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The Impact of Investments on Economic Growth: Evidence from Tajikistan

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Abstract

The aim of this paper is to assess the effect of foreign direct investment on economic growth in Tajikistan. Using annual time series data for 2005 to 2021, the study reveals a relationship between foreign direct investment and per capita GDP growth in Tajikistan. Based on the analysis of the Vector Error Correction Model (VECM), it has been found that these variables have a long-term relationship. The residuals of the regressions showed no autocorrelation in the post-estimation diagnostic tests performed to determine the validity of the VECM model. Furthermore, our findings suggest that improving the institutional quality of the country complements the improvement of the investment climate and results in significant increases in foreign direct investment inflows.

Keywords: foreign direct investments; economic growth; Tajikistan.

JEL Classification: F21; F23; O30.

Introduction

Globalization today is characterized by the increased movement of capital across borders. Foreign capital, especially foreign direct investment (FDI) has emerged as one of the key factors in the growth of developing countries over the last half century. It is believed that FDI enhances economic growth and employment, builds resilient infrastructure, promotes industrialization, stimulates job creation, increases output, generates competition among local businesses and enables the achievement of competitive advantages by enhancing technological knowledge.

The United Nations General Assembly adopted a resolution in 2015 calling for global action on Sustainable Development Goals 2030 (SDGs). In order to fulfil the estimated US$ 2.5 trillion funding gap, United Nations Conference for Trade and Development's (UNCTAD) World Investment Report 2014 indicates that a step-change in public and private investment in developing countries is required for the SDGs, which are currently being formulated by the United Nations and a wide range of stakeholders. In spite of this, investment opportunities and challenges for investors have not received much attention as they relate to closing the funding gap and maximizing the economic potential of this country.

FDI is a significant contributor to sustainable economic growth and prosperity of a country, however there are no policies or comprehensive frameworks connecting the 2030 Agenda to actionable investment opportunities for private companies (World Investment Report, 2021).

In 2021, global FDI flows increased by 64% from 2020 to US $1.58 trillion greater than the combined volume of remittances and official development assistance, however recovery was highly uneven across regions. In 2022, the international business environment and cross-border investments changed drastically (UNCTAD, 2021). A triple food, fuel, and finance crisis has been triggered in many countries around the world by the war in Ukraine, on top of the lingering effects of the pandemic. Global FDI could be adversely affected in 2022 by the resulting investor uncertainty.

It is likely that the flare up of COVID-19 in China could further deter greenfield investment in industries that are highly dependent on global value chains, resulting in renewed lockdowns in key areas (UNCTAD's World Investment Report, 2022). There was a further negative shock and disruption to the world economy in response to Russia's invasion of Ukraine and the international response that followed, with immediate impacts on FDI and other capital flows (OECD, 2022). It is also reported that the war in Ukraine is disrupting global trade, investment, and negatively affecting food and fuel consumers worldwide, according to the (World Bank, 2022).

In addition to direct effects on Central Asia countries with close investment ties, indirect effects will mostly occur on those countries, based upon the extent to which they are exposed to the triple crisis resulting from the conflict, as well as their consequent economic and political instability, which are key factors in determining international private investment.

As Tajikistan recovered from the world financial crisis in 2008-2009, the COVID-19 pandemic and later the war between Russia and Ukraine erupted, altering the landscape for FDI inflow from Russia to the country. During the 2015–2021 period, the volume of FDI provided by Russia decreased, mostly due to the commodity price shocks in Russia in 2015 and since 2019 due to an ongoing political conflict between Russia and Ukraine. Although a number of experts argue that the reduction of FDI volume by Russia was not so perceptible since China become the main provider of FDI to Tajikistan (Kessenova, 2009; Ionova, 2020).

Whereas a large number of studies have examined the effects of FDI among developing countries, there is limited literature discussing FDI's effects on Tajikistan. Tajikistan has been selected as the best-case study because China is by far Tajikistan's main source of FDI. In 2021, businesses from China invested more than US$ 211 million in Tajikistan, an amount that accounted for nearly 64% of Tajikistan's total FDI (Dezan Shira and Associate, 2011, Agency on Statistics under the President of the Republic of Tajikistan, 2021).

The Tajikistan case is the best example of FDI effect interpretation, because it is a former Soviet republic with the potential to benefit from both Chinese and Russian investment. The purpose of this paper is to analyse the major characteristics of the FDI flows recently received in Tajikistan in order not only to draw conclusions about Tajik FDI, but also to suggest policy recommendations on the effectiveness of FDI for EU, US and OECD countries.

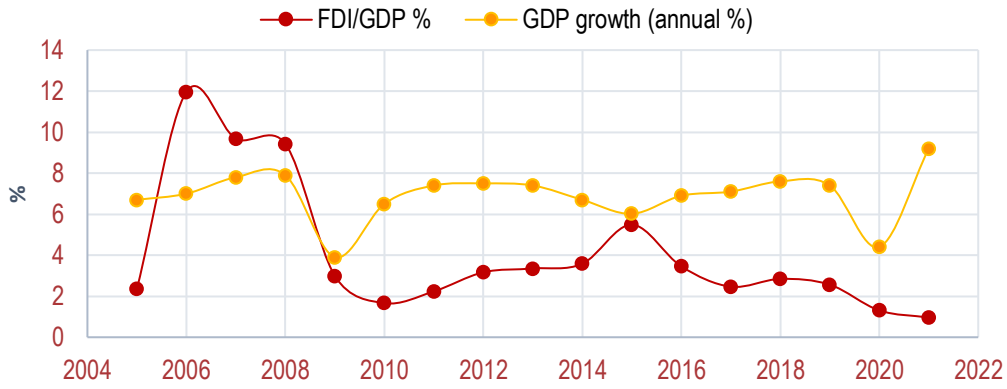
The main objective of this research is to analyse FDI effects on growth using a time series methodology (employing annual data from 2005 to 2021 for the Tajik economy).

