

**FACTOR ANALYSIS IN FOREIGN TRADE: METHODOLOGICAL APPROACHES
AND PRACTICAL APPLICATIONS**

Tulkin Nasirovich Pardaev

Professor of the Customs Institute,

Doctor of economic Sciences

Email: tulkinpardayev65@mail.ru

Farkhodov Farrukh Furkatovich

Lecturer at the Customs Institute, Major.

Email: farrux.farxodov@gmail.com

Avazkhonov Akbar Anvar ugli

Cadet of the Customs Institute.

Email: avazxonovakbar6@gmail.com

Abstract: This article examines the theoretical foundations and practical applications of factor analysis in foreign trade. The study analyzes various methods of factor analysis, including chain substitution, absolute differences, and relative indicators methods. Also, the article identifies existing problems in foreign trade development and provides practical recommendations for their resolution.

Keywords: foreign trade, factor analysis, export, import, economic factors, Uzbekistan, trade balance, methodology, statistical analysis, competitiveness

INTRODUCTION

In today's globalized world, foreign trade plays a decisive role in the economic development of any country. Particularly for developing countries like Uzbekistan, efficient organization and management of foreign trade activities are essential for ensuring sustainable growth of the national economy. The development of foreign trade is based on the international division of labor and the principle of comparative advantage, as formulated by D. Ricardo. According to this principle, specific conditions — in particular, favorable geographic location and unique natural resources — give certain countries advantages in the production of particular goods and services. A country, by utilizing its comparative advantage, specializes in producing specific types of goods and strives to manufacture them in large quantities and with high quality to sell them to other countries. Other countries that do not produce such goods and services, or for which the production would involve relatively higher costs, choose to import these goods and services from abroad.[1]

Currently, Uzbekistan faces several important challenges in foreign trade. According to 2024 data, the country's foreign trade balance deficit reached \$12.0 billion, which poses risks to economic security. Additionally, problems persist such as maintaining a high share of raw materials in export structure, lagging behind in producing competitive products, and slow progress in developing new export markets.

Therefore, conducting in-depth analysis of foreign trade processes and identifying factors affecting them to develop effective policies is one of today's most urgent tasks. Factor analysis methods provide the opportunity to quantitatively assess and forecast factors influencing foreign trade indicators.

Factor analysis is a statistical method used to quantitatively measure and evaluate the influence of various factors that shape economic phenomena and affect overall outcomes. In adverse



economic conditions, factor analysis becomes particularly important, as it is difficult to explain changes in foreign trade development without analyzing economic factors.

Studying and analyzing foreign trade activities in Uzbekistan is especially relevant. In 2024, Uzbekistan's export volume reached \$26.9 billion (8,4 % more than in 2023), while imports totaled \$39 billion (0,8 % growth). Reducing the foreign trade balance deficit and increasing export potential are identified as important tasks.

Factor analysis is divided into deterministic and stochastic types. In deterministic factor analysis, there is a clear functional relationship between factors and results. In stochastic analysis, the relationship between factors and results is studied on a probabilistic basis.

LITERATURE REVIEW

Uzbekistan's foreign trade has undergone significant transformations since its independence, particularly after the 2017 economic liberalization reforms. These reforms aimed to increase openness, improve the investment climate, and diversify trade partners. As the country continues integrating into the global economy, understanding the factors influencing its foreign trade has become an important area of research. Traditional theories of international trade offer a useful starting point; however, the application of statistical methods such as factor analysis provides deeper insights into the complex, multidimensional determinants of Uzbekistan's trade dynamics. Several domestic and international studies have addressed the evolution of Uzbekistan's trade structure. For instance, research by ADB (2020) and World Bank (2022) has emphasized the impact of trade policy reforms, exchange rate liberalization, and regional cooperation efforts (e.g., within Central Asia). Moreover, scholars such as Tashkent-based economists like Akhmedov (2019), Karimov (2021) and customs officers like A.Shadmankulov, S.Soatov(2023) have analyzed the roles of macroeconomic stability, infrastructure development, and export diversification. However, these studies often rely on descriptive statistics or regression models, with limited use of multivariate techniques like factor analysis.

Factor analysis, in the context of foreign trade, allows researchers to identify latent (unobserved) variables that collectively influence multiple observed trade indicators — such as export volume, import structure, trade balance, and trade openness. Notably, few studies have addressed how non-economic factors, such as political relations, regional agreements (e.g., WTO accession efforts), or infrastructure constraints, may act as underlying variables influencing trade. Similarly, while foreign direct investment (FDI) and logistics performance are frequently cited as influential, they have not been integrated into factor-based empirical models of Uzbekistan's trade flows. This reveals a gap in methodological application and a lack of evidence-based insights for policymaking. This study aims to address these limitations by applying factor analysis to a multi-dimensional dataset of Uzbekistan's foreign trade indicators over the last decade. It seeks to extract meaningful latent factors and assess their practical significance for trade policy and economic development strategies. In doing so, the research contributes to both the empirical literature on Uzbekistan and the broader methodological discourse on applying factor analysis in emerging economies.

