature of decentralizing the circulation of cryptocurrencies is the lack of guarantees to ensure transactions. If, when issuing a cryptocurrency, its producer (miner) receives the main reward for the production itself and not for transactions, then with the reduction and achievement of a complete cessation of the issue, only those miners who will be satisfied with a relatively low reward for transactions will remain. A decrease in the number of participants in the exchange system will inevitably lead to a decrease in its stability.

This is fully explained by K. Marx's theory of capital [30]. With each subsequent stage in the production of cryptocurrencies, the share of permanent capital increases (indirect labor) in the form of computer technology, and the share of variable capital (direct labor), due to which income is created, decreases. At some time, the capital owner's income (profit) will cease to suit the owner, and the last one will transfer the capital to another sphere of use.

Historically, the first PoW-based cryptocurrency and the one most discussed is Bitcoin. In 2023, Bitcoin's dominance exceeded 52.17% in the cryptocurrency market, indicating its significant influence on most of it [15]. In June 2021, the five largest mining pools mined 62.35 percent of Bitcoin blocks [17]. According to the TradingView platform dominance index, calculated as the ratio of coins' market capitalization to the base market capitalization of the top 125 coins, Bitcoin has been confidently holding its position for 10 years with an index measurement of more than 50%.[2] Like an unregulated market with a monopolistic tendency, Bitcoin has become an oligopolistic commodity. Centralization is beginning to take over the proclaimed decentralization.

A comparison of the main characteristics of fiat and cryptocurrencies is presented in *Table 1*.

These characteristics do not allow us to consider cryptocurrencies as full-bodied money. At their core, they are speculative financial assets.

Analyzed from the perspective of the Marxist political economy, digital currency is the result of the development of a commodity economy, a new form of commodity value with a unique credit-building mechanism [18].

The paradox is the simultaneous combination of significant material costs for their production (labor costs) and the absence of a tangible product, physicals, or having a value that, like gold, can be preserved in time and space. This is confirmed by the significant fluctuations in the valuation of cryptocurrencies, expressed in units of traditional sovereign currencies. The data from January 2018 to November 2023 shows, in terms of average monthly absolute price volatility, Dogecoin's and Ether's absolute price volatility of 489% and 126%, respectively [18].

[2] Market Cap BTC Dominance. URL: https://www.tradingview.com/symbols/BTC.D (accessed on 10.02.2025).

Table 1
The main characteristics of fiat and cryptocurrencies

Fiat currency	Cryptocurrency
Directive entity	Voluntary entity
The issue and quantity are controlled by the central bank	The release and quantity are pre-programmed and limited
The value content is regulated by a central bank, and its sharp fluctuations are generally controlled	The value content is regulated exclusively by the market, and its constant sharp fluctuations are possible
It can have a material (physical) form	There is no material (physical) form
It can be used without electricity and internet	It cannot be used without electricity and internet
It has territorial restrictions on their use	It can be used in any country
Cash and non-cash payments (transfers)	Non-cash payments (transfers)
Payments are made by banks that are responsible as an intermediary	Transfers are anonymous, all risks are borne by the direct participants of the exchange
Mass transfers, economies of scale, developed infrastructure of payments	The cost of transfers varies significantly, the infrastructure is just being formed
Historically established legislation	Formation of legislation

Source: Compiled by the author.

Thus, we find similarities between fiat and cryptocurrencies in value virtualization. At first, gold as money began to be replaced by a cheaper analog of value — paper money. The time is ripe for cryptocurrencies, which also do not represent real value, but unlike paper and electronic money, significant resources are spent on their production. This should concern both practitioners and financial regulators alike since the decentralized nature of this technology causes severe misusage and waste of electricity that can be used more efficiently elsewhere, and for potentially more useful purposes [19].

Although cryptocurrencies perform the money function as a means of payment today, they are still mainly used as an investment tool like securities. Significant trading activity in Bitcoin/US dollar, particularly during speculative attacks and short squeezes, can substantially impact the US dollar/EUR market, increasing price volatility as traders adjust their strategies [16]. However, unlike financial instruments, cryptocurrencies require significant resources for their production and circulation system maintenance that could be used in real (physical) production.

It is also worth noting that according to the survey researchers,[3] the average cryptocurrency trader is under 40 (mean age is 38) and does not have a college degree (55 percent). We assume that this financial instrument is used by people who have already achieved a certain degree of material wealth but are not armed with systems thinking.

The environmental impact of cryptocurrencies

The issue of the anthropogenic impact of the creation and usage of cryptocurrencies is pervasive and pertinent to the agenda of climate change and efforts to make the economy more environmentally friendly. The main factors of the adverse impact of cryptocurrencies on the environment are as follows:

1. High energy intensity, both in the production and subsequent use of cryptocurrencies.

Blockchain technology involves the constant use of computing resources, both in the process of generating the code of the crypto unit itself and in the process of its transactions. Cryptocurrencies whose developers use a less energy-intensive type of transaction, like Ethereum, lose out in terms of transaction security, which means they have lower demand and cost [20]. The average Ethereum electricity consumed per transaction ranges from 0.8 to 14.7 Wt, while a Mastercard transaction consumes only 0.7 Wt on average [20]. In comparison, the energy footprint per Bitcoin transaction was estimated in 2021 to be 619 kWt, which is equivalent to 350,000 VISA transactions [19]. The problem is that the next transaction is more energy wasting, and in 2024, a Bitcoin transaction was estimated to be 838 kWt — the equivalent of 77,932 hours YouTube watching.[4] The Bitcoin

[3] NORC AmeriSpeak Omnibus Survey: Spotlight on Cryptocurrency. 2021. URL: https://www.norc.org/content/dam/norc-org/pdfs/Spotlight%20on%20cryptocurrency%20Topline.pdf (accessed on 22.11.2024).

[4] Bitcoin Energy Consumption Index. Digiconomist. URL: https://digiconomist.net/bitcoin-energy-consumption (accessed on 22.11.2024).

network power demand is monitored daily by the Cambridge Bitcoin Electricity Consumption Index (CBECI), the project of the Cambridge Centre for Alternative Finance.[5] The estimated global carbon footprint in November 2024 was 97.64 Mt — equivalent to the carbon footprint of Qatar.

There are studies claiming that Bitcoin investments can be less carbon intensive than standard equity investments and thus reduce the total carbon footprint of a portfolio [2]. However, this would be justified if the authors took into account the fact that standard investments are associated with the production of real value, not fictitious (virtual).

2. The use of polluting energy sources.

Since cryptocurrencies involve high energy costs, cheap energy from fossil sources, primarily coal, is used to produce crypto units. Until 2022, China, due to cheap coal-based electricity, occupied a leading position in the production of Bitcoins — about 63%, while miners used regions with thermal energy for most of the year. According to the study [21], in less than five years in the sample period, Bitcoin mining in China has generated 77.84 million tons of carbon dioxide emissions, equivalent to one year's carbon emissions of Greece (79.91 million tons). Bitcoin mining has profoundly impacted China's regional power supply. A larger ratio of intra-provincial electricity consumption to inter-provincial electricity transmission indicates less external power transmission and more intra-provincial consumption. This trend indicates a reduction in China's proportion of hydropower supply and an augmentation in coal-fired power supply, leading to an increased "carbon footprint" in the electricity supply.

