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Foreign direct investment and domestic investment on the economic growth of the Uzbekistan: A VECM analysis

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Abstract
The present paper deals with the relationship between FDI, GDP, and DI using a vector error-correction model (VECM). The empirical model is based on quarterly data for the period 2010-2019 in Uzbekistan. The Granger causality test indicates a positive significant bidirectional relationship between GDP and GDP Granger causes FDI and a change in the GDP indicate in advance a change in the level of FDI The variance decomposition indicates that fluctuations in FDI are explained by the shocks in GDP (55.0 percent) and Uzbekistan's domestic investment has a greater impact on growth than FDI.

Keywords: foreign direct investment, domestic investment, economic growth, vector error correction model

Introduction
The level of economic development of any country directly depends on the scale and pace of investment activity in that country. Improving the mechanism for attracting foreign direct investment in the world, their access to promising sectors the study of the problems of incentives, and their effective use is one of the current topics of today.
In the context of globalization, the role of investment cooperation between countries in international economic relations is growing. Attracting and effective use of foreign investment plays an important role in ensuring sustainable economic growth in the world. Particular attention is paid to attracting foreign direct investment, especially in developing countries with high economic growth rates.
There are relatively few studies on the real impact of FTI on the economy of Uzbekistan using econometric instruments. Therefore, for Uzbekistan on the path of development, it is important to conduct an in-depth analysis of the impact of FDI on economic development, the introduction of effective mechanisms for the positive use of FDI.
For many years, Uzbekistan has been one of the most inconvenient countries for investors to invest in, but since the 3rd quarter of 2016, the country has been opening up to the outside world and demonstrating its investment potential. To attract new investors, many practical measures are being taken to improve the investment climate in the country.
It is unique in that it has the largest domestic market among Central Asian countries, young and cheap labour force, rich in natural resources, and fast-growing infrastructure. Rapid reforms in the tax and customs systems, the rise of Uzbekistan from 166th to 72nd place in the Doing Business ranking in 2019, as well as currency liberalization reforms since September 2017 are seen as a positive signal for foreign investors to enter the country's market. However, despite this, the volume of foreign direct investment (FDI) attracted to the country remains low.
Despite a large amount of literature on the subject, the role of FDI in economic growth remains highly controversial. These studies include many countries with different levels of development, and temporal analysis more or less long. Despite the alleged benefits of FDI on the host country's economic growth, the empirical literature has not succeeded in establishing a definitive positive impact (Campos and Kinoshita, 2002) [2].
According to Weisskopf's studies (1972a, 1972b), FDI had a positive effect on economic growth while a negative effect on domestic savings.

While Pesmazoglou's (1972) [12] study of 43 countries found a high positive correlation between GDP and gross fixed capital investment, Kim's (1972) study follows that FDI for the Korean economy increases tax and export earnings while providing sustainable economic growth.
According to Rothgeb's (1988) study of African and Latin African countries, a strong positive correlation was observed between FDI and economic growth, with strong coefficients of this correlation in the construction, transport, and telecommunications sectors of selected countries. Smits's (1988) study of underdeveloped countries recognized a strong link between exports, GDP, and FDI.
Borensztein E *et al*. (1998) [1] observed in 69 countries that FDI had a more positive effect on economic growth than domestic investment, while Metwally and Tamaschke (1994) [8] found that economic growth was achieved in 3 North African countries based on high utilization of FDI. Moreover, according to a study by Noorbakhsh *et al*. (2001) [9] on 36 countries with rich natural resources and a favorable investment climate, FDI has had a positive impact on sustainable macroeconomic growth, domestic market development, and foreign trade.
There are a variety of empirical studies that focuses on the influence of FDI on the host country's economic growth. Most of these studies have been able to prove a positive effect on the host country's economic growth due to FDI. This is true even for countries with differences in terms of geographical, political, economic development, etc. It is also shown in this sample that studies are conducted based on different variables and many of them depend on the countries' characteristics.
While Schneider's (2005) study of 47 states on the impact of FDI on economic growth is uncertain, Lessmann's (2013) [6] study on 55 countries FDI stimulates inequality between regions for low and middle-income countries. De Mello'S (1999) [3] study in 16 countries from OECD and 17 non-OECD countries (Africa and America) shows FDI positively affects economic growth within OECD countries, but negatively in other countries.
Trang T and *et al*. examines and provides additional and relevant quantitative evidence on the impact of foreign direct investment (FDI) on economic growth, both in the short run and the long run in developing countries of the lower-middle-income group in 2000–2014. Various econometric methods are employed such as the panel-based unit root test, Johansen co-integration test, Vector Error Correction Model (VECM), and Fully Modified OLS (FMOLS) to ensure the robustness of the findings. The results of this study show that FDI helps stimulate economic growth in the long run, although it has a negative impact in the short run for the countries.
Some other economists like Leff (1969) [5] and Griffin (1970) [4] have analyzed its negative impacts on growth. Mencinger, (2000 & 2008) outlined the structural current account deficit in NMS countries and believed that foreign direct investment can harm the current account balance of NMS.
The present paper contributes to the existing literature by applying a multivariate VAR system with the error correction model (ECM) and time series techniques of co-integration and innovation accounting to explore the possible links between FDI, domestic investment and economic growth in Uzbekistan. Specifically, we use the impulse response function and variance decomposition plus the Grange causality testing procedures to investigate whether:

