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RESEARCH ON THE IMPACT OF FOREIGN DIRECT INVESTMENT (FDI) AND TRADE OPENNESS ON ECONOMIC GROWTH BASED ON OLS (EVIDENCE FROM UZBEKISTAN)

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Abstract: This study uses OLS to analyze the impact of FDI and trade openness on Uzbekistan's economic growth. The regression analysis results passed the 5% significance test. FDI and trade openness have a significant positive impact on Uzbekistan's economic growth. For every 1% increase in FDI, the increase in GDP is 0.624 %, while for every 1% increase in trade openness, the increase in GDP is 1.08%. Thus, FDI and trade openness are necessary and effective for Uzbekistan.

Keywords: OLS, FDI, GDP, Uzbekistan, Trade openness

Introduction

FDI occurs when a foreign entity invests in a country's businesses, assets, or infrastructure. This investment can take the form of mergers, acquisitions, joint ventures, or establishing new companies. Trade openness measures a country's level of engagement in international trade, often expressed as the ratio of exports and imports combined to GDP. FDI could lead to higher GDP growth by injecting capital into an economy and countries with high FDI inflows often experience rapid industrialization and urbanization. Also, FDI inflows encourage technology transfer and innovation. Foreign investors bring advanced technologies, improving productivity and knowledge transfer enhances local workforce skills and entrepreneurship. Trade openness may also be a robust driver of economic growth, increasing economic efficiency, enhancing innovation and competitiveness and expanding consumer choice and reducing prices. Therefore, FDI and trade openness are extremely important factors when evaluating the economic growth of a particular country.

Overall trends for Uzbekistan's GDP, FDI and Trade openness.

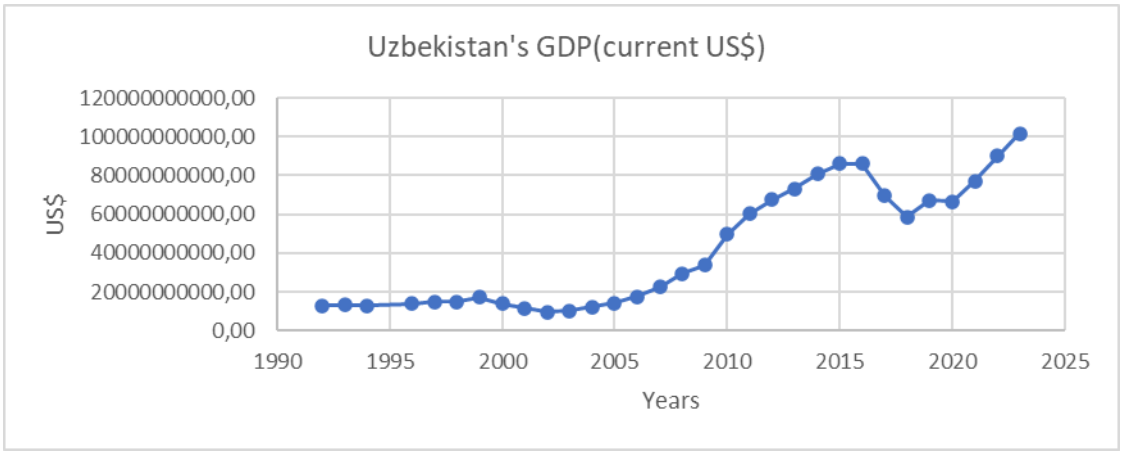


Figure 1 Overall trends for the GDP of Uzbekistan. Data Source: World Bank Open Data https://databank.worldbank.org/

It can be seen from the graph above that the level of GDP in Uzbekistan had been just below $20 billion between 1992 and around 2007. The figures began rising rapidly and reached a high of over $80 billion in 2015. There was an unexpected decline in the amount of GDP over the next 3 years between 2015 and 2018. Since then, the figures have been increasing consistently, reaching over $100 billion in 2022.