There is a strong positive, significant relationship between Bitcoin returns and both Chinese and Russian electricity company price volatility, indicating that there exists evidence of interactions between Bitcoin and electricity companies in these key mining pool regions [19].

Initiatives to use alternative energy sources for the production and use of cryptocurrencies should be critically evaluated since short-term benefits are outweighed by long-term losses to society from the costs of recycling "green" generation (solar panels, wind turbines, nuclear fuel).

The causality result shows bidirectional causality between bitcoin and climate policy uncertainty, while unidirectional causality runs from the price of the energy index to bitcoin [22].

3. The expenditure of a vital resource — water.

Bitcoin's expanding water footprint must be considered in the context of escalating water scarcity [23]. The direct water footprint of Bitcoin miners is the water consumption of the data centers (systems cooling and air humidification). The indirect water footprint is the water consumption of electricity generation. The total water footprint of US Bitcoin miners could be equivalent to the average annual water consumption of around 300,000 US households, comparable with a city such as Washington, DC. The estimated water footprint of Bitcoin mining in Kazakhstan alone was 997.9 GL in 2021, while the nation's capital could face a water shortage of 75 GL per year by 2030.

4. The expenditure of computing resources and the growth of computer recycling costs.

In 2009, competing Bitcoin miners were able to successfully win blocks with an average laptop. Minimum viable mining operations today require several hundred tailored computers in the form of Application Specific Integrated Circuit (ASIC) units [24]. Redundant units create around 30,400 tonnes of e-waste each year [25].

The problem of electronic waste is compounded by the desire of owners of capital used in the production of computing equipment to constantly expand demand to maintain return on capital:

- a consistent shift in the consumption pattern which pushes replace over repair;
- software upgrades are pushing the hardware upgrades [31].

Thus, the production and use of cryptocurrencies as goods are associated with both obvious costs and significant negative external effects. The authors [24] argue that the deceptive and/or clandestine appropriations of energy, water, and land (and excretions of noise, heat, electronic and other wastes) by crypto miners create a parasitic relationship between the cryptocurrency software and local communities. There are the disingenuous development credentials used by blockchain projects to colonize places and displace the locals, usually in the Global South. Despite their professed decentralized architectures, blockchain projects inevitably tend to centralize power, rather than redistribute it or bring it down.

Policymakers need to be concerned about the environmental challenge of using cryptocurrencies and introduce sufficient regulation in this area.

[5] Electricity Consumption Index. Cambridge Centre for Alternative Finance. URL: https://ccaf.io/cbnsi/cbeci (accessed on 22.11 2024).

Regulation of the issue and circulation of cryptocurrencies

The current regulation of cryptocurrencies is less related to their anthropogenic impact and external effects than to competition with centralized finance and a lack of energy capacity. Cryptocurrency negative externalities, like others, are difficult to quantify. The decentralized model has made regulatory efforts difficult, so determining who ought to be responsible for taxes or charges, and how a state may implement them, is problematic [26].

However, the complete lack of regulation of cryptocurrencies means that the country is going against global efforts to reduce anthropogenic impact and decarbonize the planet. The main directions in internalizing the costs of cryptocurrencies are as follows:

- stimulating the transition to less energy-intensive production and transaction technologies by taxing participants in the cryptocurrency system;
- stimulating the transition to less energy-intensive equipment by taxing not only cryptocurrency producers but also equipment manufacturers.

In several countries — China, Algeria, Egypt, Morocco, Afghanistan, Bangladesh, Nepal, etc.,— cryptocurrencies are completely illegal. They are seen as a serious obstacle to fiat money and as a tool to circumvent laws. A serious blow to cryptocurrencies was the ban on their mining and circulation in the world's largest economy (according to purchasing power parity) — China.[6] It has led to the migration of miners to other countries with low electricity costs, due to the availability of natural resources or government subsidies: Kazakhstan, Russia, Moldova, Abkhazia, Canada, as well as some US states [24].

The main reason for banning cryptocurrencies in China was the introduction of the digital yuan. Central bank digital currency (CBDC) or digital fiat currency, as well as cryptocurrencies, are issued using computer programs. But they are issued by the central bank as fiat money. The question of the possibility of competition between CBDC and cryptocurrencies is whether the CBDC release will use blockchain technology and transaction decentralization. Opponents of the CBDC argue that while maintaining the centralization of settlements, the CBDC will be used as a tool to control public spending, as well as the implementation of limits or a complete ban on economic exchange.[7] According to the European Central Bank research, the CBDC unconstrained demand is between 3% and 28% of total household liquid assets, but with an illustrative € 3,000 holding limit per person, the aggregate digital euro take-up could range only between 2% and 9% of total household liquid assets in a steady state [32].

The Russian Federation, with its rich natural resources and low energy costs, is an attractive place for cryptocurrency miners. On November 1, 2024, mining was legitimized by amending several existing laws.[8] Miners are to provide information about the mined cryptocurrency and the addresses of their crypto wallets and mining pool if they are individuals who exceed the energy consumption limit of 6000 kW a month or legal entities. At the same time, advertising and digital currency payments are prohibited, except for foreign trade settlements. Taxation is carried out similarly to the taxation of foreign exchange transactions. The government may also ban or restrict mining in certain regions.

Based on the introduced norm of 6,000 kW, the owner of no more than 2–3 mining computers is considered a small miner in Russia (based on the average consumption of 1 mining machine of 2,160 kW, excluding air conditioning[9]).

To reduce energy consumption, including the production of cryptocurrencies, Russia has begun switching to a three-tariff electricity payment system, which should be completed by January 1, 2026.[10] Consumption from 3,600 to 6,000 kW per month belongs to the second most expensive category, and more than 6,000 kW per month belongs to the third, most expensive one. Thus, large miners will incur increased energy costs, which may reduce the production and use of cryptocurrencies.

For comparison, before this switching, the border of the social norm (low tariff) in the Irkutsk

[6] The People's Bank of China. Notification of further prevention and control of speculative risks in virtual currency transactions. 24.09.2021. (In Chinese). URL: http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/4348556/index.html (accessed on 23.11.2024).

[7] Snowden E. Your money and your life. 2021. URL: https://edwardsnowden.substack.com/p/cbdcs. (accessed on 23.11.2024).

[8] Federal Law of the Russian Federation "On amendments to certain legislative acts of the Russian Federation". 08.08.2024, No. 221. (In Russ.). URL: http://publication.pravo.gov.ru/document/0001202408080016 (accessed on 22.11.2024).

[9] Analysts have named the cheapest regions of Russia for mining. Eksklyuzivy RBK. 18.11.2024. (In Russ.) URL: https://www.rbc.ru/business/18/11/2024/6738c61d9a79471b919f75a9 (accessed on 23.11.2024).

[10] The Government of the Russian Federation. Government Decree No. 1469. 11.11.2024. URL: http://publication.pravo.gov.ru/document/0001202411010020 (accessed on 23.11.2024).

region was 25,000 kW; by means of it, as well as its proximity to China, which banned mining, this Russian region became a Mecca for crypto miners. More than 50% of the energy consumption by manners in the unified energy system of Siberia falls on the Irkutsk region.[11] The planned data centers capacity is 1,245 megawatts, more than the capacity of large industrial enterprises. The tax return from 1 megawatt of connected power from legitimate mining is 220 times less than that from conventional industrial enterprises in this region. The result was a shortage of electricity in this and adjacent regions (the Republic of Buryatia and the Trans-Baikal Territory) and a ban on mining during the heating period.