The remainder of the paper proceeds as follows: Section 1 gives a brief account of the economic conditions in and specifically FDI flows to Tajikistan. Section 2 provides a brief literature review of the relationship between FDI and economic growth. Section 3 presents the specification of the applied model. Section 4 discusses econometric estimation and presents empirical results regarding the effect of FDI on per capita GDP levels. In the final section of the paper, some policy implications are discussed.

1. Patterns of Foreign Direct Investment Inflows into the Tajik Economy

In 2021, Tajikistan's FDI to China increased by 175% to US$ 211 million, representing 40% of all FDI. Iranian FDI was the second largest source of Tajikistan's FDI that amounted US$ 32.6 million, followed by Turkish FDI of $25 million and Swiss FDI of US$ 21.5 million in 2021 (OECD, 2022; US Department, 2022). Annual FDI inflow in Tajikistan during 2000-2021 averaged 4.3% of GDP (Figure 1).

Figure 1. FDI inflow as a % of GDP and GDP growth annual of Tajikistan

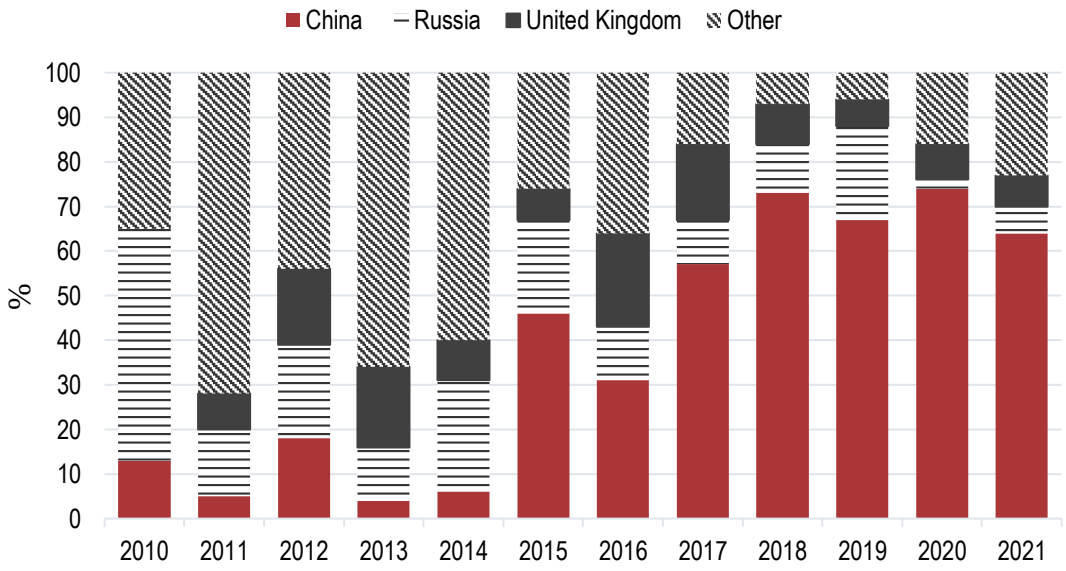


Source: UNCTAD (2022), OECD (2022).

As of 2020 an accumulated FDI stick of 38.65% of GDP in Tajikistan (UNCTAD, 2020). In dollar terms, Tajikistan's inward FDI stick stood at $3.1 billion before pandemic and in recent two decades the country attracted $ 14.51 billion both FDI and other foreign investment from 2000 to 2021 (Agency on Statistics under the President of Tajikistan, 2020; UNCTAD, 2022). However, FDI trend in Tajikistan dropped after 2008 due to global recession, financial crisis and after 2018 due to the political instability in Russia.

Tajikistan calls for greater People's Republic of China, United Kingdom, Turkey, Russia, and Iran. Figure 2 shows that People's Republic of China has become an important provider of FDI to Tajikistan, starting in 2015. In Tajikistan, investments have been predominantly from public funds. Only 25% of investments in 2020 came from private sources, therefore the government focused on the priority sectors, particularly aluminium, and energy (Santander Trade 2021, OECD, 2022).

Figure 2. Incoming FDI to Tajikistan by country, in absolute USD



Source: UNCTAD (2022), OECD (2022).

