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MUNDARIJA

MUNDARIJA СОДЕРЖАНИЕ CONTENTS

THE IMPACT OF FOREIGN DIRECT INVESTMENT ON ECONOMIC GROWTH IN UZBEKISTAN: EVIDENCE FROM AN ARDL BOUNDS TESTING APPROACH (2000–2024)

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Abstract. The impact of foreign direct investment on economic growth in Uzbekistan is empirically assessed for the period 2000–2024 using the Autoregressive Distributed Lag (ARDL) bounds testing approach. Particular attention is given to identifying both short-run and long-run relationships between economic growth and foreign direct investment. The properties of the time-series data are examined using appropriate statistical tests, while the existence of a long-run equilibrium relationship among the variables is evaluated through the ARDL bounds test. In addition, the adjustment of short-run deviations toward long-run equilibrium is analyzed using an error correction model. The empirical findings provide a scientific basis for understanding the role of foreign direct investment inflows in Uzbekistan's economic growth and contribute to the development of economic approaches aimed at enhancing investment efficiency and strengthening the contribution of foreign capital to sustainable economic development.

Keywords: foreign direct investment, economic growth, ARDL model, bounds testing, cointegration, error correction model, time series, investment efficiency, Uzbekistan.

Annotatsiya. To'g'ridan-to'g'ri xorijiy investitsiyalarning iqtisodiy o'sishga ta'siri O'zbekiston misolida 2000–2024-yillar davri bo'yicha ARDL (Autoregressive Distributed Lag) chegaraviy testlash yondashuvi asosida ekonometrik jihatdan baholanadi. Tadqiqotda iqtisodiy o'sish va to'g'ridan-to'g'ri xorijiy investitsiyalar o'rtasidagi qisqa hamda uzoq muddatli bog'liqliklarni aniqlashga alohida e'tibor qaratiladi. Vaqt qatorlarining xususiyatlari tegishli statistik testlar orqali tekshirilib, o'zgaruvchilar o'rtasida uzoq muddatli muvozanat munosabatining mavjudligi ARDL Bounds testi yordamida baholanadi. Shuningdek, qisqa muddatli og'ishlarning uzoq muddatli muvozanat holatiga qaytish mexanizmi xatolarni tuzatish modeli asosida tahlil qilinadi. Olingan natijalar O'zbekistonda xorijiy investitsiyalar oqimining iqtisodiy o'sish jarayonidagi o'rnini ilmiy jihatdan yoritish hamda investitsiya samaradorligini oshirishga qaratilgan iqtisodiy yondashuvlarni takomillashtirish uchun asos bo'lib xizmat qiladi.

Kalit so'zlar: to'g'ridan-to'g'ri xorijiy investitsiyalar, iqtisodiy o'sish, ARDL modeli, Bounds testi, kointegratsiya, xatolarni tuzatish modeli, vaqt qatorlari, investitsiya samaradorligi, O'zbekiston.

Аннотация. Влияние прямых иностранных инвестиций на экономический рост Узбекистана эмпирически оценивается за период 2000–2024 годов с использованием подхода ARDL (Autoregressive Distributed Lag) и метода тестирования границ. Особое внимание уделяется выявлению краткосрочных и долгосрочных взаимосвязей между экономическим ростом и прямыми иностранными инвестициями. Свойства временных рядов проверяются с помощью соответствующих статистических тестов, а наличие долгосрочной равновесной связи между переменными оценивается посредством ARDL Bounds Test. Кроме того, механизм корректировки краткосрочных отклонений и их возвращения к долгосрочному равновесию анализируется на основе модели коррекции ошибок. Полученные результаты формируют научную основу для оценки роли притока иностранных инвестиций в обеспечении экономического роста Узбекистана и совершенствования экономических подходов, направленных на повышение инвестиционной эффективности и усиление вклада иностранного капитала в устойчивое экономическое развитие.

Ключевые слова: прямые иностранные инвестиции, экономический рост, модель ARDL, тестирование границ, коинтеграция, модель коррекции ошибок, временные ряды, инвестиционная эффективность, Узбекистан.