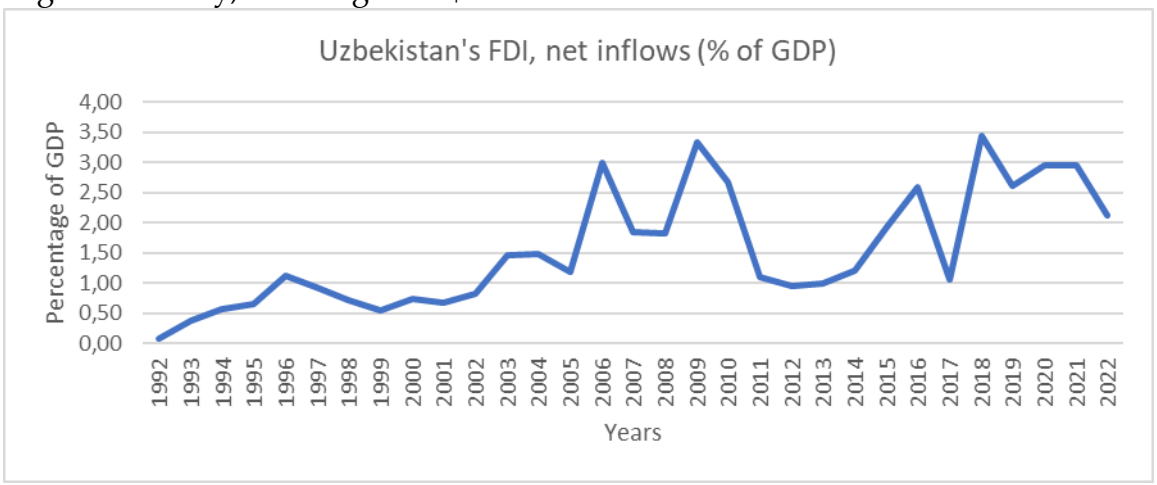


Figure 2 Uzbekistan's FDI, net inflows (% of GDP) Data Source: World Bank Open Data https://databank.worldbank.org/

After gaining independence from the Soviet Union, FDIs started pouring in Uzbekistan. Net inflows of FDI as a percentage of GDP stood at almost zero in 1992, at a meagre 0,07%, and the figures picked up quite rapidly, reaching higher than 1 % in 1996 before starting to drop slowly to 0,5% in 1999. The trends for FDI net inflows as a percentage of GDP were quite turbulent, experiencing ups and downs. It is quite notable that the figures jumped from just of 1% of GDP in 2005 to a peak of 3% in 2006 before falling suddenly to 2% of GDP. The percentage of FDI net inflows rose dramatically again to nearly 3,5% in 2009. However, disappointingly, there was a large reduction in the level of FDI net inflows to 1% of GDP again and the figures remained steady at 1% over the next 3 years prior to going up considerably to 2,5% in 2016 and falling back to 1% in 2017. The percentage of FDI new inflows climbed sharply to 3,5%, which was the highest level of FDI net inflows as a percentage of GDP over the entire period.