At the same time, the norm of 6,000 kW is contestant to the climatic conditions of Siberia, where electricity is consumed more than this norm in winter for household heating. An alternative would be natural gas-based heating, but many regions of Siberia are poorly gasified, unlike the European part of the country. Thus, by trying to impose restrictions on miners, the state affects the interests of ordinary consumers.

After China's exit as a strong player from the cryptocurrency market, Russia and the United States became the primary competing platforms for cryptocurrency production.[12] The introduction of US sanctions against Russian IT companies is a confirmation of the intensification of this competitive struggle.[13]

Cryptocurrency regulation should be comprehensive, given the involvement of the IT sector in this process. The negative impact of the IT sector on the environment could be reduced to a certain extent by adopting the responsible practices of the circular economy, which signifies reusing some of the raw materials of the disposed equipment for a more sustainable approach to consumption. The governments and local authorities also have larger responsibilities by legislating the circular economy model, promoting eco-friendly manufacturing and adopting a responsible way of sustainable consumption [31].

Discussion

Our research has shown that the problem of the growing environmental impact of cryptocurrencies co-exists with the political and economic difficulty of the contradiction between the costs of creating and preserving the value of cryptocurrencies and the benefits of using them as a decentralized financial instrument. Both the principles of the green economy implementation and reducing the anthropogenic impact of cryptocurrencies require government regulation. The latter one demands the proposal of an alternative that limits the use of decentralized cryptocurrencies. This alternative and the subject of further research is the combination of the principles of functioning of centralized and decentralized finance: the synthesis of an administrative mechanism and a clean market as coordination systems. DeCeFi: decentralization with accompanying elements of centralization, but not vice versa, since the ideology of cryptocurrencies, albeit in a modified form, must be preserved [33].

Every central bank will eventually have to confront the looming challenges from cryptocurrencies, stablecoins such as Libra, and broader fintech developments [34]. The country whose currency will be the first to become a successful embodiment of DeCeFi with well-developed legislation, technical support, and guarantees of uninterrupted payment system operation can become a new global financial leader.

Conclusion

Cryptocurrencies, despite their resource consumption, do not have the property of preserving commodity value, like fiat money. The technology of using cryptocurrencies (PoW, especially) does not contribute to reducing the employment of resources but rather to increasing it considerably. Resource consumption, especially the energy consumption of cryptocurrencies, is becoming a significant problem in reducing the effects of human impact on nature and climate change. Regulators are more concerned about the financial losses from cryptocurrencies production than their anthropogenic impact and impact on sustainable development.

An alternative to regulatory restrictions could be the development of CBDC with elements of decentralization.

[11] In the Irkutsk region, mining is going to be banned throughout the territory during the heating season. IRK.RU. 18.11.2024. (In Russ.). URL: http://www.irk.ru/news/20241119/mining/ (accessed on 26.11.2024).

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[13] Department of the Treasury. Prohibition on Certain Information Technology and Software Services. 06.06.2024. URL: https://ofac.treasury.gov/media/932951/download?inline (accessed on 20.11.2024).

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Conflicts of Interest Statement: The author has no conflicts of interest to declare.
The article was submitted on 12.12.2024; revised on 18.02.2025 and accepted for publication on 07.03.2025.
The author read and approved the final version of the manuscript.

ORIGINAL PAPER

DOI: 10.26794/2308-944X-2025-13-1-93-108
UDC 334.7,331.1,338(045)
JEL M10, M14, J21

A Comprehensive Review of Enhancing Collaboration and Performance in Virtual Teams

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ABSTRACT

This review aims to analyze and assess the main factors that influence the effectiveness of Virtual Teams (VT) in diverse applications. The study used two complementary **methods**: systematic literature review and bibliometric analysis. The paper showcases the critical drivers of virtual team performance, including leadership, communication, trust, and digital collaboration tools, while also considering challenges such as cultural diversity and technological limitations. In addition, the paper outlines specific virtual team implementation approaches adopted within different industries while assessing collaborative technology performance and management strategies that impact team productivity and efficiency. **The results** indicate that while virtual teams offer significant advantages in global business environments, their success is highly dependent on effective leadership, structured communication, and the appropriate use of digital tools and technology. Finally, **the conclusion emphasizes** the need for organizations to adopt a strategic approach to managing virtual teams, ensuring optimal engagement, performance, and long-term sustainability.

Keywords: virtual team; collaboration tools; performance management; remote team building; work strategies; communication; technology collaboration platforms; innovation project; systematic literature review

For citation: **Hoque M.U., Zhang X., Rahman M.F.F., Zahra B., Hasnat M.S. A comprehensive review of enhancing collaboration and performance in virtual teams. *Review of Business and Economics Studies*. 2025;13(1):93-108. DOI: 10.26794/2308-944X-2025-13-1-93-108**

ОРИГИНАЛЬНАЯ СТАТЬЯ

Комплексный обзор проблем улучшения сотрудничества и производительности в виртуальных командах

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АННОТАЦИЯ

Целью данного обзора является анализ и оценка основных факторов, влияющих на эффективность виртуальных команд (ВК) в различных ситуациях. В исследовании использовались два взаимодополняющих **метода**: систематический обзор литературы и библиометрический анализ. В статье представлены важнейшие факторы эффективности виртуальной команды, включая лидерство, коммуникацию, доверие и инструменты цифровой совместной работы, а также рассматриваются такие проблемы, как культурное разнообразие и технологические ограничения. Кроме того, в статье излагаются конкретные подходы к внедрению виртуальной команды, принятые в различных отраслях, а также оценивается эффективность технологий совместной работы и стратегий управления, которые влияют на производительность и результативность команды.

Результаты показывают, что виртуальные команды обладают значительными преимуществами в глобальной бизнес-среде, однако их успех в значительной степени зависит от эффективного руководства, структурированной коммуникации и надлежащего использования цифровых инструментов и технологий.
В заключении подчеркивается необходимость принятия организациями стратегического подхода к управлению виртуальными командами, обеспечивающего оптимальную вовлеченность, производительность и долгосрочную устойчивость.
Ключевые слова: виртуальная команда; инструменты совместной работы; управление производительностью; удаленное построение команды; стратегии работы; коммуникация; платформы технологического сотрудничества; инновационный проект; систематический обзор литературы

Для цитирования: **Hoque M.U., Zhang X., Rahman M.F.F., Zahra B., Hasnat M.S. A comprehensive review of enhancing collaboration and performance in virtual teams. *Review of Business and Economics Studies*. 2025;13(1):93-108. DOI: 10.26794/2308-944X-2025-13-1-93-108**

1. Introduction

The 21st century's interconnected global economy and the tremendous acceleration of modern technologies have led to the development of virtual teams that solve a wide range of issues in the corporate and educational sectors, including leadership, intra-team relationships, cultural diversity, time zone differences, and many more [1]. Numerous businesses and academic institutions have adopted the virtual team approach and continue to implement it [2]. The escalation of working remotely and using digital communication technology has redefined how organizations operate, leading to the increased importance of understanding how virtual teams perform efficient operations. Virtual teams have been a significant method of conducting business within organizations to gain a competitive edge since the early 1990s. The concept of working remotely was introduced in the late 20th century due to advancements in communication technologies. At the same time, the advent of Internet communication enabled real-time interactions through email and instant messaging, making remote work more feasible and lucrative for the corporate world. The development of project management tools and video conferencing platforms such as Skype at the beginning of the 21st century facilitated remote teamwork, reduced resource requirements, leveraged global talent, and adopted more flexible policies. Several prominent companies have adopted a fully remote work model in recent years [3].