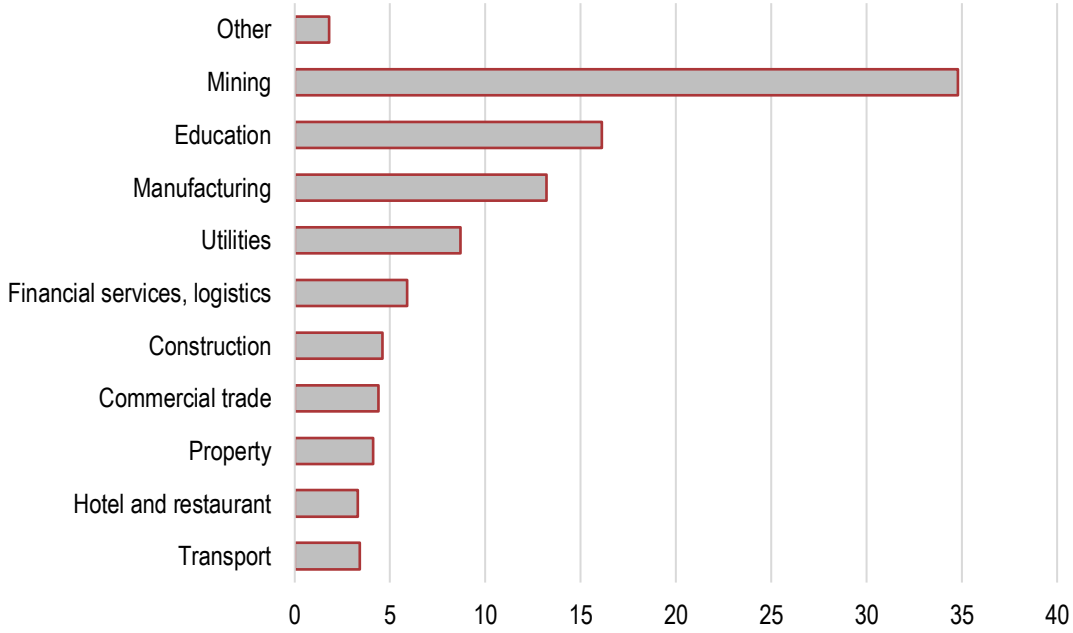
In 2018, the mining sector received 61% of total FDI (World Bank, 2020). In view of the fact that FDI continues to concentrate in the extractive sector, the volume of FDI inflows is correlated more closely with global demand and pricing for extractive goods than with the investment climate as a whole (EBRD, 2020).

Tajikistan's largest gold mining operation is also located in Sughd Province, where silver deposits are the most abundant (Silk Road Briefing, 2022). Most investments from China into mining gold and semi-conductor applicable minerals. It is estimated that Tajikistan has more than 400 mineral deposits of more than 70 different minerals, including strontium, tungsten, molybdenum, bismuth, salt, lead, zinc, fluorspar, and mercury, among others (Agency on Statistics under the President of Tajikistan, 2022).

Approximately US$136 million of the 2022 investment was attributed to the opening of a new gold processing plant built by China's Talco Gold. Talco Gold is a joint venture between the Talco Aluminum Company, a local Tajik company, and China's Tibet Huayu Mining. Approximately 1,500 workers will be employed by the mine, which is expected to produce as much as 2.2 tons of gold and 21,000 tons of antimony annually. An important component of semiconductor manufacturing is antimony, a metallic crystalline substance (TajInvest, 2019).

Figure 3 indicates that the mining, human capital accumulation, and manufacturing sectors attracted a significant amount of FDI in the country in 2021. It is worthy to note that more capitals should be invested in order to increase the human capital and to reduce the productivity costs.

Figure 3. The volume of FDI to Tajikistan, in %



Source: UNCTAD (2022), OECD (2022).

Given fewer alternative domestic private or public sources of capital and the need to cover pandemic, Tajikistan needs more diversified FDI (Embassy of Switzerland in Tajikistan 2020). According to (OECD 2022), Tajikistan is well positioned to diversify its FDI flow, with a particular emphasis on attracting FDI to manufacturing and other non-recourse tradable sectors.

It is anticipated that this would not only reduce the vulnerability of the economy to fluctuations in commodity prices but would also result in more productive jobs in the formal sector. Recursive attraction generates relatively little employment because it is capital rather than labour intensive. Furthermore, the introduction of a greater amount of diversified FDI will create indirect employment opportunities and promote entrepreneurship and the growth of small and medium-sized businesses through supplier relationships. By integrating into international production chains of multinational enterprises and transferring skills and technologies, these investments open up new markets for domestic companies.

2. Background Research

Research on the relationship between FDI and economic growth in developing countries has failed to provide conclusive evidence.

From a theoretical viewpoint, FDI can be divided into three categories: Horizontal, Vertical and Conglomerate (Herger and McCorriston, 2016). The horizontal FDI is a type of investment that occurs when a firm operates abroad in the same industry that the firm operates abroad, and it produces exclusively for local or original markets without exporting much product to the host country. In contrast, vertical FDI involves companies investing in businesses that are geographically dispersed and involving a chain of suppliers or distributors as part of their business (Alfaro and Charlton, 2009; Haile and Assefa, 2006, Botric and Skuflic, 2006). The bulk of FDI flowing into advanced countries is driven by market seeking strategies as a result of horizontal investments.

The growth of an economy can be enhanced by the increase in FDI volume or its efficiency under neoclassical growth models (Sala-I-Martin 1996, Solow 1956). As outlined in the endogenous growth framework, sustained economic growth results from technological transfer, diffusion and spillover effects (Barro and Sala-I-Martin 1995, Romer 1986).