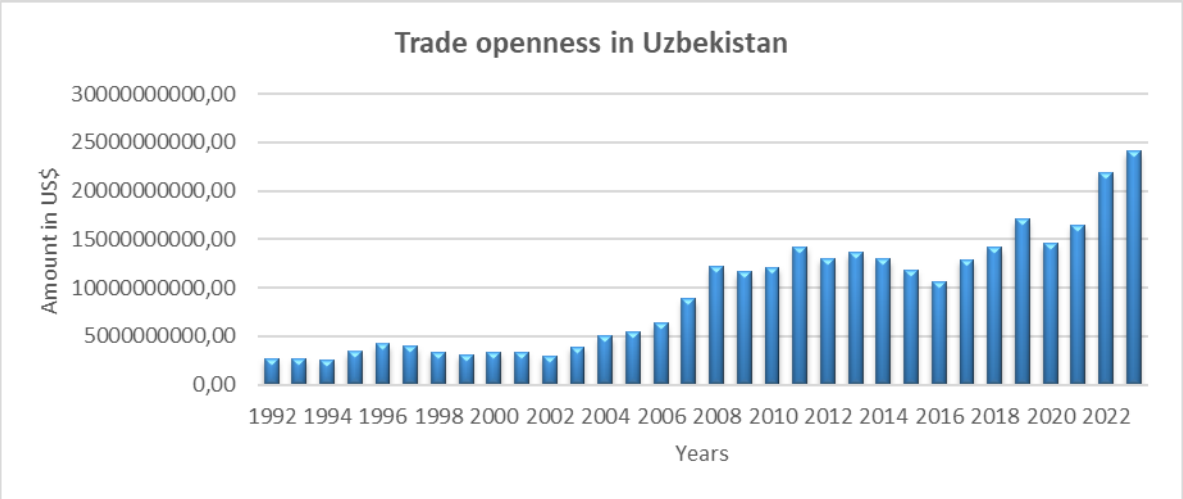


Figure 3 Trade Openness in Uzbekistan. Data Source: World Bank Open Data https://databank.worldbank.org/

Overall, the figure shows that trade openness is on the rise. It can be seen that trade openness, the ratio of exports and imports combined to GDP was below $5billion between 1992 and 2004, and then there was a significant rise in trade openness, reaching almost $15 billion before slowly falling to just over $10 billion in 2016. Since then, the figures experienced a slight fluctuation, but ultimately jumped to nearly $25 billion in 2022.

Figure 1(Uzbekistan's GDP), Figure 2 (Uzbekistan's FDI net inflows as a percentage of GDP) and Figure 3 (Trade openness) all show rising trends over the period given. In the subsequent sections of this study, after doing literature review, I am going to estimate the impact of FDI net inflows (% of GDP) as well as the impact of trade openness on GDP.

Literature review

FDI has a favorable impact on economic growth, according to a number of studies, especially in nations with robust institutional structures and macroeconomic policies. Borensztein et al. (1998) using data from 69 developing countries found that FDI contributes to growth, especially when recipient countries have a minimum threshold of human capital. Alfaro et al. (2004) found that FDI in manufacturing and financial sectors has a more significant impact on growth than in primary sectors. Hansen and Rand (2006) using panel data for 31 developing countries concluded that FDI has a causal relationship with GDP growth. By contrast, some scholars argue that the impact of FDI on growth depends on institutional quality, financial markets, and infrastructure. Durham (2004) found that FDI boosts growth only when supported by strong financial institutions. Carkovic & Levine (2005) argued that FDI has no independent impact on growth unless host countries have policies that encourage productivity spillovers.

Some studies suggest that FDI does not always translate into economic growth due to weak absorptive capacity or market distortions. Aitken & Harrison (1999) found that in Venezuela, FDI negatively impacted domestic firms due to competitive pressures. Moran (2005) suggested that resource-seeking FDI (e.g., oil & mining) often leads to economic dependence rather than sustainable growth. The literature suggests that FDI positively contributes to economic growth, but its impact depends on country-specific conditions

such as institutional quality, human capital, and sectoral composition. While FDI can enhance capital formation, productivity, and technology diffusion, it does not automatically lead to sustainable growth. Policies that improve governance, strengthen financial markets, and encourage domestic innovation are essential to maximizing FDI's benefits.

Regarding Uzbekistan's FDI, most of it is based on theoretical analysis and lacks the integration of empirical analysis. Although many scholars in the world have focused on Uzbekistan's economic development and its FDI attractiveness, they have not been able to give a scientific and reasonable explanation with quantitative thinking. This research combines the theories of economics and applies OLS to test the impact of FDI and trade openness on Uzbekistan's economy. Different from previous researches focusing on FDI in Uzbekistan, this article adds research content on expanding the trade openness. Therefore, this article provides a valuable supplement to the research on the effects of FDI and trade openness in Uzbekistan.

As a developing country in Central Asia, Uzbekistan has practical needs to promote growth and expand the market. Is FDI necessary for Uzbekistan? How much can the FDI effect have on Uzbekistan's economic growth? How much effect can trade openness have on Uzbekistan's economic growth? These are the questions that this research needs to answer. In the OLS model constructed in this study, FDI and trade openness are the independent variables. The GDP is a dependent variable. The model verifies the impact of FDI and trade openness on economic growth and draws the conclusion that FDI and trade openness are necessary for Uzbekistan's economic growth.