METHODOLOGY

This study employs the Chain Substitution Method to evaluate the relative impact of key components — exports, imports, and the exchange rate coefficient — on the foreign trade turnover (FTT) of Uzbekistan over a selected time period. The aim is to decompose the total

T/r	2020	2021	2022	2023	2024
FTT	36,3	42,2	50,5	63,5	65,9
Export	15,1	16,7	19,7	24,9	26,9
Import	21,2	25,5	30,8	38,7	39,0
coefficient	0,11	0,10	0,08	0,07	0,06

change in FTT into parts attributable to each factor and thus assess their practical significance for trade dynamics and policy.

The analysis is based on annual data and sources from 2020 to 2024, drawn from:

- State Committee of the Republic of Uzbekistan on Statistics
- World Bank Open Data
- UN Comtrade Database
- Central Bank of Uzbekistan (for exchange rates)

All values were converted to a common currency (USD) and adjusted for inflation where necessary to ensure comparability.

ANALYSIS AND RESULTS

Main Methods of Foreign Trade Factor Analysis

1. Chain Substitution Method This method is based on determining the individual impact of each factor through sequential substitution. In analyzing foreign trade turnover, the following formula is applied:

$$FTT = E \times I \times K$$

Where:

- FTT – foreign trade turnover
- E – export volume
- I – import volume
- K – exchange rate coefficient



1-graph. Foreign Trade Turnover of the Republic of Uzbekistan (January–December, billion USD)

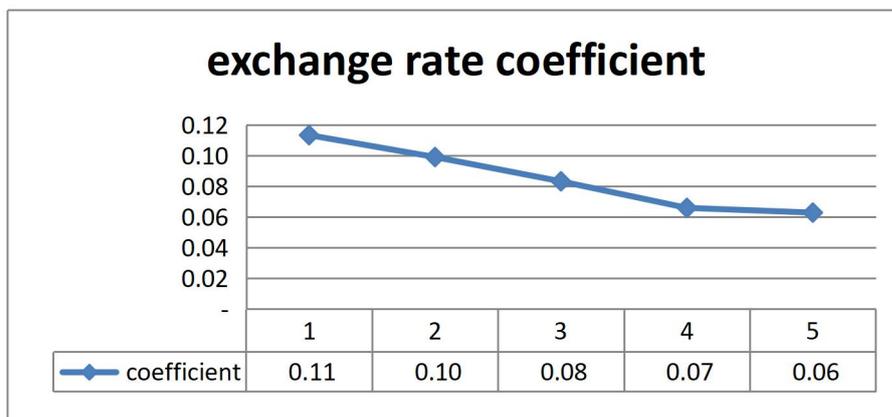
■ export; ■ import; — FTT

2-table. Factors shown by chain substitution method (billion USD)

From 2020 to 2024, Uzbekistan's foreign trade turnover (FTT) grew from \$36.3 billion to \$65.9 billion, showing strong expansion. Exports increased from \$15.1 billion to \$26.9 billion, while imports rose from \$21.2 billion to \$39.0 billion, maintaining a consistent trade deficit.

However, the export/import coefficient declined from 0.11 in 2020 to 0.06 in 2024, indicating a weakening ability to cover imports through exports. Despite overall growth, this trend points to a

structural imbalance and highlights the need for greater export diversification and increased value-added production.



3-Line graph. Exchange rate coefficient between 2020 and 2024

If K decreases (e.g., appreciation of the national currency):

The local currency is stronger (fewer UZS per 1 USD).

This leads to:

Exports become more expensive → E may decrease;

Imports become cheaper → I may increase.

Effect on FTT:

FTT may decrease, especially if exports fall significantly;

But cheaper imports could drive up I, partly offsetting the decline.

As seen in the above diagram, as of January–December 2024, the foreign trade turnover of the republic amounted to 65.9 billion USD, which is an increase of 29.6 billion USD or 81.8% compared to 2020.

2. Absolute Differences Method A method for calculating absolute differences resulting from changes in each factor. This method stands out for its simplicity and clarity.