Researchers gained access to firm-level data on the operations of multinationals in the late 1990s, which led to a significant increase in the empirical analysis of FDI (Helpman, 2006; Branstetter *et al*., 2004; Yeaple, 2003). FDI has been found to affect Chinese growth via the diffusion of ideas, according to the research carried out by Dees (1998). Chinese long-run growth is significantly enhanced by FDI, which introduces new ideas, allows multinational firms to develop technical progress and contributes to long-term economic growth.

In a pioneering paper, Ericsson and Manuchehr (2001) using panel data in case of Denmark, Sweden and Norway over the period 1970-1997 found a positive relationship between FDI and economic growth. In the same period Nair-Reichert and Weinhold (2001) used panel data for 24 developing countries over the period 1971-1995 and the result of mixed fixed and random coefficient approach revealed that there a statistically significant positive effect of FDI on economic growth. Moreover, they state that the relationship between FDI and growth is heterogenous across countries.

Choe (2003) conducted a study of 80 developed and developing countries from 1969 to 2000. The results of Granger causality test of Holtz-Eakin show that there was a positive and statistically significant relationship of FDI on economic growth. Based on their findings in 66 developing countries, (Makki and Somwaru 2004) indicate a strong and positive interaction between FDI and trade for advancing economic growth. Over the period 1960-2002, Dritsaki et al. (2004) examined the relationship between trade, FDI and economic growth in Greece. According to their cointegration analysis, there appears to be a long-term equilibrium between the variables.

Hsiao and Hsiao (2006) set up a panel vector autoregressive model in the case of China, Korea, Taiwan, Hong Kong, Singapore, Malaysia, Philippines, and Thailand. The results of the study indicate that FDI has unidirectional effects on GDP, both directly and indirectly through exports, and that exports play a significant role in GDP through bidirectional causality.

In case of India similar result were found by Chakraborty and Nunnenkamp (2006) using Granger causality tests cointegration over the period 1987-2000. The conclusions are that a bidirectional causality in manufacturing sector. Although, similar conclusions were reached by Al-Iriani (2007) conducted a study of Bahrain, Kuwait, Oman, Saudi Arabia, and United Arab Emirates using Granger causality test of Holtz-Eakin. He argues that there is bidirectional causality between FDI and economic growth. Similarly, it has been demonstrated by Shah *et al*. (2015) that long-run bidirectional causality exists between institutional quality and aggregate FDI for Pakistan using the ARDL technique. Moreover, they argue that institutional quality and FDI in manufacturing are bidirectional causally

related in the short run, whereas FDI in primary and service industries is not significantly associated in the short run.

Iqbal et al. (2010) analysed time series data from 1998 to 2009 in order to analyse the relationship between FDI and economic growth in Pakistan. According to the results, there is a significant relationship between economic growth and FDI and trade growth in Pakistan. In light of the results of their VAR model, integration and cointegration analyses indicate that the factors are related over the long term.

By developing human capital, transferring technology, creating jobs, increasing competitiveness, and improving exports, FDI benefits the economies of receiving countries (Makieła and Ouattara, 2018, Alfaro *et al.*, 2010, Kobrin, 2005; OECD, 2002).

The GMM model results from Solomon (2011), who examined panel data for 111 countries from 1981 to 2005, indicate that the level of economic development, human capital, and political environment all have a significant impact on the relationship between inward FDI and growth. FDI and international trade have both been cited as contributing factors to economic growth in 23 Asian countries during the period 1986-2008 by Tiwari and Mutascu (2011).

Koojaroenprasit (2012) examined the impact of FDI on economic growth in Korea over the 1980–2009 period. As a result, the author observed a significant positive effect of FDI on Korea's economic growth, as well as an increase in human capital, exports, and employment. Later, Ndiaye and Xu (2016) developed a theoretical model of investment that included an FDI variable and tested it with panel data from 1990 to 2012. The estimation results show that FDI has a positive impact on economic growth. They argue that FDI is going to facilitate the trade, economic cooperation, improve the business environment and increase the labour cost in most African countries.

A dynamic panel threshold model used by Osei and Kim (2020) to analyse 62 middle- and high-income countries spanning 1987-2016 found that FDI promotes economic growth in general. They assert that FDI has a negligible growth effect when the ratio of private sector credit to gross domestic product exceeds 95.6%.

Quite recently within a new growth framework, Ayenew (2022) examined 22 nations in Sub-Saharan Africa from 1988 to 2019 through PMG/ARDL model. His results assert that FDI boosts long-term economic growth and concluded that in the long run, the increase in FDI by 1% results in increasing economic growth of sub-Saharan African countries by 0.138%.

A number of authors argue on the ambiguous effect of FDI on economic growth and claim that institutional quality is likely to affect the absorptive capacity of the host economy (Minović et al. 2020, Hayat 2019, Alguacil et al. 2011, Meyer and Sinani, 2009, Prüfer and Tondl 2008, Bevan et al. 2004).

Yussof and Ismail (2002) identified a large number of factors affecting FDI inflow in the ASEAN region. It was argued by the authors that since the high growth industries of the future will all be technologically based, Malaysia, Thailand, Philippines and Indonesia must invest in higher education and professional training to develop their human resource capability in order to achieve international competitiveness. Among the 69 developing countries studied by Borensztein et al. (1998), human capital development was found to play a critical role in the positive effects of foreign direct investments.