The massive adoption of the virtual team has introduced a new area of research, with several scholars already establishing various aspects, variables, and factors and solving many challenges; however, considerable progress has to be made. Nearly 85% of businesses responded that virtual teamwork was essential in a survey of over 1300 businesses in 2016 [4]. Flexibility is one of the most significant advantages to those businesses due to the better utilization capability of the time zone and geographic location differences through electronic communication, resulting in a possible productivity time 24/7. Even half of those businesses reported that over 50% of their virtual team workers are from non-native cultures and geographical locations, leading to another significant advantage of "Access to Global Talent." [5]. Managing and leading diverse teams effectively increases creativity and enhances teams problem-solving capabilities by gathering diverse perspectives and resources brought by the team members. Convening diverse talents also brings the advantage of cost-effectiveness by eliminating the need to travel to meet in person or relocate colleagues from different countries, exploiting information and communication technologies. By leveraging virtual team capabilities and possibilities, organizations can reduce operational rental and overhead costs and save money and time on travel-related expenses.

Virtual teams use related technologies, such as the cloud, artificial intelligence, and virtual reality, to support their communications. Such technologies assist in filling the gap where real-time communication and coordination are lacking and enhance team efficiency and the quality of end output [6]. Recent studies have demonstrated that virtual teams are more effective at decision-making and creativity than co-located face-to-face teams because communication is less stressful and gives more time for reflection. In addition, the structured parts of virtual teams lead to higher overall effectiveness because of organized processes, formalities, and better digital communication tools. Drawing on current literature and empirical evidence [7], this paper outlines practices and novel ideas that enhance virtual collaboration

through structured communication protocols, clear objectives, and feedback recognition mechanisms.

This review is not only a summary of current knowledge but also a reference for further studies and practical applications, outlining the directions that are worth future exploration to the scholars and stating the suggestions that might be useful for practitioners who deal with virtual teams. The first section of this paper focuses on the evolution of virtual teams and a comparison between virtual and traditional teams. The second section presents a literature review and highlights previous research in this field. Section 3 discusses the methodological approach, followed by Section 4, which examines virtual teamwork across the phases of the project life cycle. This section highlights how virtual teams collaborate and perform during the various stages of a project's development, providing insights into the specific challenges and opportunities that arise in each phase. It also addresses key aspects of managing virtual teams, focusing on strategies to optimize team performance, enhance communication, and ensure project success in a virtual environment. In addition, it analyzes virtual teams in specific contexts and explores how team dynamics are affected by different organizational, cultural, and technological factors. Section 5 presents the findings and discussion. Finally, the research concludes with a summary in the concluding remarks.

2. Literature review

Virtual teams (VTs) are increasingly important in modern organizations, especially with the rise of remote work during the COVID-19 pandemic [8]. Communication and trust are critical factors for the success of virtual work teams. Due to the COVID-19 pandemic, remote work and virtual team (VT) integration have become part of the modern organizational structure. Communication tools like email and video calls often cause delays and misunderstandings while adopting new technologies [9]. These examples shed light on the need for companies to prioritize leadership and develop effective communication strategies to address the challenges associated with transitioning to a virtual workspace. As we have seen, the capacity to communicate with and within virtual teams is a critical success factor. The level of virtual project teams' understanding of the specific information and communication technologies (ICTs) required to support their particular coordination needs determines their effectiveness, optimistically or pessimistically [10]. According to [11], collaboration technologies proved helpful during the COVID-19 pandemic, and virtual teams intending to manage their operations require consistent and situation-appropriate communication tools. Practical virtual work requires leadership and trust within a team to produce outstanding results. Leadership in the literature also informed task complexity and trust building in virtual environments [12].

Their systematic review of a decade of virtual team research identified manager support as a critical variable; leaders who empower and breed trust within virtual teams serve them best. *Table 1*, focused on organizational behavior, synthesizes findings from hundreds of virtual team studies to provide insights into team dynamics and performance. This section highlights different methods for analyzing virtual team interactions, explores common challenges across various industries, and offers solutions to improve team cohesion and efficiency in remote work environments.

Table 2 provides another critical finding highlighted by [16]: team members must develop good communication channels and use good leadership practices when engaging virtual teams. Finally, both ICT tools and knowledge sharing are mandatory in virtual teams. Davidavičienė et al. [17], asserts that motivation, trust, and leadership foster effective knowledge-sharing in virtual teams and that interruptions in knowledge-sharing processes enhance productivity in remote work environments. Malhotra and Majchrzak [18], state that ICT can be used selectively in a more strategic manner when a virtual team requires particular forms of coordination or information to occur in its environment, and the strategic use of ICTs was found to improve their performance. Kilcullen et al. [19], confirmed that virtual teams could preserve high-performance levels during the COVID-19 pandemic by enhancing communication approaches. These studies show that ICT and knowledge-sharing-facilitating devices are crucial in effectively running virtual teams. Last, it is vital to facilitate knowledge transfer and incorporate ICT facilitators in virtual teams. A more recent study established a positive correlation between motivation, trust, and leadership and the willingness of virtual team members to share knowledge, pointing to the need to enhance protocol-based KS in the virtual working environment. It is noted that selectively using ICTs to address coordination and

Table 1
Recent VT research findings in different organizational sectors

Authors	Field	Topic and Objectives	Method of Research	Contribution
[8]	Organizational Psychology	Communication and trust in leadership, empowerment, and cohesion influence virtual team performance during pandemics.	This methodology provided robust insights into the relationships. The partial least squares (PLS) method is based on variance and was derived from a quantitative approach using structural equation modeling (SEM).	Studied the determinants of performance in virtual teams during the pandemic, focusing on communication, leadership, and trust.
[13]	Organizational Behavior	This study explores the micro-dynamics of intercultural communication within global virtual teams, focusing on how relational-oriented content in initial messages during team formation creates a psychologically safe communication climate, enhancing team performance.	The research analyzed early asynchronous communication in 60 global virtual teams composed of MBA students. The study assessed team communication climate and performance to test the hypotheses.	Investigate the role of media and language diversity in global teams.
[14]	Organizational Behavior	The study aims to examine the transition of work teams to remote work during COVID-19, assess factors that helped or hindered virtual team performance, and explore the challenges these teams face.	Based on actual data from an electronic questionnaire conducted in June 2020, the research analyzes the experiences of Human Resources and Financial Department teams as they adapted to remote work. Relevant literature on virtual teams and leadership supports this analysis.	Analyzed how HR and Finance teams adapted to remote work during the pandemic, highlighting challenges and strategies for virtual team success.
[15]	Organizational Management	The study explores the experiences of IT professionals working in virtual teams in India, focusing on motivators, skills, and challenges to enhance understanding of virtual work environments	A qualitative approach, using semi-structured interviews with 52 IT professionals, was used, and the data were analyzed through thematic and content analysis methods	Studied the challenges and motivators for virtual team members in the IT sector in India, highlighting the required skills and challenges of virtual work

Source: Compiled by the authors.