- Is there causality between economic growth, FDI and domestic investment, and what is its level?
- Which factor is more important for economic growth in Uzbekistan, FDI, or domestic investment?

The organization of the paper is as follows. Section 2 offers an overview of FDI inflows, domestic investment, and economic growth in Uzbekistan. This is followed by the econometric analysis in section 3. The final section of the paper presents the conclusion and some policy implications.

An overview of the FDI inflows, domestic investment, and economic growth in Uzbekistan: 2010-2019

Uzbekistan continues to go unnoticed as a destination for investment, the volume of FDI is significantly lower than in comparable countries. However, FDI inflows to Uzbekistan are mainly concentrated in the oil and gas industry - in recent years 10 years it accounted for more than 40% of the total FDI. Investments in other industries are critical to modernization industrial base and increase its productivity. According to the State Committee of Statistics of the Republic of Uzbekistan, the amount of FDI inflows into Uzbekistan totalled $USD 18,2 billion during the period 2010-2019, with 10903 foreign and joint-venture companies operating in Uzbekistan.
Until recently, Uzbekistan was not on the map of investors due to the closed economy and adverse investment climate. Before 2017, foreign investors faced such kind of barriers to doing business in the country: (i) restrictions on currency conversion and repatriation of profits, (ii) regulatory complexity and opacity and non-compliance with the principles of supremacy law, (iii) low reliability and complexity connect electricity, gas supply, and water supply, (iv) preferential customs conditions for some market participants and complex customs clearance procedures, (v) high tax burden and complexity of the tax regime.
Although the volume of FDI attracted to Uzbekistan is small compared to the existing opportunities, significant growth was observed during the selected period. However, in 2018, the volume of FDI declined by 14.2% compared to 2017. The positive reforms carried out by the government to increase investment attractiveness have begun to yield their first results by 2019. Particularly, in 2019, the volume of FDI rocketed by 3 times compared to 2018. As a result of the establishment of a separate ministry for foreign investment in the structure of public administration and its regional structures in all regions, districts, and cities, the Uzbek ambassadors to foreign countries were tasked to promote the country's investment potential. From 2018, foreign investment flow is also observed in agriculture, services, tourism, construction. Uzbekistan ranks third in Central Asia after Kazakhstan and Turkmenistan in terms of FDI inflows into the economy, and as a result of existing opportunities and effective reforms, it is expected that shortly it will become the hegemon in the region in terms of FDI inflows. Total direct foreign investment expected at up to $ 65 billion over the next 10 years, of which up to $ 20 billion in non-primary industries.

While the share of FDI in GDP was in the range of 3.6-7.18% in 2010-2018, in 2019 FDI reached its highest point concerning GDP (11.5%). Significant growth was also observed in domestic investment during the selected years. The highest growth on this indicator was observed in 2017 (51.3 percent), the lowest growth rate was observed in 2018 (5.8 percent). Data on the share of domestic investment in GDP in the selected period fluctuated in the range of 10.35-13.22 percent, and the minimum value was observed in 2018, the maximum value in 2016.

In 2010-2016, high growth rates of GDP were observed and the data fluctuated in the range of 7.8-8.5 percent. In 2017-2018, the growth rate slowed to 5.3: 5.1 percent, respectively, while in 2019, the country's economy grew by 5.6 percent.