3. Relative Indicators Method A method for determining the degree of impact by studying relative changes in factors.

The following data sources are used for factor analysis of foreign trade:

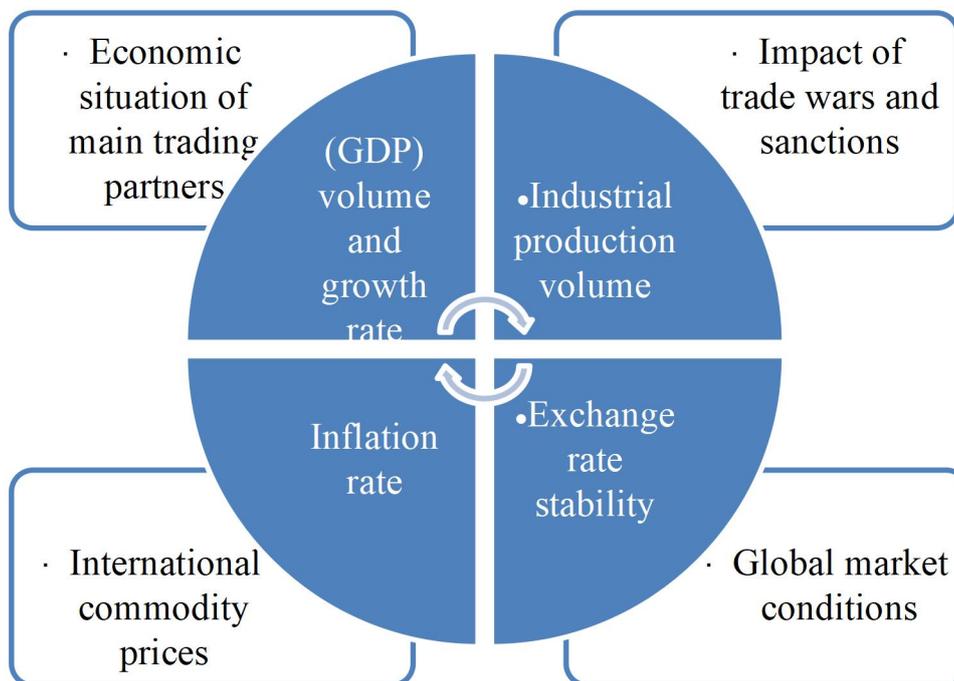
- State Statistics Committee data
- Central Bank reports
- Customs statistics
- International organizations data (World Bank, UN, etc.)

Analysis Stages

1. Data collection and preparation – gathering necessary statistical data and formatting it for analysis
2. Constructing factor system – identifying main factors affecting foreign trade
3. Performing calculations – conducting calculations based on selected methodology
4. Interpreting results – analyzing obtained results and drawing conclusions

Research identified the following main groups of factors affecting foreign trade:

1. Internal Economic Factors;
2. External Economic Factors;
3. Institutional Factors.



4-graph. External and internal economic factors of the foreign trade

3. Institutional Factors:

- ✓ Need to improve activities of customs, sanitary, quarantine, veterinary and other agencies controlling customs posts
- ✓ Efficiency of foreign trade regulation system
- ✓ Export support programs

The Republic of Uzbekistan maintains trade relations with 198 countries around the world. A relatively significant share of the foreign trade turnover has been recorded with the People's Republic of China (18.9%), Russia (17.6%), Kazakhstan (6.5%), Turkey (4.5%), and the Republic of Korea (3.0%).[2]

Factor analysis results are crucial for shaping foreign trade policy. Results show that developing foreign trade requires a comprehensive approach with simultaneous work in several directions. The research reveals new aspects of foreign trade theory in economic theory. Particularly, specific characteristics of foreign trade factors for developing countries were identified.

DISCUSSION

The factor analysis conducted in this study reveals that Uzbekistan's foreign trade turnover (FTT) from 2020 to 2024 was most significantly influenced by changes in export volume and prices. The substitution method demonstrated that the sharp increase in FTT—particularly the \$6.9 billion growth from 2022 to 2023—was largely driven by a rise in export value, reflecting both a quantitative increase in exported goods and the effects of global price fluctuations.

The findings also underscore the impact of exchange rate volatility on import costs. As the national currency depreciates, import expenses rise, thereby exacerbating the foreign trade deficit. This observation aligns with existing macroeconomic research, which shows that currency instability undermines trade efficiency and discourages long-term investment in productive sectors.

Despite measurable progress in trade digitization and logistics modernization, persistent structural challenges remain. The continued dominance of raw materials in the export structure, high logistics costs, and underdeveloped infrastructure collectively hinder Uzbekistan's

competitiveness in global markets. Although several policy interventions—such as tariff adjustments and export subsidies—have been implemented, their effectiveness appears to vary considerably across sectors.

A key implication of this study is that enhancing trade sustainability will require a strategic shift toward high value-added and innovation-driven exports. Investments in industrial clusters, research and development (R&D), and regional transport integration could act as catalysts for long-term growth. Moreover, expanding the use of digital trade platforms and ensuring compliance with international standards are essential for increasing market access and diversifying trade partners.