Table 2
Recent literature on virtual teams across management sectors

Authors	Field	Topic and Objectives	Method of Research	Contribution
[20]	Management and Organizational Studies	The study aims to review the virtual team (VT) literature over the past decade, organizing key themes from research and identifying 10 opportunities for future study in VT dynamics, mainly influenced by technological advancements.	An inductive review of empirical studies from the past 10 years was conducted.	Provided a thematic review of virtual team research, identifying trends and future research opportunities in technology, leadership, and trust.
[11]	Information Systems and Management	It aims to improve comprehension of effective virtual collaboration in both pandemic and post-pandemic scenarios.	Based on participant feedback, the study analyzed qualitative data from 55 graduate students transitioning to remote work and identified critical technology affordances.	Explored key collaboration technology affordances and their role in improving virtual collaboration during and after the COVID-19 pandemic.
[18]	Management and Information Systems	Geographically distributed teams can enhance performance by utilizing ICTs to explicitly address situational awareness requirements rather than exclusively relying on technology.	The research gathered data from 54 geographically diverse teams that utilized ICT solely, incorporating questionnaires from team leaders, sponsors, and members.	Studied how geographically distributed teams use ICT to enhance performance, focusing on task awareness and collaboration.
[16]	Project Management	This study emphasizes the crucial role that improved trust and collaboration play in boosting the likelihood of success in project management.	Using structural equation modeling (SEM) and data from an international survey of 151 project practitioners	Demonstrated how trust and collaboration influence project management success using structural equation modeling (SEM).
[21]	Project Management	The research analyzes the impact of motivational climates on collaboration in project teams and the function of prosocial motivation in this dynamic transition	Surveyed 173 senior project members to evaluate the influence of the alignment between performance and mastery climates on team cooperation	Studied how motivational climates (mastery and performance) affect collaboration in project teams

Source: Developed by the authors.

situational awareness levels significantly boosts the productivity of virtual teams. Various studies confirm this, showing that virtual teams performed exceptionally well through effective communication even after the coronavirus attack. Ybañez et al., also extended support for these findings by revealing that VPM requires ICT integration for performance assessment and leadership [14].

3. Methodological approach

Our research began with a comprehensive examination of the current trends in VT literature. To enhance the relevance of our work and establish stronger connections between theories and practices. In addition, we conducted research on virtual teams by utilizing keywords such as "virtual team," "remote team," "geographically distributed team," and team performance in 'Google Scholar' and 'ResearchGate,' along with other business, communication, and management research databases. This was done to facilitate a more accurate comparison with the data shown in [22, 23]. We emphasized the literature review research to effectively determine the key difficulties and solutions and discern the trends and subjects in the literature. Initially, our study focused on the most recent patterns highlighted in the literature, and subsequently, we evaluated the qualitative feedback. All qualitative responses regarding cooperation and collaboration, whether direct or indirect, were considered. In addition, we adopted a dual-methodological approach by combining systematic literature review (SLR) with bibliometric analysis. The studies utilizing the CIMO model (Context, Intervention, Mechanism, and Outcome) have highlighted the utility of integrating bibliometric analysis with SLR. Bibliometric analysis allows for an extensive, automated overview of the research landscape, while a systematic literature review enables a more profound, systematic selection of the most relevant studies. This combination ensures a comprehensive analysis, as bibliometric analysis provides a broad perspective, and SLR refines it by focusing on critical studies. Thus, this methodology proved appropriate for finding the elements influencing virtual team effectiveness by searching a vast body of literature and selecting the most relevant articles for systematic review. Together, these methodologies allowed us to present a comprehensive and in-depth examination of virtual teams' critical difficulties, trends, and solutions in the context of projects.

4. Virtual teamwork across the phases of the project life cycle

The phases of the project life cycle examine virtual teamwork from different angles. This cycle explores the vital role that communication tools like Slack and Zoom, project management software like Asana and Trello, and information-sharing platforms like Google Drive and Dropbox play. These systems have high adoption rates and deal with issues such as cybersecurity and the potential of new technologies such as artificial intelligence (AI) and virtual reality (VR). Employees have different experience levels, and these organizational norms and structures help them perform their jobs better [24]. They also help build trusting relationships, deal with cultural differences, keep employees motivated, settle disagreements, and improve work. Managing the different stages of the life cycle, using Agile methods, setting up good communication channels, keeping an eye on performance, and making practices that are all about improving all the time are all parts of the process. The features, difficulties, and growth of virtual teams in project management are rooted in technological changes, subtleties of human interaction, and simplified processes, providing a global view [10].

Fig. 1 illustrates that the blue ring around the outside shows factors that depend on technology and are essential for virtual teamwork. "Social Presence" refers to how technology can create a psychological presence for team members through media. "Reliability of Project Information" shows how technology could provide correct and up-to-date information. These points to the role of technology in making virtual teamwork work effective. The human-centered factors that affect how the team works together and how well they do their job are in the middle yellow ring. In a virtual setting, "communication" is just as important as in a real one, but it is doubled because there are no actual cues. "Trust" is still the most important thing when working together and getting things done in a virtual setting. It takes a certain level of leadership to get a group to work together on a problematic virtual job. Motivation is the drive and desire of a person to help the project reach its goals. All these factors help define how people connect in virtual teams. The second "inner" green ring shows processes that significantly affect how well a virtual project team completes the project as a whole, whether they are

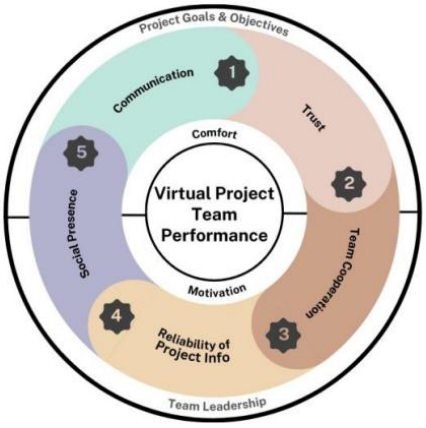

Fig. 1. **Virtual teams throughout the project life cycle**

Source: Developed by the authors.

present or not. It supports "Comfort" as an essential part of the virtual space. This could mean something physical, like how the remote work setting supports people's comfort, or psychological, like how people feel comfortable in the virtual space. "Team Cooperation" shows that virtual teamwork includes tasks that require your team to work together. This part discusses the process approach, which stresses that group standards and methods are essential for reaching project goals and targets when working as a virtual team.

4.1. Enhancing collaboration among virtual teams

In order to enhance collaboration between teammates in virtual teams (VT), it is essential to use a combination of communication and project management tools that are customized to meet the team's requirements. Communication tools such as Slack and Microsoft Teams provide instant connections, creating an atmosphere of prompt response and lively conversation [25]. Project management software such as Asana and Trello visually depicts work advancement, improving transparency and fostering responsibility among team members [26]. Utilizing collaborative tools such as Miro for brainstorming and Figma for design facilitates a smooth transition from ideation to implementation [27]. Protecting communication and group activities with cybersecurity is important, primarily through VPNs and good antivirus software [28]. Cloud storage services such as Google Drive and OneDrive are also helpful for centrally handling papers and controlling who can see them. This lets team members work from home with the most up-to-date information [29].