Lensink and Morrissey (2006) suggest that institutional quality has a negative and significant relationship with FDI volatility, suggesting that FDI volatility may have an adverse impact on economic growth. It is noted by Gani (2007) that FDI is positively correlated with rule of law, corruption control, regulatory quality, government effectiveness, and political stability in a sample of countries drawn from Asia, Latin America, and the Caribbean.

Won et al. (2008) analysed the case generation Asian newly industrializing economies (China, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand) by using panel-vector autoregressive models from 1981 to

2005. Their results conclude that the inward FDI, openness of the economy is, among others, the most important economic factor attributed to the rapid growth of these economies.

Based on panel data for 164 countries from 1996 to 2006, Buchanan et al. (2012) found that good institutional quality is a significant determinant of foreign direct investment. More specifically, they argue that a one standard deviation change in institutional quality improves FDI by a factor of 1.69.

Recently, Baiashvili and Gattini, (2019) analysed 111 countries using GMM model spanning between 1980 and 2014 and found that FDI benefits do not accrue mechanically and evenly across countries. They argue that an inverted U-shaped relationship between countries' income levels and the size of FDI impact on growth. Furthermore, they argue that institutional factors have a mediating positive effect on FDI within country income groups, whereby countries with better-developed institutions relative to their income group peers show a positive impact of FDI on growth. According to Hayat, (2019) institutional quality is considered to be an important factor in boosting economic growth of a country. With a dataset of 104 countries, he applied the GMM estimation method to a dynamic panel data set and discovered that the FDI led growth occurred only in countries with low and middle incomes. A better level of institutional quality was also found to contribute to the economic growth resulting from FDI in these countries.

Quite recently, Minović et al. (2020) conducted a study of Western Balkans countries in the period 2002-2017 using unit root tests and causality, indicating that corruption control, political stability, and the rule of law contribute to an increase in FDI in the Western Balkans. It was found that there was a relationship between political stability and the rule of law, a relationship between corruption control and the rule of law, and a relationship between corruption control and foreign direct investment. While a study of Qureshi et al. (2021) claims that economic growth is positively associated with corruption in developing countries while it is negatively associated with corruption in developed countries.

Although FDI has been shown to have a positive and significant effect in the recipient countries, a number of authors have argued that FDI does not provide the receiving countries with a stable platform on which to grow sustainably (Beugelsdijk, 2008; Khaliq and Noy, 2007; Akinlo, 2004), dependency on FDI (Vo, 2021; Srivastava and Talwar, 2020; Kentor and Boswell, 2003), technological gap (Razzaq et al., 2021; Hong et al., 2019; Liu, 2005), efficiency on government expenditure (Bulus and Koc, 2021; Zhang et al., 2019; Huang, 2011), and provoking corruption (Lestari et al., 2022; Tang et al. 2019; Karim and Karim, 2018).

A study conducted by Markusen and Venables (1999) asserted that FDI might negatively impact the host economy through a reduced balance of payments, a lack of positive links with local enterprises, a negative impact on the environment, and the displacement of domestic investments. Later, Lyroudi et al. (2004) examined the case of 17 transition countries over the period 1995-1998 and conclude that FDI and economic growth have no meaningful association.

In order to address the question of whether FDI impacts economic growth, Huong (2021) employs a VAR model based on unit root tests, Granger causality, impulse responses, and variance decompositions. In his conclusion, FDI has a positive impact on short-term economic growth, but negative impacts on long-term growth.

It has been quite recently shown that FDI has been associated with entrepreneurship at the individual owner level in the United States between 1996 and 2008, as investigated by Erena et al. (2019). They assert that FDI's effect on the average monthly creation and destruction of businesses is found to be decreasing in non-Right-to-Work states as FDI increases. According to their findings, a 10% increase in FDI decreases the average monthly rate of new businesses being created and destroyed by approximately 4% and 2% (relatively to the sample mean), respectively.

As can be seen from the above-cited review of empirical studies, it is quite clear that the majority of studies have found that FDI has positive effects on the economic growth of the host country. A few case studies illustrate that FDI does not always promote economic growth. Since better government institutions are associated with economic growth among FDI recipient countries, it has been deemed to be an important determinant in the development process.

3. Sample Data and Research Methodology

A database of annual data for Tajikistan was obtained from the online databases of UNCTAD and the World Bank, which covers the years 2005 to 2021. An empirical examination of the relationship between FDI inflows and economy growth in Tajikistan will be the focus of the study, which will be based on the gross domestic product to demonstrate a quantitative relationship. This study examines whether FDI has a positive or negative effect on economic growth. Various econometric methods will be employed in the econometric analysis, including the Vector Autoregression Model and the Vector Error Correction Model.

A number of popular techniques have been used to test for the unit roots of time series variables: the Augmented Dickey-Fuller test (Dickey and Fuller, 1979), Kwiatkowski–Phillips–Schmidt–Shin (Kwiatkowski et al., 1992) test, the Variance Decomposition and the Impulse of Response Function, and the CUSUM and CUSUMQ stability tests (Luger, 2001). To avoid the problem of spurious regression, it is recommended not to use non-stationary time-series variables in regression models (Hill and Griffiths, 2007).

Augmented Dickey–Fuller (ADF) test has been employed at first with and without a time trend in order to determine whether or not these two time series variables are non-stationary.

$$\Delta_{\gamma_t} = \theta + (\beta - 1)\, Z_{t-1} + \varphi\, P + e_{1t} \tag{1}$$

where: Δ_{γ_t} shows change in GDP per capita or change in FDI in time t, θ is constant; Z_{t-1} represent GDP per capita or FDI are lagged one period;

while: φ parameter with trend t; e denote error term in time t.