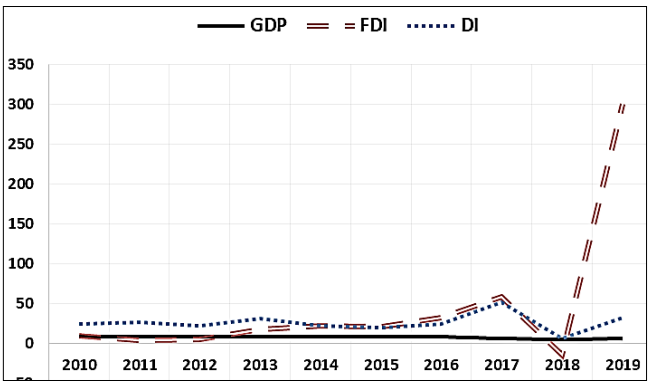

Fig 1: Growth rates of FDI, DI and GDP (%), 2010-2019

Empirical analysis and findings

Data and Unit root test

To test the relationship between FDI, GDP, and DI volume in Uzbekistan, we used quarterly data covering the period 2010-2019. We used all variables in a billion sum, as provided by the State Committee of Statistics. The GDP deflator adjusted the time series to express the real value.

In this paper, we employ the augmented Dickey-Fuller (ADF) test to test the stationarity of the three-time series FDI, DI, and GDP. Indicators of the three series appear to be non-stationary in level form. Therefore, we investigate the stationarity of the first difference of the three series by testing for unit roots. The ADF tests are performed on both the level and first differenced observations by estimating the following three models:

The model does not have a trend and intercept:

$$\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta y_{t-1} + \varepsilon_t \quad (1)$$

The model with intercept only:

$$\Delta y_t = \propto_0 + \gamma y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta y_{t-1} + \varepsilon_t \quad (2)$$

The model with trend and intercept:

$$\Delta y_t = \propto_0 + \propto_2 \gamma y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta y_{t-1} + \varepsilon_t \quad (3)$$

Where:

$\Delta y_t = y_t - y_{t-1}$ is the first difference of the series y*t;*

$\Delta y_{t-1} = y_{t-1} - y_{t-2}$ is the first difference between y_{t-1}, etc.;

α, γ and β_i – are parameters to be estimated;

ε_t – is a stochastic disturbance term.

Table 1: Augmented Dickey-Fuller test fora unit root

Variables	Model 1 No constant & No trend	Model 2 Constant & No trend	Model 3 Constant & Trend
1. ADF test for unit root on the level series			
GDP	-0.228	-1.499	-4.373
FDI	1.347	0.742	-0.466
DI	-0.176	-1.584	-5.250
2. ADF test for unit root on the first differenced series			
GDP	-9.11	-9.05	-8.94
FDI	-10.73	-10.95	-12.123
DI	-14.46	-14.25	-14.44

The results of the ADF test (Table 1) show that the null hypothesis of a unit root is: (i) accepted for the level series of GDP in all three models; (ii) rejected for the level series of FDI in a model (1) and model (2), and (iii) rejected for the level series of DI in a model (3). The results based on the first differenced data indicate that all three series are stationary and integrated of order one, which further suggests the possibility of a co-integration relationship.

Testing for co-integration of variables

Before the application of the Johansen co-integration test, it is important to find the lag length of the VAR through some lag selection criteria to have a parsimonious model. Numbers of lag selection criteria have been used in the literature, e.g., Akaike Information Criterion (AIK), Hannan-Quinn information Criterion (HQ), Sequential modified LR test statistics, Schwarz Information Criterion (SIC), Final Prediction Error (FPE). However, one or more than criteria may be used for lag selection. Schwarz information criterion (SIC), final prediction error (FPE), and Hannan-Quinn information criterion (HQ) confirm lag length one (1).

Now, the co-integration test is performed to investigate any long-run equilibrium relationships among the three variables of FDI, DI, and GDP. After a careful search and trial, a model with 1 lag, constant, and centered seasonal dummy variable was chosen. The result of the Johansen co-integration rank test is summarized in Table 2, which indicates the presence of two co-integrating vectors at 5 percent levels of significance, respectively (i.e., the null

hypotheses of no co-integration are rejected for the rank of zero and less than or equal to (2). This means that there exists a long-run relationship between the three variables. The positive result requires the modelling of the vector error correction model (VECM) and not a VAR model.