Research Methodology

Variable description

The method of this study is to disentangle and capture the impact of trade openness and FDI on GDP through ordinary least squares (OLS). The data obtained from the World Bank Database is used for doing the analysis from 1992 to 2022. The independent variables of the model are FDI net inflows as a percentage of GDP and trade openness (the ratio of total exports and imports combined to GDP). The dependent variable is GDP. To take account of the economic significance of the model, the natural logarithm of the variable data is considered.

Model Specification

The model used is going to verify whether FDI and trade openness have an impact on GDP and also estimate and measure the scale of the impact. According to the theoretical basis, the functional forms of the models related to FDI and GDP as well as trade openness and FDI used in this study are specified as follows:

Model 1: The regression model of the impact of FDI on Uzbekistan's GDP:

$$Ln(GDP)_{ij} = \alpha_1 + \beta_1 Ln(FDI)_{ij} + e_1$$

Model 2: The regression model of the impact of trade openness on Uzbekistan's GDP:

$$Ln(GDP)_{ij} = \alpha_2 + \beta_2 Ln(Trade\ Openness)_i + e_2$$

In the formula, i represents a certain country and j represents a certain year of observation. For the double logarithmic model, the economic significance of the variable coefficients is very clear. α is intercept term. β represents the FDI elasticity coefficients of GDP, export trade, total investment capital, national rate of unemployment. And e is random disturbance term.

Analysis and Results

Model testing

Ordinary least squares (OLS) method of regression was used to evaluate the slope of the coefficients of the autoregressive model. The use of OLS relies on the stochastic process being stationary. In the case where the stochastic process is not stationary, the use of OLS can result in invalid estimates. These estimates are called 'spurious regression' results thus high adjusted R^2 values and high t-ratios yielding results with no economic meaning. Python is used for estimation, and the statistical significance level of 5% is uniformly set in the model. A total of 31 observations are included from 1992 to 2022 and 2 models are estimated to capture the impact of trade openness and FDI on GDP of Uzbekistan.

Estimation of Model 1:

The estimation of model 1 being the FDI on GDP is expressed in the functional form below as:

Model 1:

$$Ln(GDP)_{ij} = \alpha_1 + \beta_1 Ln(FDI)_{ij} + e_1$$

Adopting Python, the estimation result is provided in table 1 below.

Table 1 OLS Estimation of FDI on GDP from 1992 to 2022

Regression Statistics	
Multiple R	0,600518533
R Square	0,360622508
Adjusted R Square	0,338575008
Standard Error	0,683704724
Observations	31

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	7,645935758	7,645935758	16,35661697	0,000354644
Residual	29	13,55611233	0,467452149		
Total	30	21,20204809			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	24,0289143	0,126379661	190,1327636	1,88031E-46	23,77043887	24,28738973
Ln (FDI)	0,623690721	0,154213552	4,044331461	0,000354644	0,308288593	0,939092849

Explanation of the Model:

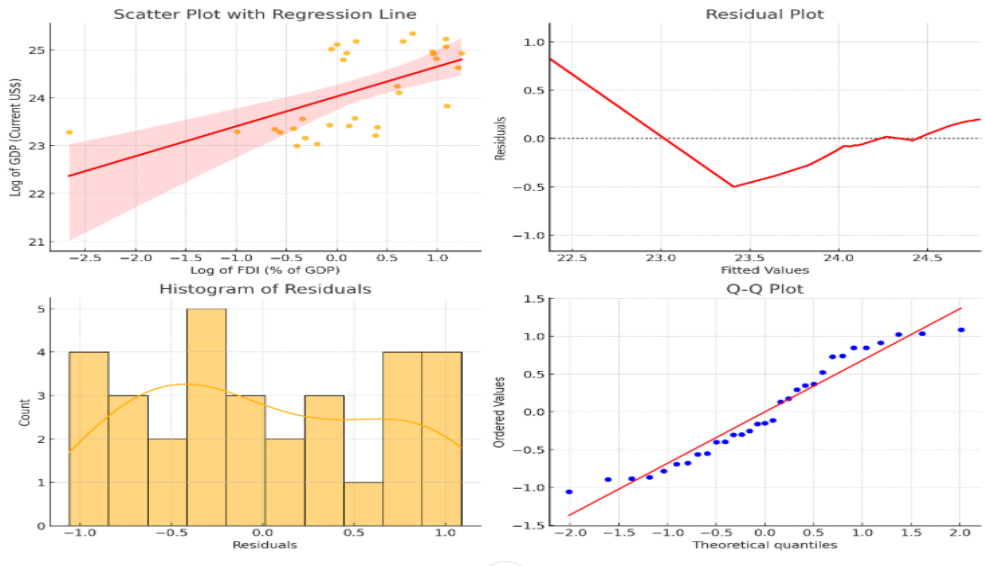
Dependent variable: $Ln(GDP)_{ij}$ → Log of GDP for country i in year j