4.1.1. Selection criteria

The selection of appropriate technology for virtual teams requires a comprehensive evaluation of key criteria to ensure effective collaboration and productivity. These tools should feature user-friendly interfaces and be able to integrate with other systems. In addition, evaluating the potential for future expansion and the associated costs is essential. The effectiveness of these technologies depends on improving team communication, managing tasks more efficiently, and integrating with other systems smoothly. Selecting appropriate technology ensures that the chosen technology meets the team's real needs and helps them reach their project goals [21]. On the other hand, servant leaders prioritize the needs of the team, encourage initiative, and empower members to take ownership of their work by trusting their expertise, providing access to the necessary tools and information, promoting work-life balance, offering opportunities for training and career development, and encouraging open communication. It is not about delegating tasks and setting expectations; leaders should also provide the support and resources for achieving those goals. Leaders should offer feedback while being open to receiving it well. This two-way communication builds team cohesion and trust.

In [30], some factors that influence the team's efficiency are highlighted, which can be seen in *Fig. 2* from [16]. The ratio of remote teams with communication barriers gradually decreases yearly, including in industries like IT and finance.

4.1.2. Geographical considerations

Geographical variables significantly impact the selection of technology for virtual teams. Because these teams usually work in different locations and time zones, it is essential to select appropriate technology tools to handle these differences. This means giving more weight to technologies that support asynchronous contact and teamwork, which allows team members work well even in different time zones [31]. In addition, these options need to be available to everyone, considering the different infrastructures in different areas. This ensures that everyone has the same opportunity to participate, no matter where they live. Virtual teams are helpful for businesses because they allow them to use many talented people worldwide. This method gives companies access to a broader range of skills and gives people who work from

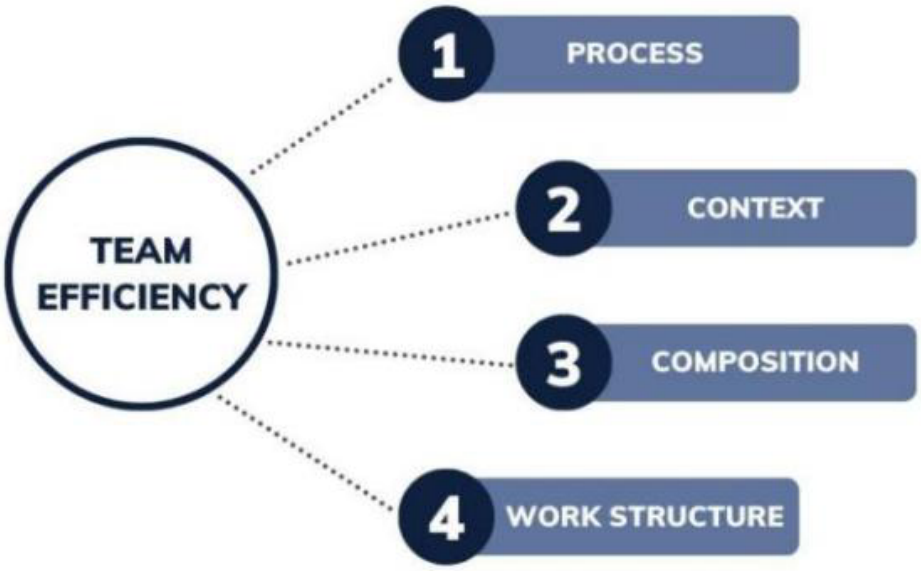

Fig. 2. **Factor influencing team efficiency**

Source: Developed by the authors.

home or travel much more freedom. Examples of how location, time, and distance work together in virtual teams are shown in *Fig. 3* [32]. This shows how they join to make virtual teamwork easier. *Fig. 3* also shows how to understand the different levels of complexity of Virtual Teams (VTs) regarding geographical factors. The axes on this three-dimensional graph show location, time, and distance. Location tells the difference between home-based team members and expatriate team members, who work from home and abroad.

On the timeline, asynchronous work (where tasks do not happen simultaneously) is shown next to synchronous work (where team tasks are organized in real-time). Lastly, the distance line goes from the single distance dimension, which shows a simple way to measure the distance between two points, to multiple distance dimensions, which shows how complicated it is to measure the distance between many points. These picture dimensions show how difficult it is for teams that work in different time zones and parts of the world compared to the primary company's operations.

4.1.3. Structuring virtual meetings

Virtual meetings begin with "Preparation," a vital phase due to the reduced likelihood of casual interactions in virtual environments. This highlights the necessity of prior preparation, as illustrated by [33] in *Fig. 4.* Before the meeting, it is essential to establish the purpose, themes, objectives, and intended outcomes. The "Agenda and Invitations" stage involves implementing formal procedures that, according to [34], improve output quality in virtual teams. The agenda provides a comprehensive overview of the subjects that will be discussed, the sequence in which they will be presented, and the designated time for each item.

During the "Conduct Meeting" phase, the formal framework serves as a substitute for the absence of external incentives as [35] discussed, as having a leader physically present is impossible. The use of "Action Items and Summary" aids in preserving clarity and ensuring responsibility, which effectively tackles the communication obstacles emphasized by [36]. A synopsis of the meeting's content, including the tasks to be completed, is compiled after the meeting. The last phase, "Follow-up and Review," guarantees continuous involvement and tackles the decline in team unity caused by the lack of informal connections, as posited by [33]. This encompasses the determinations, allocations, time limits, and obligations allocated to various persons or teams.

4.1.4. Communication tools used by project team members

International organizations utilize these communication solutions to enhance virtual collaboration among project members. Each sector collaborates uniquely, as shown in *Table 3*, with specific project management and file-sharing tools tailored to its functions. In the tech field, Slack and Trello are essential for effective project management [37]. At the same time, healthcare utilizes compliance and

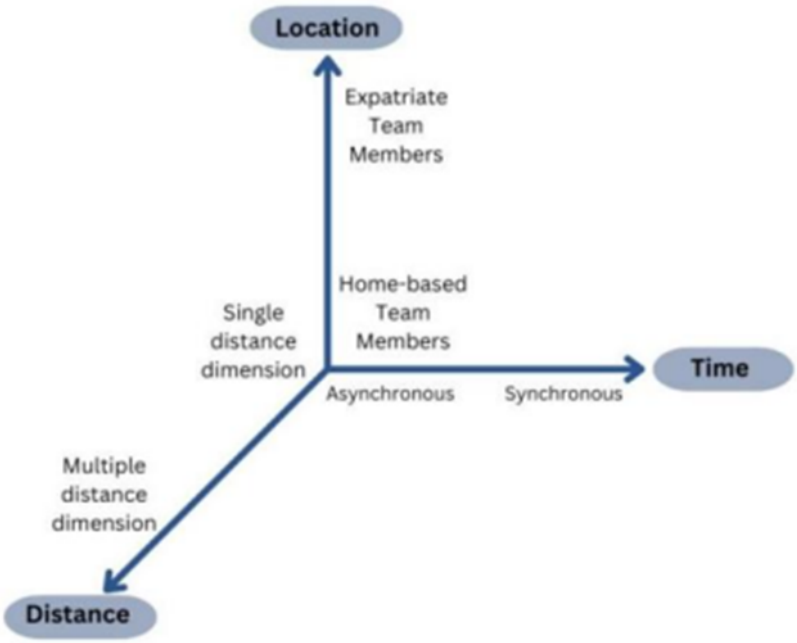

Fig. 3. **Complexity dimensions of VTs**

Source: Developed by the authors.