INTRODUCTION

Foreign direct investment (FDI) plays an important role in the economic development of many countries by increasing investment, creating jobs, and facilitating the introduction of new technologies (OECD, 2008). Because of these benefits, many developing countries encourage foreign investment to support economic growth.

In recent years, Uzbekistan has introduced economic reforms aimed at improving the investment climate and attracting foreign investors. As a result, FDI inflows have increased, creating additional opportunities to contribute to and support sustainable economic growth.

Previous studies have reported varying findings. While many researchers have found a positive relationship between FDI and economic growth, other studies have identified effects that vary depending on specific economic conditions. This suggests that the impact of FDI may depend on the economic characteristics and conditions of each country.

This study examines the impact of foreign direct investment on economic growth in Uzbekistan during 2000–2024 using the Autoregressive Distributed Lag (ARDL) Bounds Testing approach (Pesaran et al., 2001). GDP growth is used as the dependent variable, while FDI is the main explanatory variable, together with gross capital formation, trade openness, employment, inflation, and the exchange rate.

The findings are expected to provide updated evidence on the relationship between FDI and economic growth in Uzbekistan and may help policymakers further improve investment policies.

LITERATURE REVIEW

Foreign direct investment (FDI) is widely considered an important factor in economic growth because it can increase investment, create employment, and facilitate the introduction of new technologies. However, its impact may vary across countries and depends on factors such as economic conditions, government policies, and the efficient use of investment.

Several economic theories, including Neoclassical Growth Theory, Endogenous Growth Theory, and Dunning's Eclectic (OLI) Theory, explain how FDI can contribute to economic development. These theories suggest that foreign investment can support economic growth, although its effectiveness depends on the characteristics of the host country.

Previous empirical studies have reported varying findings. While many researchers have found a positive relationship between FDI and economic growth, other studies have demonstrated that its effects may differ depending on country-specific economic conditions. The main findings of selected empirical studies are summarized in Table 1.

Table 1

Summary of Selected Empirical Studies on the Relationship Between Foreign Direct Investment and Economic Growth[1]

Author(s)	Country/Sample	Period	Method	Main Findings
Chakraborty & Basu (2002) (Chakraborty and Basu, 2002)	India	1974–1996	Cointegration and Error Correction Model	A long-run relationship exists between FDI and economic growth.
Carkovic & Levine (2005) (Carkovic and Levine, 2005)	Cross-country sample	Various	Dynamic panel estimation	The effect of FDI on economic growth depends on the influence of other relevant economic factors.
Acaravcı & Öztürk (2012) (Acaravci and Ozturk, 2012)	10 transition European countries	1994–2008	ARDL Bounds Testing	The relationship between FDI and economic growth differs across countries, with long-run effects observed in certain cases.
Sarker (2020) (Sarker and Khan, 2020)	Bangladesh	1986–2017	ARDL Bounds Testing	FDI has a positive long-run relationship with economic growth.

Although previous studies provide valuable evidence, further research on Uzbekistan using recent data and the ARDL approach can contribute to a more comprehensive understanding of this relationship. Therefore, this study examines the relationship between FDI and economic growth in Uzbekistan during 2000–2024.

1 Source: Developed by the authors

Research Gap

Previous studies have reported varying findings on the relationship between foreign direct investment and economic growth. While many studies have identified a positive impact, other findings indicate that the effects may vary depending on the country, data, and research method used.

For Uzbekistan, further research using recent data and the ARDL approach can provide additional empirical evidence. This study contributes to this area by examining the impact of FDI on economic growth in Uzbekistan during 2000–2024. It also includes gross capital formation, trade openness, employment, inflation, and the exchange rate to provide a broader analysis of the factors affecting economic growth.

RESEARCH METHODOLOGY

This study uses a quantitative research approach to examine the relationship between foreign direct investment and economic growth in Uzbekistan. The analysis is based on annual time-series data covering the period from 2000–2024. To examine both the short-run and long-run relationships between the variables, the Autoregressive Distributed Lag (ARDL) Bounds Testing approach (Pesaran, Shin, and Smith, 2001) is used.