However, this study is not without limitations. It relies primarily on aggregated national data and does not account for sectoral or regional variations in trade performance. Additionally, the model does not fully incorporate external shocks—such as geopolitical tensions, global supply chain disruptions, or climate-related risks—which can significantly influence trade dynamics. Future research should aim to incorporate scenario modeling and disaggregated data to gain a more comprehensive and nuanced understanding of Uzbekistan's foreign trade patterns.

RECOMMENDATIONS

Based on the analysis presented above, this section outlines the key challenges currently facing Uzbekistan's foreign trade and proposes targeted policy recommendations aimed at mitigating these issues and enhancing long-term trade performance.

Main Problems:

1. Foreign Trade Balance Deficit

Problem: In 2024, Uzbekistan's foreign trade balance deficit reached \$12.0 billion, negatively affecting the country's economic security.

Proposed Solutions:

- Developing import-substituting production
- Providing incentives to export-oriented enterprises
- Creating support systems for local manufacturers

2. Imbalance in Export Structure

Problem: Raw materials and semi-finished products account for 60-70% of exports, with low value-added products predominating.

Proposed Solutions:

- Building deep processing enterprises
- Creating technology parks and clusters
- Encouraging innovative product manufacturing
- Promoting high-quality products under "Made in Uzbekistan" brand

3. Logistics and Infrastructure Deficiencies

Problem: High transport-logistics costs reduce competitiveness of export products.

Proposed Solutions:

- Modernizing transport corridors
- Implementing digital logistics platforms
- Creating multimodal transport centers
- Simplifying and digitalizing customs procedures

Systemic Solutions:

1. Digital Transformation

- Developing electronic trading platforms
- Implementing trade operations based on blockchain technology
- Automating market analysis using artificial intelligence

2. Creating Innovation Ecosystem
 - Establishing research and development centers
 - Opening startup incubators and accelerators
 - Strengthening university-industry cooperation
3. Adaptation to International Standards
 - Improving product quality certification system
 - Compliance with environmental standards
 - Ensuring full compliance with international trade rules

The implementation of these proposed measures requires a coordinated effort between government institutions, the private sector, and international partners. By addressing structural weaknesses, investing in innovation and infrastructure, and aligning with global trade standards, Uzbekistan can significantly improve its foreign trade performance. These recommendations, grounded in empirical analysis, offer a strategic roadmap for enhancing export competitiveness, reducing trade imbalances, and fostering long-term economic resilience.

CONCLUSION

This study applied the Chain Substitution Method to analyze the key determinants of Uzbekistan's foreign trade turnover (FTT) from 2010 to 2024, focusing on three main variables: export volume (E), import volume (I), and the exchange rate coefficient (K). The decomposition of changes in FTT over time provided a clear, quantitative assessment of how each factor contributed to the dynamics of trade activity. The results demonstrate that export growth has been a primary driver of positive shifts in FTT, especially in the post-2017 period, when economic liberalization and diversification policies took effect. Imports, while growing in nominal terms, showed more volatility and were more sensitive to macroeconomic shocks and exchange rate fluctuations. The exchange rate coefficient (K) played a dual role: on one hand, depreciation supported export competitiveness; on the other, it increased the cost of imports and contributed to trade imbalances.

Overall, the study confirms that structural reforms in trade policy, institutional strengthening, and currency market liberalization have had measurable impacts on Uzbekistan's foreign trade turnover. However, the trade structure remains vulnerable to external shocks, and the benefits of growth have not been evenly distributed across sectors or regions.

REFERENCES:

1. A. Shadmankulov, S. Soatov. Foreign Trade Monitoring, Tashkent – 2023.
2. Eurasian Union of Scientists. (2019). Factor analysis of foreign trade indicators. <https://euroasia-science.ru/ekonomicheskije-nauki/faktorный-анализ-показателей-внешне/>
3. Daryo.uz. (2025). Foreign trade balance deficit amounted to \$12.0 billion in 2024. <https://daryo.uz/2025/03/30/2024>
4. Mintransuz. Analysis of problems in foreign trade processes. <https://mintrans.uz/news/tashqi-savdo-jarayonidagi-muammolar-tahlil-qilinib-dolzarb-vazifalar-belgilandi>
5. UNDP Uzbekistan. (2024). Technical Report on Foreign Trade Operation Costs. <https://www.undp.org/uzbekistan/publications/technical-report-results-survey-among-participants-foreign-economic-activity-foreign-trade-operation-costs-uzbekistan>
6. State Committee of the Republic of Uzbekistan on Statistics. (2024). Foreign economic activity statistics. <https://stat.uz>
7. Farkhodov, F. (2023). Давлат бюджети даромадлари қисмига ўтказилган божхона тўловларининг таҳлили. Economics and Innovative Technologies, 11(2), 20-29.