ADF test is derived from each other, and the lagged values of the dependent variables are added to Equation (2) as follows:

$$\Delta_{\gamma_t} = \theta + (\beta - 1)\, Z_{t-1} + \varphi\, P + \delta \Delta Z_{t-1} + e_{1t} \tag{2}$$

Data processing is used to estimate the coefficients. In order to determine whether roots exist per unit for each variable, the null hypothesis and alternative hypothesis are given below:

$$H_0: \alpha = 0 \qquad \text{vs.} \qquad H_1: \alpha < 0 \tag{3}$$

where: if do not reject the $H_0: \alpha = 0$ we conclude that the series is non-stationary; If we reject $H_1: \alpha < 0$ we conclude that the series is stationary (Hill and Griffiths 2007, Rehman 2016).

Depending on the null hypothesis of non-stationarity, the t-statistic may require critical values as determined by MacKinnon (1991). Engle and Granger (1987) demonstrate that there is a corresponding short-term relationship if two variables are co-integrated. In this case, (Hendry's 1995) general to specific approach has been applied, with the following form of the model:

$$\Delta GDPpc_t = \alpha_1 + \sum_{i=0}^{p} \beta_{1t}\, \Delta GDP_{t-1} + \sum_{i=0}^{v} \beta_{2t}\, \Delta FDI_{t-1} + \sum_{i=0}^{w} \beta_{3t}\, \Delta\, School_{t-1} + \sum_{i=0}^{s} \beta_{4t}\, \Delta\, OPEN_{t-1} + \sum_{i=0}^{z} \beta_{2t}\, \Delta Corr_{t-1} + \omega_1\, \varepsilon_{t-1} + \varepsilon_t \tag{4}$$

$$\Delta FDI_t = \alpha_2 + \sum_{i=0}^{p} \beta_{1t}\, \Delta GDP_{t-1} + \sum_{i=0}^{v} \beta_{2t}\, \Delta FDI_{t-1} + \sum_{i=0}^{w} \beta_{3t}\, \Delta\, School_{t-1} + \sum_{i=0}^{s} \beta_{4t}\, \Delta\, OPEN_{t-1} + \sum_{i=0}^{z} \beta_{2t}\, \Delta Corr_{t-1} + \omega_1\, \varepsilon_{t-1} + \varepsilon_t \quad (5)$$

$$\Delta School_t = \alpha_3 + \sum_{i=0}^{p} \beta_{1t}\, \Delta GDP_{t-1} + \sum_{i=0}^{v} \beta_{2t}\, \Delta FDI_{t-1} + \sum_{i=0}^{w} \beta_{3t}\, \Delta\, School_{t-1} + \sum_{i=0}^{s} \beta_{4t}\, \Delta\, OPEN_{t-1} + \sum_{i=0}^{z} \beta_{2t}\, \Delta Corr_{t-1} + \omega_1\, \varepsilon_{t-1} + \varepsilon_t \quad (6)$$

$$\Delta OPEN_t = \alpha_4 + \sum_{i=0}^{p} \beta_{1t}\, \Delta GDP_{t-1} + \sum_{i=0}^{v} \beta_{2t}\, \Delta FDI_{t-1} + \sum_{i=0}^{w} \beta_{3t}\, \Delta\, School_{t-1} + \sum_{i=0}^{s} \beta_{4t}\, \Delta\, OPEN_{t-1} + \sum_{i=0}^{z} \beta_{2t}\, \Delta Corr_{t-1} + \omega_1\, \varepsilon_{t-1} + \varepsilon_t \quad (7)$$

where: p, v, w, and *s* are the number of lag lengths determined by several selection criteria with Δ being the first difference operator; $\omega_1, \omega_2, \omega_3, \omega_4$ and ω_5 are being error correction terms; ε being random disturbance terms.

4. Results and Discussion

To gain a better understanding of the normality and symmetry of the distributions of the variable estimators in the model, Table 1 presents the results of the descriptive statistics. We also present the summary statistics and correlation coefficient of the key variables.

Table 1. Summary statistics of important variables

Variable	Mean	Median	S.D.	Min	Max
l_GDPpc	6.64	6.74	0.321	5.83	7.01
l_FDI/GDP	1.17	1.10	0.683	-0.039	2.48
l_Schooling	4.49	4.48	0.065	4.39	4.58
l_Openness	4.32	4.27	0.363	3.98	4.98

Table 2. Correlation matrix

Variable	l_GDPpc	l_FDI/GDP	l_Schooling	l_Openness
l_GDPpc	1.0000			
l_FDI/GDP	0.2170	1.0000		
l_Schooling	0.0377	0.2343	1.0000	
l_Openness	0.0908	-0.2331	-0.9142	1.0000

Following that, ADF unit root tests and KPSS tests are conducted for the variables using different specifications and lag lengths. ADF is tested without constant on a minimum AIC basis with lag one for all variables with constants and trends. We also select lag one for all variables include a trend of KPSS based. Results are summarised in Table 3. The results show that all variables were confirmed to be stationary at 5% and 10%, respectively. The Ln_GDPpc, Ln_FDI/GDP and Ln_Openess at 10%, and Ln_Schooling is stationary at 5% with constant and trend and test without constant.