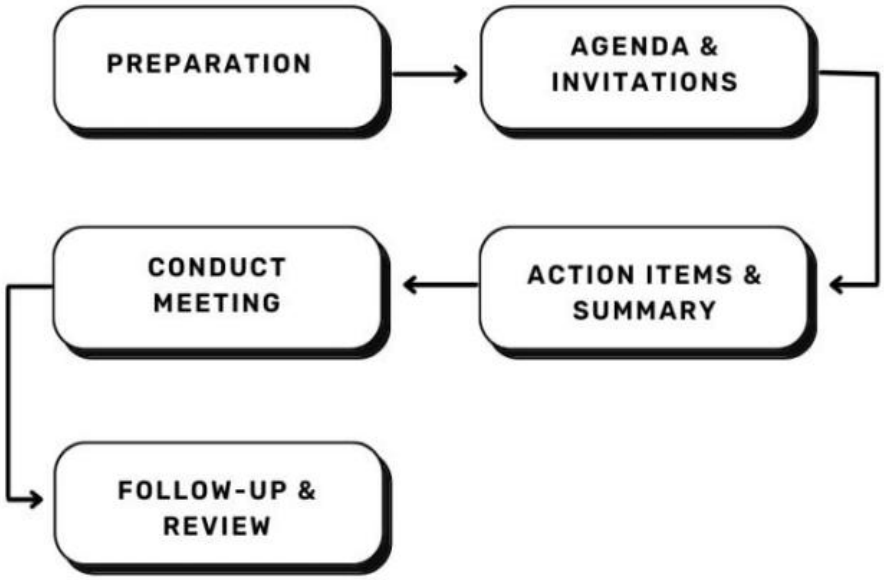

Fig. 4. **Virtual meeting structure**

Source: Developed by the authors.

security paired with HIPAA-compliant cloud storage and Wrike to manage sensitive projects. The energy sector is keen on applying tools such as ArcGIS to handle geographic information. In contrast, the retail sector has focused on Figma as a platform for the collective design of applications to enhance interaction with the end consumer. Video and audio conferencing has remained a key area of necessity worldwide, with applications like Zoom, Cisco WebEx, and Microsoft Teams instrumental in the ongoing virtual teams. The importance of technology in team management is highly significant. It connects remote team members for communication, collaboration, and project management. Proper selection and application of technological tools contribute to the effective operation of virtual teams. These resources support team members' unity and encourage creativity, in addition to helping with daily tasks. Video conferencing platforms (Zoom, Tencent, Skype, Microsoft Teams, and so on) have become crucial in today's work environment. These platforms offer features that replicate

Table 3
Communication tools for virtual teams

Category	Collaboration Tools	Project Management Tools	File Sharing and Document Storage	Meeting Tools	Video and Audio Conferencing
Tech Industry	Slack, Red booth	Jira, Trello	Google Drive, SharePoint	Zoom, WebEx	Microsoft Teams
Financial Services	Miro, Notion, Huddle	Asana, Monday.com	Dropbox Business, Box	Adobe Connect, iMeet	Skype, Cisco WebEx
Healthcare and Pharma	Go plan, Lucid chart	Wrike, Proof Hub	HIPAA-compliant Cloud Storage	Google Meet	Viber
Manufacturing	Autodesk BIM 360, Blackboard	SAP Project Management, Apollo	IBM Cloud, Amazon S 3, Zoho Docs	GoToMeeting	Polycom Telepresence
Retail	Figma, Collaborate	Basecamp, Smartsheet	iCloud, Microsoft OneDrive	Cisco Jabber	Join Me
Energy Sector	ArcGIS, Chanty	Zoho Projects, Clarizen	AWS, Azure Files	GoToMeeting	Cisco WebEx
Tech Industry	Slack, Red booth	Jira, Trello	Google Drive, SharePoint	Zoom, WebEx	Microsoft Teams

Source: Developed by the authors.

face-to-face interactions, such as screen sharing, virtual backgrounds, and breakout rooms for group discussions. By incorporating these tools into meetings, the personal touch of in-person communication is preserved, resulting in engaging and productive interactions.

Project management software such as Trello, Jira, and Asana provide teams with platforms to seamlessly organize tasks, deadlines, and workflows. These tools utilize elements like Kanban boards and Gantt charts to track project phases and individual contributions, enhancing accountability and efficiency within the team. Cloud storage and collaboration platforms like Google Drive, Dropbox, and OneDrive enable real-time document sharing and editing. They make collaborative work effortless by eliminating file size or format compatibility barriers. The students from two different schools use daily tools to work together on their daily tasks. According to [38], messaging tools (Facebook, Messenger, WhatsApp, Telegram) are vastly used, and some collaboration tools (Yammer, Jive) are less used.

4.1.5. Virtual teams in business and economic applications

Virtual teams are pivotal in modern business and economic contexts, driving productivity, reducing costs, and enabling global collaboration. Across industries, VT leverages digital tools to optimize remote operations. Slack and Trello support agile technological development, while financial institutions utilize Asana and Monday.com for secure collaboration and investment management. Healthcare providers employ VT for telemedicine and research, ensuring data security with HIPAA-compliant tools like Wrike. Autodesk BIM 360 and SAP Project Management in manufacturing enable remote quality control and supply chain management. Retail sectors adopt Figma and Smartsheet to streamline e-commerce operations, and the energy industry uses ArcGIS and Zoho Projects for remote data analysis and compliance tracking.

VT drives significant business outcomes, including cost efficiency through reduced overhead, enhanced productivity via streamlined workflows, and expanded access to global talent, fostering innovation and competitiveness. Additionally, remote collaboration promotes work-life balance, boosting employee retention and organizational resilience. According to [26], effective VT implementation requires a strong IT infrastructure with secure cloud services, standardized communication protocols, and skilled remote leadership to ensure accountability and engagement. By supporting operational agility and global market

reach, VT contributes directly to economic growth and competitive advantage on industry-specific tools to enhance productivity, streamline communication, and optimize project execution within virtual teams, reinforcing their growing role in modern business and economic environments.

4.2. Performance management in virtual teams

Assessing team performance in virtual teams (VT) is essential for ensuring productive online collaborations. Instruments such as Asana are crucial in overseeing work quality and progress relative to deadlines, which are fundamental performance indicators [39]. There is a growing trend among virtual team leaders to utilize video conferencing platforms such as Zoom, Google Meet, and Skype to receive real-time feedback. This practice enables prompt discussions and fosters team cohesion. Tools such as Microsoft Teams, Slack, and Discord provide valuable insights into levels of engagement and communication patterns, which serve as indicators of team participation [40]. Additionally, surveys and self-evaluation instruments offer instrumental insights into individual contentment and team morale for a project's long-term viability [41]. When used together, these methods give a complete picture of how well a virtual team is doing, ensuring that online workers work toward the same goals as the organization.

4.2.1. Training for effective conferencing

Virtual teams need "effective conferencing" because it is the primary way people can talk to each other and work together. Proper training in this area can make meetings run much more smoothly, help people make better decisions, and boost team happiness [42]. It is also essential to avoid misunderstandings and problems when people communicate poorly. According to [43], teams that get full training on virtual communication tools and methods are more productive and successfully complete their projects. One exciting aspect of this study was comparing how well teams with different levels of training performed when they started using a new method [44]. At first, both teams' abilities decreased, but the team with more training improved faster and more significantly than the team with less training. Training is an integral part of team growth, especially for virtual teams that need specific types of training in areas like self-management, communication and meeting facilitation, project management, and technology [45].