Table 2: Co-integration testing unrestricted co-integration rank test (Trace)

Hypothesized No. of CE (s)	Eigen value	Trace statistic	0.05 Critical value	Prob.**
None *	0.590336	50.23952	29.79707	0.0001
At most 1 *	0.315270	16.32762	15.49471	0.0374
At most 2	0.049668	1.935873	3.841465	0.1641

Trace test indicates 2 co-integrating eqn. (s) at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values

Table 3: Unrestricted co-integration rank test (Maximum Eigen value)

Hypothesized No. of CE (s)	Eigen value	Max-Eigen statistic	0.05 Critical value	Prob.**
None *	0.590336	33.91190	21.13162	0.0005
At most 1 *	0.315270	14.39174	14.26460	0.0477
At most 2	0.049668	1.935873	3.841465	0.1641

Max-eigenvalue test indicates 2 co-integrating eqn. (s) at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values

The error correction model

To analyse the causal relationship between the three variables FDI, DI and GDP, we use an error correction model (ECM) of the following VAR system:

$$\Delta FDI_t = \alpha_1 + \alpha_{fdi}\hat{e}_{t-1} + \sum_{i=1}^{k} \alpha_{11}(i)\Delta FDI_{t-i} + \sum_{i=1}^{k} \alpha_{12}(i)\Delta DI_{t-i} + \\ + \sum_{i=1}^{k} \alpha_{13}(i)\Delta GDP_{t-i} + \beta_1 D_t + \varepsilon_{fdit} \quad (1)$$

$$\Delta DI_t = \alpha_2 + \alpha_{di}\hat{e}_{t-1} + \sum_{i=1}^{k} \alpha_{21}(i)\Delta FDI_{t-i} + \sum_{i=1}^{k} \alpha_{22}(i)\Delta DI_{t-i} + \\ + \sum_{i=1}^{k} \alpha_{23}(i)\Delta GDP_{t-i} + \beta_2 D_t + \varepsilon_{fdit} \quad (2)$$

$$\Delta GDP_t = \alpha_3 + \alpha_{gdp}\hat{e}_{t-1} + \sum_{i=1}^{k} \alpha_{31}(i)\Delta FDI_{t-i} + \sum_{i=1}^{k} \alpha_{32}(i)\Delta DI_{t-i} + \\ + \sum_{i=1}^{k} \alpha_{33}(i)\Delta GDP_{t-i} + \beta_3 D_t + \varepsilon_{fdit} \quad (3)$$

Where

FDI_t = FDI inflows in Uzbekistan in year t;

DI_t = Enterprise and population capital in gross capital formation represents a domestic investment in year t, but excludes any forms of foreign investment;

GDP_t = Gross Domestic Product in year t;

$\hat{e}_{t-1}$ = The error correction term;

D_t = The centred seasonal dummy variable;

$\alpha_1, \alpha_{ij}(i)$ and β_i = The parameters;

$\varepsilon_{fdit}, \varepsilon_{dit}$ and ε_{gdpt} = White noise disturbance terms that may be correlated with each other.

Table 4 presents, in the first part, the coefficients obtained through the VECM in the long-run relationship. Both the long-term coefficients of GDP and the exports are significant In the second part of the table, the error correction term (CointEq1) is significant and has a negative sign, which means that the series are co-integrated and go together toward long-term equilibrium. It is the negative response required for balancing the FDI series in the long-term. The negative sign indicates that every quarter, a certain amount of deviation from the long-term balance is compensated. In our case, the error correction term for FDI has a value of -0.33 [-3.51], which shows that the deviation from the long term balance is corrected by 33% every quarter. As the error the correction term is negative and significant, this means that we have causality in at least one direction.

Table 4: The results of the VECM

Vector error correction estimates			
Included observations: 35 after adjustments			
Standard errors in () & t-statistics in []			
Co-integrating Eq	**CointEq1**		
FDI (-1)	1.000000		
GDP (-1)	-0.601991		
	(3.83113)		
	[-0.15713]		
DI (-1)	-8.646280		
	(1.21384)		
	[-7.12308]		
C	1574.886		