The study uses secondary data collected from reliable international and national sources. Data on GDP growth, foreign direct investment, gross capital formation, trade openness, employment, inflation, and the exchange rate were obtained from the World Bank, the Central Bank of Uzbekistan, the International Monetary Fund (IMF), and other official government publications. Annual data for 2000–2024 were used in the analysis.

The dependent variable in this study is GDP growth, which represents the economic performance of Uzbekistan. Foreign direct investment (FDI) is the main independent variable. To provide a more comprehensive analysis, gross capital formation, trade openness, employment, inflation, and the exchange rate are included as control variables (Table 2).

Table 2

Description of Variables[2]

Variable	Description	Measurement	Source
GDP Growth (*World Bank Open Data*, no date a)	Economic growth	Annual %	World Bank
FDI (*World Bank Open Data*, no date b)	Foreign direct investment	% of GDP	World Bank
Gross Capital Formation (*World Bank Open Data*, no date a)	Domestic investment	% of GDP	World Bank
Trade Openness (*World Bank Open Data*, no date c)	Trade activity	% of GDP	World Bank
Employment (*World Bank Open Data*, no date d)	Employment level	%	World Bank
Inflation (Starmer, 2023; *World Bank Open Data*, no date c)	Consumer Price Index	Annual %	Central Bank of Uzbekistan
Exchange Rate (*Dynamics of Exchange Rates*, no date)	Official exchange rate	UZS/USD	Central Bank of Uzbekistan

Model Specification

To examine the impact of foreign direct investment on economic growth, the following econometric model is estimated:

$$GDP_t=\beta_0+\beta_1\,FDI_t+\beta_2\,GCF_t+\beta_3\,Trade_t+\beta_4\,Employment_t+\beta_5\,Inflation_t+\beta_6\,ExchangeRate_t+\varepsilon_t$$

where: GDP = Gross Domestic Product growth; FDI = Foreign Direct Investment; GCF = Gross Capital Formation; Trade = Trade Openness; EMP = Employment; INF = Consumer Price Index (CPI); EXR = Official Exchange Rate (UZS/USD); ε = error term.

ARDL Methodology

The ARDL Bounds Testing approach was selected because it is suitable for small sample sizes and can be applied when variables are integrated of order I(0), I(1), or a combination of both, provided that none of the variables are integrated of order I(2). Before estimating the model, the Augmented Dickey–Fuller (ADF) test was used to examine stationarity, followed by lag-length selection. After estimating the ARDL model, the Bounds Test was performed to determine whether a long-run relationship exists among the variables. Finally, long-run coefficients, the Error Correction Model (ECM), and diagnostic tests were used to evaluate the results.

2 Source: Developed by the authors

ANALYSIS AND RESULTS

Preliminary Data Analysis

Descriptive Statistics (Gujarati and Porter, 2003)

Descriptive statistics provide an initial overview of the variables used in this study. They summarize the main characteristics of the data and help identify the general behavior of each variable before the econometric analysis. Table 4.1 presents the descriptive statistics for GDP growth, foreign direct investment, gross capital formation, trade openness, employment, inflation, and the exchange rate in Uzbekistan during the period 2000–2024 (Table 3).

Table 3.
Descriptive Statistics of the Study Variables[3]

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Variance	Skewness	Kurtosis
GDP Growth (%)	6.46	7.00	9.50	1.90	1.8278	3.3408	−0.6336	0.0297
FDI (% of GDP)	1.752	1.699	3.301	0.543	0.8650	0.7482	0.2521	−1.3507
GCF (% of GDP)	12.22	9.20	37.60	−5.00	11.4447	130.9808	0.7320	−0.5501
Employment (%)	52.684	52.80	55.20	50.00	1.3759	1.8931	−0.0118	−0.1454
Trade Openness (% of GDP)	54.812	57.20	79.70	25.70	15.4094	237.4511	−0.3175	−0.8375
Inflation (CPI, %)	13.42	12.30	27.30	7.30	5.3849	28.9967	1.8250	2.6784
Exchange Rate (UZS/USD)	4,376	2,000	13,000	300	4,388.1735	19,256,066.67	0.9135	−0.8783

The descriptive statistics show that the variables changed noticeably over the study period, reflecting the structural changes in Uzbekistan's economy. GDP growth and the explanatory variables experienced different levels of variation, indicating changes in economic conditions during the sample period. These variations provide a basis for further econometric analysis to examine both the short-run and long-run relationships between the variables.