4.2.2. Defining goals

Numerous theories aim to explain how people collaborate effectively in virtual teams. These theories emphasize the importance of visibility and measurement of actions. Essential tasks for successful virtual teamwork include setting goals, creating plans, communicating, collaborating, and reflecting on performance [46]. In contrast to the direct leadership styles common in traditional teams, virtual team members may benefit more from a leadership style that gives team members the power to make decisions and share management duties among the team members [47]. This strategy changes the traditional job of a team manager as a controller into more like coaching and moderation for their goals [48]. Leaders of virtual teams should prioritize finding things that everyone can agree on right from the start. At the same time, they should focus the team on meeting key performance goals and setting up a clear way for the team to recognize and celebrate its successes.

4.2.3. Process-oriented approaches in virtual teamwork

Process-oriented approaches in virtual teamwork have become more critical as the world of online work changes. These methods involve making different parts of virtual teams work better to be more efficient, work better together, and do better overall. The key to effective virtual teamwork is getting team goals and tactics to work together well. Also, virtual talks are essential to working as a team from afar, but they must be set up correctly to be helpful.

Fig. 5 shows process-oriented approaches in virtual teamwork by ensuring everyone on the team is on the same page through effective communication. The team can build strong relationships and a feeling of unity, which is strategic alignment. Virtual meetings can be more productive and improve performance if the plan considers the team's social and emotional aspects, such as building relationships and cohesion. Also, the tools we use for communication should make it easier to do more than share information. They should also help build relationships and create a "cohesive" team. When judging a team's work in a virtual setting, we should look at how well they interact, build relationships, and remain together [21].

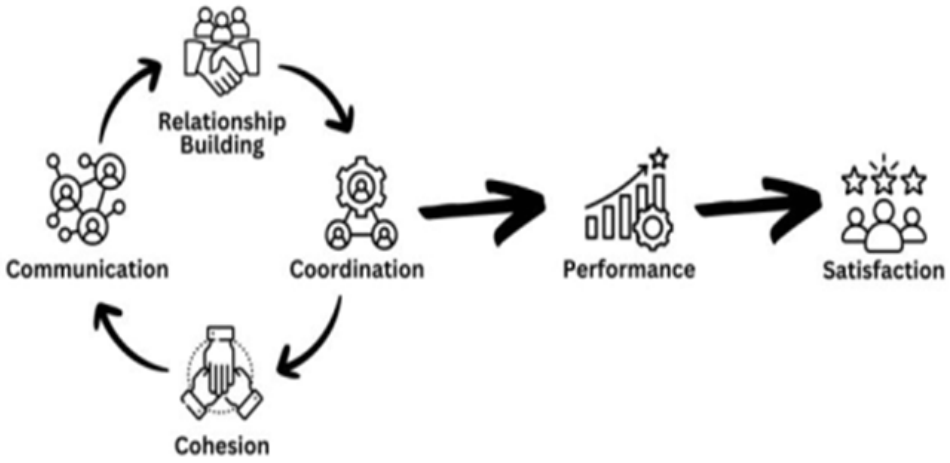

Fig. 5. **Process-oriented approaches in VT**

Source: Developed by the authors.

5. Findings and discussion

This paper thoroughly reviewed literature and related resources on virtual teams and identified 44 relevant studies. Virtual teams provide advantages to firms that are adapting to a more challenging work environment but have many difficulties and drawbacks. Key failure factors include geographic and temporal dispersion, cultural variety, and unfavorable leadership traits. The study discovered that while virtual work allowed for focused individual activities, it impeded spontaneous collaboration and relationship development. This necessitated careful planning and the adjustment of digital tools to enhance team engagement. In virtual team settings, challenges in obtaining information were more prominent than difficulties in sharing knowledge. Additionally, new technology has increasingly become essential for facilitating cooperation across distances. The study emphasizes six essential leadership practices for successful virtual team management: building trust through communication technology, valuing and utilizing diversity, overseeing the virtual work process, tracking team progress with technology, increasing team and member visibility, and guaranteeing individual benefits from involvement in virtual teams.

This research offers a crucial advancement in understanding the development of virtual team efficacy and its implications within virtual team environments. The results highlight the critical role of technology selection in improving virtual teamwork. However, we must address location-specific challenges like technology access and literacy disparities through standardized platforms and comprehensive training programs. Additionally, the research emphasizes the importance of people-oriented strategies — particularly reward structures and clear communication protocols — which significantly influence team morale and engagement. These approaches are crucial for maintaining focus and cohesion, especially in diverse, globally distributed teams. Effective process management, including aligning team goals, structured meetings, and continuous performance measurement, emerged as vital for ensuring operational efficiency in virtual teams.

Moreover, we dealt with the issue of closing the virtual gap by discussing the practical communication tools and strategies involved in bridging the social gap and creating a sense of community among the virtual team. We identified leadership development, trust building, and team cohesion building as critical strategies to maintain performance and team cohesion. Therefore, the findings underscore the need for industry-specific strategies in virtual team management. While asynchronous communication and performance tracking tools help IT and software development teams become flexible and productive, they also help customers write async code through the same process.

6. Concluding remarks

In summary, this review paper highlighted the unique dynamics of virtual teams, focusing on improving collaboration and performance. The worldwide acceptance of remote work, especially during the COVID-19 pandemic, has demonstrated the importance of companies and businesses in adapting to remote work sufficiently. The paper also highlights the fundamental role that technology, trust, and communication play in the

ultimate success of virtual teams. Though tools like video conferencing or Microsoft Project are crucial factors, the effectiveness of virtual teams depends equally on individualistic factors, such as team cohesion, clear communication protocols, and the strategic alignment of goals. Thus, leadership comes out as a key component, and effective virtual teams are defined by leaders who enhance trust, set clear expectations, and promote team cooperation. Geographical distance, time zone differences, and cultural differences make it necessary to address these issues effectively through successful virtual meetings, a cross-cultural reward systems, and continued training in virtual technologies.

Moreover, this paper points out the importance of managing virtual teams with flexibility and adaptability, ensuring communication remains open and that team members are supported in their professional tasks and personal well-being. The study also suggests that industry-specific approaches are vital to addressing virtual teams' main dilemmas in different sectors, such as construction and IT. Subsequently, in future studies, questions related to the analysis of virtual team dynamics, such as flexible working and team dynamics, will be even more influenced by modern trends like AI, VR, and so on. More organizations are adopting virtual teams as part of their business models, hence the need for further conceptual and pragmatic support to enhance the existing virtual team performance. This review serves as a decent resource for scholars and practitioners, providing valuable information regarding the factors contributing to effective virtual teamwork and establishing the basis for further developments of virtual collaboration practices.

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X. Zhang — Focused on the Literature Review and Methodological Approach, synthesizing relevant studies and thoroughly comparing existing research.
M.F.F. Rahman — Contributed extensively to the Virtual Teams in Business and Economic Applications and Geographic Considerations sections. He also contributed to the Findings and Discussions, Concluding Remarks, and ensuring clarity and coherence throughout the manuscript.
B. Zahra — Developed the sections on Training for Effective Conferencing, Defining Goals, and Process-Oriented Approaches in Virtual Teams. She provided analytical insights into performance management and shaped the Findings and Discussions.
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Conflicts of Interest Statement: The authors have no conflicts of interest to declare.
The article was submitted on 09.12.2024; revised on 20.02.2025 and accepted for publication on 01.03.2025.
The authors read and approved the final version of the manuscript.