Table 3. Summary of Augmented Dickey-Fuller and KPSS unit root tests

Variables	Augmented Dickey-Fuller		KPSS
	with constant and trend	test without constant	include a trend
Ln_GDPpc	−0.47334	0.001280	0.000404
Ln_FDI/GDP	−0.134074	−0.020646	−0.016263***
Ln_Openness	−0.0533557	−0.002401	−0.012908***
Ln_Schooling	−0.0067914	−0.348013***	0.0025780**
Variables' first difference			
ΔLn_GDPpc	0.502036***	0.507652**	0.000252
ΔLn_FDI/GDP	0.903052***	0.906460***	−0.001316
ΔLn_Openness	−0.386142***	0.491589**	0.0001991
ΔLn_Schooling	−0.357496**	−0.746764***	−0.103508

Note: the lag of ADF test is determined by the AIC and BIC values. Lag order is shown in parenthesis based on AIC and BIC at ADF level. *, ** and *** indicate significant at 1%, 5% and 10%, respectively.

Source: Computed by Author

For DF-GLS critical values after the first difference are as follows: -2.74 (10%), -3.03 (5%), -3.29 (2.5%), -3.58 (1%). Cointegration tests such as Johnsen's are used to determine whether there is an equilibrium association between two variables over a long period of time. To determine the number of cointegrating equations, Eigenvalues and Trace Statistics can be employed. At the 5% level of significance, the Johansen Cointegration test proposes the null hypothesis that no cointegrating equations exist. Therefore, based on the Johansen test, using the Trace criterion, the variables studied are provided at cointegrated models.

Table 4. Johansen's cointegration test

Unrestricted cointegration rank test (Maximum eigenvalue) Log-likelihood = 123.391 (including constant term: 77.9846)					
Rank	Eigen value	Trace test	p-value	Lmax test	p-value
1	0.88494	62.292	0.0010	34.597	0.0036
2	0.67625	27.695	0.0874	18.044	0.1316
3	0.43383	9.6508	0.3143	9.1018	0.2842
4	0.033729	0.54898	0.4587	0.54898	0.4587

Based on the Trace statistic results, a VECM will be estimated for FDI's impact on economic growth in Tajikistan. A major objective of the study is to determine whether the dependent variable is associated with the independent variables in the long run or in the short run. In order to determine the long-term economic relationship between variables, the VECM model can be applied. The results of the VECM model are given in the Table 5.

The result indicates that the coefficient of GDPpc is positive (0.0477382 > 0) and statistically significant at 10%. Furthermore, FDI coefficient is positive (0.242491 > 0) and satirically significant at 5%.

The coefficient of schooling is also suggested to be found positive and statistically significant at 1%. By increasing human capital, more FDI will be attracted to the economy, and unemployment may be reduced. Consequently, the production level and the level of national income of the country would increase. The coefficient of trade openness is found to be negative, however statistically is not significant.

Table 5. Vector error correction model results

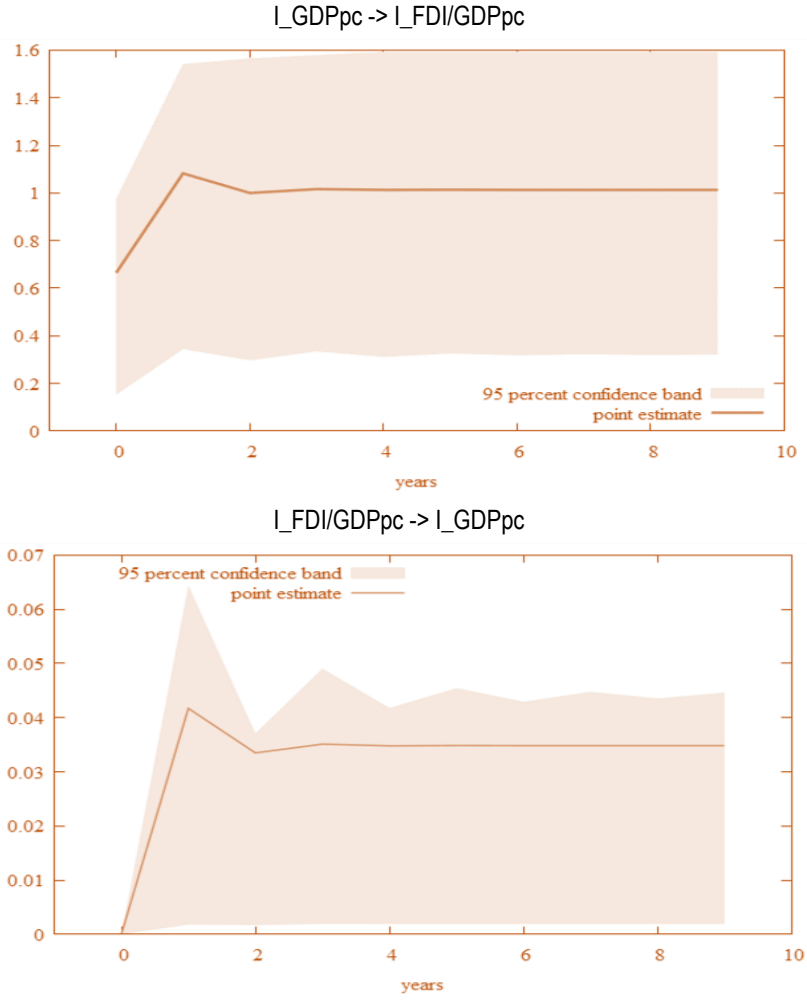
Maximum likelihood estimates, observations (T=16) Determinant of covariance matrix = 2.3213143 Log-likelihood = 100.79602		AIC = -8.8495 BIC = -7.4009 HQC = -8.7753		
	Coefficient	Std. Error	t-ratio	p-value
D_L_GDPpc	0.0477382	0.0111477	4.282	0.0008***
D_L_FDI/GDP	0.242491	0.105803	2.292	0.0379**
D_L_Openness	−0.00816965	0.0166439	−0.4908	0.6311
D_L_Schooling	0.00044122	0.00098198	0.4493	0.6601*
R-squared Adjusted R-squared Durbin-Watson		0.567080 0.536157 2.339546		