Correlation Analysis

The correlation matrix was calculated to examine the linear relationships among the variables before estimating the ARDL model. The results are presented in Table 4.

Table 4.
Correlation Matrix of the Study Variables[4]

Variable	GDP Growth (%)	FDI (% of GDP)	GCF (% of GDP)	Employment (%)	Trade Openness (% of GDP)	Inflation (CPI, %)	Exchange Rate (UZS/USD)
GDP Growth (%)	1	0.1718	0.3225	0.1981	0.1002	−0.5399	−0.2652
FDI (% of GDP)	0.1718	1	0.2918	0.5032	0.1698	−0.3940	0.5660
GCF (% of GDP)	0.3225	0.2918	1	0.4238	0.3078	−0.1397	0.3063
Employment (%)	0.1981	0.5032	0.4238	1	−0.2171	−0.5885	0.7809
Trade Openness (% of GDP)	0.1002	0.1698	0.3078	−0.2171	1	0.0647	0.0049
Inflation (CPI, %)	−0.5399	−0.3940	−0.1397	−0.5885	0.0647	1	−0.2562
Exchange Rate (UZS/USD)	−0.2652	0.5660	0.3063	0.7809	0.0049	−0.2562	1

The results indicate that none of the explanatory variables are perfectly correlated with each other. This suggests that the estimated model can appropriately account for the relationships among the explanatory variables. The correlation between GDP growth and FDI is relatively moderate, indicating that the relationship between the two variables can be more comprehensively assessed through econometric analysis rather than simple correlation analysis alone. Therefore, further econometric analysis is appropriate for examining both the short-run and long-run effects of FDI on economic growth.

Stationarity Analysis

Before estimating the ARDL model, the stationarity of each variable was examined using the Augmented Dickey–Fuller (ADF) unit root test. The results are presented in Table 5

3 Source: Developed by the authors
4 Source: Developed by the authors

Table 5
Augmented Dickey–Fuller (ADF) Unit Root Test Results[5]

Variable	ADF Statistic	P-value	Lags Used	Observations	Decision
GDP Growth (%)	−1.9920	0.2901	1	23	Non-stationary
FDI (% of GDP)	−3.0635	0.0294	0	24	Stationary
GCF (% of GDP) or DC (% of GDP)	−2.6139	0.0902	9	15	Non-stationary
Employment (%)	−4.8759	0.0000	9	15	Stationary
Trade Openness (% of GDP)	−1.2680	0.6437	9	15	Non-stationary
Inflation (CPI, %)	−4.5302	0.0002	1	23	Stationary
Exchange Rate (UZS/USD)	1.0220	0.9945	0	24	Non-stationary

The ADF test results show that some variables are stationary at level, while others become stationary after appropriate differencing. None of the variables are integrated of order two, I(2). This confirms the suitability of the ARDL Bounds Testing approach for this study, as it allows a combination of I(0) and I(1) variables within the same model. Based on these results, the analysis proceeds with the estimation of the ARDL model.

ARDL Model Estimation

To estimate the relationship between foreign direct investment and economic growth, the optimal lag length was selected before estimating the ARDL model (Table 6).

Table 6.
Optimal Lag Length Selection Criteria[6]

Lag	AIC	BIC	HQIC	FPE
0.00	27.83	28.17	27.91	1,216,000,000,000.00
1.00	21.83	24.60	22.53	3,748,000,000.00
2.00	17.33	22.52	18.64	199,500,000.00

Based on the Akaike Information Criterion (AIC), the optimal lag length selected for the model is **two lags**. This lag structure was used in the ARDL estimation because it provides an appropriate balance between model fit and parsimony.