Error correction	D (GDP)	D (FDI)	D (DI)
CointEq1	-0.906731	0.213577	-0.097985
	(0.78768)	(0.06394)	(0.04379)
	[-1.15115]	[3.34001]	[-2.23762]
CointEq2	-1.938839	-1.938839	-0.054066
	(0.36173)	(0.36173	(0.03492)
	[-5.35997]	[-5.35997]	[-1.54846]
D(FDI(-1))	-0.981277	0.072162	0.087935
	(2.36685)	(0.19214)	(0.13158)
	[-0.41459]	[0.37556]	[0.66829]
D (GDP (-1))	0.113419	-0.174202	0.140933
	(0.78320)	(0.06358)	(0.04354)
	[0.14482]	[-2.73984]	[3.23681]
D (DI (-1))	4.937039	1.563892	-1.836021
	(8.45129)	(0.68609)	(0.46984)
	[0.58418]	[2.27943]	[-3.90777]
R-squared	0.835694	0.929366	0.937237
Adj. R-squared	0.733981	0.885640	0.898384
Sum sq. resids	4.39E+09	28918299	13561536
S.E. equation	14455.01	1173.483	803.6090
F-statistic	8.216201	21.25429	24.12252
Log likelihood	-375.9813	-288.0940	-274.8424
Akaike AIC	22.28464	17.26251	16.50528
Schwarz SC	22.90678	17.88465	17.12742
Mean dependent	3910.180	709.8686	340.1229
S.D. dependent	28026.09	3470.076	2520.946
Determinant resid covariance (dof adj.)		4.85E+19	
Determinant resid covariance		1.05E+19	
Log likelihood		-915.4261	
Akaike information criterion		54.88149	
Schwarz criterion		56.88123	
Number of coefficients		45	

Granger causality test and variance decomposition

According to the Granger causality test results for the three variables, the effects of GDP and FDI on DI are statistically significant, at the same time, the effect of DI on GDP is statistically significant too and causal links between GDP and DI are bi-directional. The main point that GDP Granger causes FDI and a change in the GDP indicates in advance a change in the level of FDI. The result is similar to the ones in the literature that assigns GDP (or market size) as a determinant of FDI.

Table 5: Granger causality Wald tests

Equation	Excluded	F	Df	df r	Prob > F
FDI	GDP	3.1074	5	19	0.0324
FDI	DI	1.7323	5	19	0.1756
FDI	All	13.618	10	19	0.0000
GDP	FDI	2.4078	5	19	0.0749
GDP	DI	7.0794	5	19	0.0007
GDP	ALL	4.3604	10	19	0.0029
DI	FDI	7.7073	5	19	0.0004
DI	GDP	16.805	5	19	0.0000
DI	All	16.013	10	19	0.0000

The variance decomposition allows the identification of the percentage proportions in the variance of a variable that is driven by the shocks that occur in the other variables. According to Enders (2003), the variance decomposition shows to what degree variable changes under the impact of the own shocks or the other variables' shock. One disadvantage of this method is that the variance of a variable is fully explained only based on the variables introduced in the analysis, without quantifying the potential impact on other omitted variables (Boțel, 2002). Under these circumstances, a careful interpretation of the results is recommended. The results obtained for the variance decomposition are shown in Table 7. All three variables are endogenous.

Within a long run forecasting horizon, the variance decomposition results indicate, in the case of Uzbekistan, the innovations in FDI are mainly explained by GDP (55.0 percent) than its past values (44.2 percent) and only 0.8 percent due to past domestic investment. The innovations in GDP also mainly explained by its past values (45.9 percent), but the total share of FDI and DI is high. These results suggest the strength of the relationship between FDI, domestic investment, and economic growth are different. In the case of Uzbekistan, the influences of FDI on economic growth are less than domestic investment (23.8 percent versus 30.3 percent).

GDP shows stronger influences on Uzbekistan's domestic investment than FDI does (30.4 percent versus 3.2 percent). The relationship between GDP and DI is strong, with a 30.4 percent influence from GDP to DI and 30.3 percent in reverse.

Table 5: Variance decomposition percentage of ten-quarter error variance

Percent of forecast error variance in	Typical shock in		
	FDI	DI	GDP
FDI	76,6	12,8	10,6
DI	37,3	47,7	15,0
GDP	30,8	26,0	43,2

Empirical findings

Using a VAR system with ECM, we find that:

1. FDI plays an important role in complementing domestic investment in Uzbekistan, the larger FDI the greater the domestic investment. Further, FDI has a significant effect on Uzbekistan's economic growth;
2. Uzbekistan's domestic investment and economic growth are positively correlated, great economic growth spurs large domestic investment and vice versa;
3. GDP of Uzbekistan has much impact on FDI inflows in the long run. The causal link between GDP and DI is bi-directional.
4. Uzbekistan's domestic investment has a greater impact on growth than FDI. These lend some support to the theoretical view that FDI has complementary effects on domestic investment, and that long-run economic growth is positively associated with FDI.

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