Independent variable: $Ln(FDI)_{ij}$ → Log of trade openness for country i in year j

Intercept (β_0) → Represents the baseline level of GDP when FDI is at 1 (in log scale)

Coefficient (β_1)→ Measures the elasticity of GDP with respect to FDI (i.e., the % change in GDP for a 1% change in FDI)

Error term (e_1) → Captures unobserved factors that influence GDP



Diagnostic Plot Analysis:

Scatter plot shows a positive relationship between log FDI and log GDP while residual plot displays some pattern that suggests possible heteroskedasticity or autocorrelation. Histogram of residuals are roughly normal but slightly skewed and Q-Q Plot shows that residuals mostly follow a normal distribution but deviate in the tails.

Estimation of Model 2:

The estimation of model 2 being trade openness on GDP is expressed in the functional form below as:

Model 2:

$$Ln(GDP)_{ij} = \alpha_2 + \beta_2 Ln(Trade\ Openness)_{ij} + e_2$$

Adopting Python, the estimation result is provided in table 2 below.

Table 2 OLS Estimation of trade openness on GDP from 1992 to 2022

Regression Statistics	
Multiple R	0,931305
R Square	0,867328
Adjusted R Square	0,862906
Standard Error	0,311047
Observations	32

ANOVA

	df	*SS*	*MS*	*F*	*Significane F*
Regression	1	18,97487	18,9748	196,1223	1,07E-14
Residual	30	2,902507	0,09675		
Total	31	21,87738			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-0,52388	1,760849	0,29752	0,768122	-4,12002	3,07225
Ln(TradeOpen)	1,084607	0,077448	14,0043	0.0000000000107	0,926437	1,24277

Explanation of the Model:

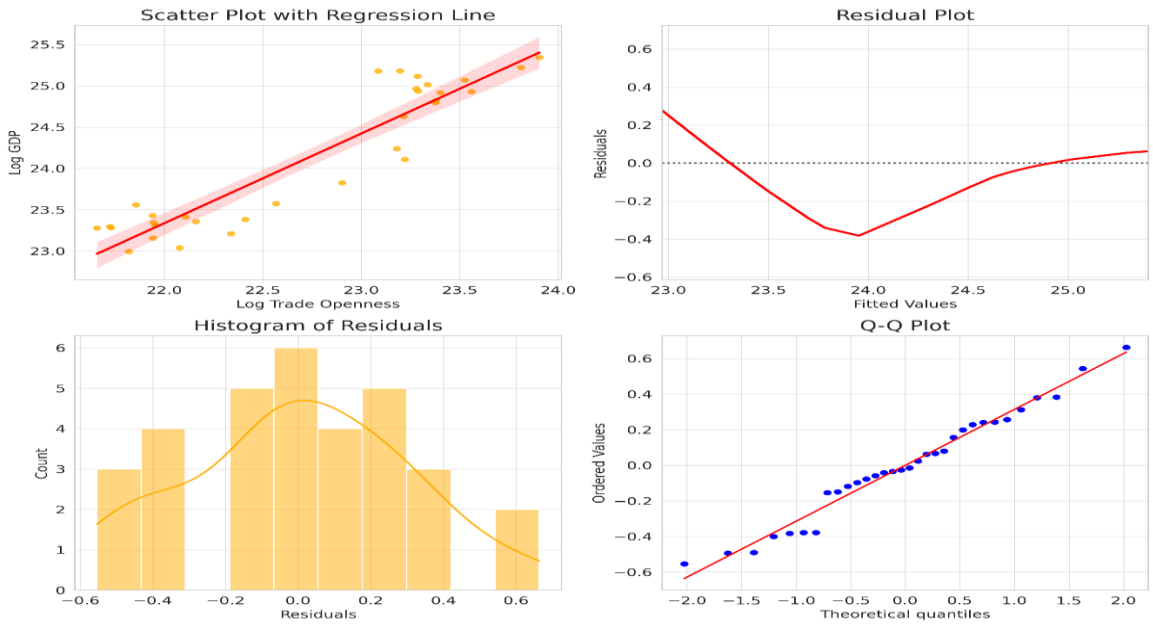
Dependent variable: $Ln(GDP)_{ij}$ → Log of GDP for country i in year j