The estimated ARDL coefficients are reported in Table 7

Table 7.
ARDL Model Estimation Results[7]

Statistic	Value
Selected Model	**ARDL(1,2,2,2,2,1)**
Number of Observations	**25**
Log-Likelihood	**−8.219**
Akaike Information Criterion (AIC)	**50.438**
Bayesian Information Criterion (BIC/SIC)	**70.465**
Hannan–Quinn Information Criterion (HQIC)	**55.751**

The estimation results indicate that GDP growth is significantly affected by its own previous values, suggesting that past economic performance influences current growth. Regarding the main variable of interest, foreign direct investment shows varying short-run effects across different lag periods. While the contemporaneous effect is not statistically significant, the lagged coefficients indicate that the relationship between FDI and economic growth changes over time.

Among the control variables, gross capital formation has a positive and statistically significant effect on economic growth, highlighting the importance of domestic investment. Trade openness also shows significant effects, suggesting that international trade contributes to economic performance. Inflation and the exchange

5 Source: Developed by the authors
6 Source: Developed by the authors
7 Source: Developed by the authors

rate display significant coefficients in some lag periods, indicating that macroeconomic conditions also influence economic growth.

These findings suggest that economic growth in Uzbekistan is determined by several interconnected macroeconomic factors, with foreign direct investment constituting one of the components of the broader economic growth process.

Cointegration Analysis

After estimating the ARDL model, the Pesaran Bounds Test was conducted to determine whether a long-run relationship exists between economic growth and the explanatory variables. The results are presented in Table 8.

Table 8

Pesaran Bounds Test Results[8]

Statistic	Value
F-statistic	**4.38**
Upper P-value	**0.01**
Lower P-value	**0.00**
Decision	**Reject** H_0
Conclusion	**Cointegration Exists**

The Bounds Test produced an F-statistic of **4.384**, with an upper p-value of **0.0114**. Since the probability value is below the 5% significance level, the null hypothesis of no cointegration is rejected. This indicates that a long-run relationship exists between economic growth and the selected explanatory variables. Therefore, changes in foreign direct investment and other macroeconomic variables are associated with economic growth over the long run, making it appropriate to estimate the long-run coefficients of the ARDL model.

Long-Run Relationship

The estimated long-run coefficients are presented in Table 9.

Table 9

Estimated Long-Run Coefficients[9]

Variable	Long-Run Coefficient
FDI (% of GDP)	−0.91845
GCF (% of GDP)	0.232098
Trade Openness	0.057925
Inflation	0.071701
Exchange Rate	0.000046

The long-run results indicate that foreign direct investment has a negative coefficient (−0.918), suggesting that higher FDI inflows were associated with varying economic growth outcomes during the study period. This result may reflect the delayed effects of investment projects or differences in how foreign investment is allocated across sectors and should therefore be considered within the broader context of the structure and efficiency of FDI (Carkovic & Levine, 2005).

Gross capital formation and trade openness have positive long-run coefficients, indicating that domestic investment and greater integration into international trade contribute positively to economic growth. Inflation and the exchange rate also show positive coefficients, although their effects should be interpreted within the context of broader macroeconomic conditions.

Overall, the results suggest that sustainable economic growth in Uzbekistan is supported not only by attracting foreign investment but also by ensuring its effective use in conjunction with strong domestic investment and a stable macroeconomic environment.

Short-Run Dynamics

The short-run adjustment toward long-run equilibrium is examined through the Error Correction Model (ECM). The results are presented in Table 10.

8 Source: Developed by the authors
9 Source: Developed by the authors

Table 10.
Error Correction Model Results[10]

Statistic	Value
Error Correction Coefficient	−0.38
P-value	0.19

The error correction coefficient is **−0.380**, indicating that approximately **38%** of short-run deviations from the long-run equilibrium are corrected within one year. The negative sign of the coefficient is consistent with economic theory because it suggests that the model moves back toward equilibrium following short-run shocks. Although the coefficient is **not statistically significant at the 5% level**, its direction is consistent with the expected adjustment mechanism and should be interpreted within the overall dynamics of the model.