Note: P-value of t-statistics are in parentheses *Significant at 1% level; **Significant at 2% level; ***Significant at 5% level

Stability Test Result

Figure 4 shows the reaction in one variable due to shocks in another variable. Results indicate that economic growth experiment a positive response because of shocks in FDI or the determination of parameter stability and monitoring the changes in detection, CUSUM and CUSUMQ were applied.

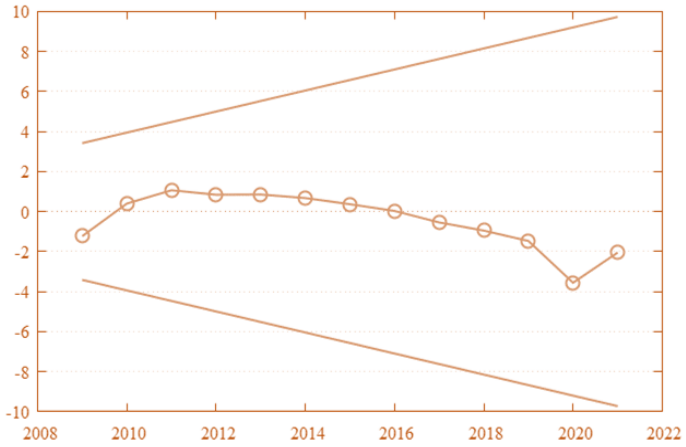
Figure 4. Impulse of response function



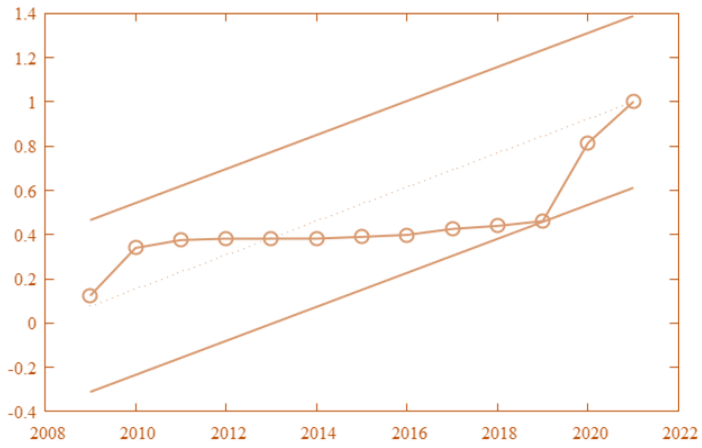
During the diagnostic test, we examine heteroscedasticity and serial correlation, as well as the validity of our estimations (Brown *et al*. 1975). At a 5% level of significance, the CUSUM and CUSUMQ are plotted see Figure 5 which indicates that the CUSUM and CUSUMQ statistics are well within the critical bounds of the 5% confidence interval.

Figure 5. Plot of CUSUM and CUSUMQ (Stability test for economic growth)

CUSUM plot with 95% confidence band



CUSUMQ plot with 95% confidence band



Note: Harvey-Collier t(12) = -0.568325 with p-value 0.5803

Conclusion

The paper concludes that Tajikistan's development has been significantly influenced by foreign direct investment. In line with our expectations, this study confirms our expectation and reveals that FDI is positively correlated with economic growth in Tajikistan. Due to rigid and ineffective policies, FDI can, however, result in unintended negative effects on economic growth. There is a negative but diminishing impact of trade openness on GDP growth rates. The improvement of the investment climate is a complementary measure to the improvement of openness, and it results in a significant increase in FDI inflows. It has been argued by Fenny (2005) that openness encourages a skilled labour force to contribute more to growth through technological advancements and the importation of research and development. Consequently, Tajikistan should formulate policies that encourage FDI and ensure a greater degree of capital formation in order to increase its economic growth rates.

To summarise, while our empirical results generally suggest the expected trend, the result obtained by this study has a number of policy implications. A strong emphasis must be placed on ensuring that FDI policies do not

adversely affect economic growth policies, and efforts must be made to reorient FDI in order to enhance economic growth and social development, with the objective of maximizing the impact of FDI on economic development.

Credit Authorship Contribution Statement

The author takes the sole credit for writing the paper, and drafting and modelling the theory, as to conceiving the idea of the paper, thus having played the full part in conducting the entire research.

Conflict of Interest Statement

The author declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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