Independent variable: $Ln(Trade\ Openness)_{ij}$ → Log of trade openness for country i in year j

Intercept (β_0) → Represents the baseline level of GDP when trade openness is at 1 (in log scale)

Coefficient (β_1)→ Measures the elasticity of GDP with respect to trade openness (i.e., the % change in GDP for a 1% change in trade openness)

Error term (ε_1) → Captures unobserved factors that influence GDP



Scatter plot shows a strong positive relationship between LnTradeOpenness and LnGDP. **Residual plot** shows that some pattern suggests possible autocorrelation. **Histogram of residuals shows** roughly normal, though minor skewness is visible while **Q-Q Plot** shows residuals largely follow a normal distribution, with some deviation in the tails.

Result analysis

Through the analysis of the impact of Uzbekistan's FDI and trade openness on economic growth, the following conclusions have been reached: When this study applied OLS for verification, the regression analysis results passed the 5% significance test, which ensured the validity of the results in the economic sense. β_1 is equal to 0.624, meaning 1 % increase in FDI leads to a 0.624% increase in GDP. **Adjusted R Square** is equal to 0.339, meaning about 33.9 % of the variation in log GDP is explained by FDI. P-value is equal to 0.000, meaning the effect of FDI on GDP is highly significant.

When it comes to trade openness, **adjusted R Square is equal to 0.8629**, meaning 86.2% of the variation in LnGDP is explained by LnTradeopenness. β_1 is equal to 1,084607, meaning 1% increase in trade openness is associated with an approximately 1.08% increase in GDP. **P-value for LnTradeopenness is equal to 0.000, meaning t**he relationship is statistically significant

The above results show that trade openness and FDI have a significant role in promoting economic growth and market expansion in Uzbekistan. FDI is necessary and effective for Uzbekistan.

Conclusion and Recommendations

Overall, Trade openness and FDI have positive impacts on a country's economic growth and market expansion. Our conclusion supports their certainty in

Uzbekistan. Based on the premise that FDI and trade openness play crucial roles in raising standards of living and increase GDP per capita in Uzbekistan, it is recommended to:

-strengthen trade facilitation and infrastructure by improving customs procedures, investing transport and logistics and adopting digital trade solutions;

-enhance institutional and regulatory frameworks by promoting transparent trade policies, strengthening intellectual property rights (IPR) and reducing bureaucratic barriers;

-promote export diversification by encouraging value-added exports, supporting small and medium enterprises (SMEs) and developing strategic trade partnerships;

-manage trade liberalization and tariff policies by gradual tariff reduction, using strategic protection measures and negotiating favorable trade agreements;

-strengthen human capital and labor market readiness by enhancing workforce skills, ensuring fair labor standards and encouraging research and development as well as innovation;

-Strengthen regional and multilateral cooperation by engaging in regional trade agreements (RTAs), actively participating in the WTO and improving cross-border cooperation;

-strengthen the investment climate by ensure macroeconomic stability, improving ease of doing business and enhancing property rights and legal frameworks;

-develop infrastructure and logistics by investing in transport and energy infrastructure, expanding digital infrastructure and enhancing special economic zones (SEZs);

-offering strategic incentives for investors by providing tax incentives with performance conditions, facilitating public-private partnerships (PPPs) and supporting sector-specific investments.

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