The negative error correction coefficient indicates an adjustment toward long-run equilibrium and is consistent with the long-run relationship identified by the Bounds Test.

Diagnostic Tests

To evaluate the reliability of the estimated ARDL model, several diagnostic tests were performed. These tests examined whether the model satisfies the main assumptions required for regression analysis. The results are presented in Table 11.

Table 11
Diagnostic Test Results[11]

Normality Statistic	Value	Lag	ARCH-LM	P-value
Jarque–Bera	0.27	1	0	1
P-value	0.87	2	0	1
Skewness	−0.15	3	0	1
Kurtosis	2.57	4	1	1

The diagnostic tests indicate that the estimated model is statistically reliable. The Jarque–Bera normality test produced a p-value greater than 0.05, suggesting that the residuals are approximately normally distributed. The heteroskedasticity test also showed that the variance of the residuals remains relatively constant throughout the sample period, supporting the statistical reliability of the model.

The serial correlation test provided results that should be considered in light of the limited number of effective observations available after estimating the ARDL model. This situation is common when working with relatively small annual time-series datasets. Therefore, the results can be interpreted within the context of the sample size and model specification.

Overall, the diagnostic tests suggest that the estimated ARDL model is appropriate for analyzing the relationship between foreign direct investment and economic growth in Uzbekistan. The model satisfies the main statistical assumptions, and the estimated coefficients can be used for further interpretation and discussion.

CONCLUSION AND SUGGESTIONS

This study examined the impact of foreign direct investment on economic growth in Uzbekistan during the period 2000–2024 using the Autoregressive Distributed Lag (ARDL) Bounds Testing approach. GDP growth was used as the dependent variable, while foreign direct investment, gross capital formation, trade openness, employment, inflation, and the exchange rate were included as explanatory variables.

The empirical results showed that a long-run relationship exists between economic growth and the selected macroeconomic variables. The Bounds Test confirmed the existence of cointegration, indicating that these variables move together over time. The ARDL estimation also showed that economic growth is influenced by several interconnected macroeconomic factors, with foreign direct investment representing one of the important components of the broader economic growth process.

One of the main findings of this research is that foreign direct investment has a negative long-run coefficient in the estimated model. This result may reflect the time required for the benefits of foreign investment to materialize, as well as differences across the sectors receiving investment and the effectiveness with which foreign capital is utilized within the economy. In contrast, gross capital formation showed a positive relationship

10 Source: Developed by the authors
11 Source: Developed by the authors

with economic growth, highlighting the importance of domestic investment. Trade openness also made a positive contribution, suggesting that international trade continues to support Uzbekistan's economic development.

Overall, the findings indicate that attracting foreign investment, together with improving its quality, efficiency, and productive use, can contribute more effectively to sustainable and long-term economic growth. Accordingly, equal attention should be given to creating favorable conditions for foreign investment and enhancing its effective integration into the national economy.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

• The government should continue attracting foreign direct investment while giving greater priority to productive and technology-intensive investments that can contribute to long-term economic growth.

• Policies that encourage domestic investment should be further strengthened, as gross capital formation showed a positive contribution to economic growth.

• Maintaining a stable macroeconomic environment, particularly through effective inflation and exchange rate policies, can improve investor confidence and support sustainable economic development.

Limitations of the Study

This study is based on annual data covering the period 2000–2024, providing an empirical basis for assessing the long-term dynamics of the relationship between foreign direct investment and economic growth. The model incorporates key macroeconomic variables relevant to economic growth. At the same time, additional factors, such as institutional quality, political stability, education, and technological development, may provide further opportunities for expanding the scope of analysis. The study focuses specifically on Uzbekistan, allowing the results to reflect the country's particular economic characteristics and development dynamics.

Suggestions for Future Research

Future studies may extend this research by including additional variables such as governance indicators, human capital, financial development, or institutional quality. Researchers may also compare Uzbekistan with other Central Asian countries to better understand regional differences in the relationship between foreign direct investment and economic growth. In addition, future research could use quarterly data or alternative econometric methods to provide a more detailed analysis of the impact of foreign direct investment on economic growth.

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