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INVESTMENT FLOWS AND ECONOMIC DEVELOPMENT IN UZBEKISTAN: AN ECONOMETRIC ANALYSIS

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Abstract

This study investigates the impact of foreign direct investment (FDI) and domestic direct investment (DDI) on economic growth in Uzbekistan, a rapidly reforming economy in Central Asia. Over the past decade, particularly following structural reforms initiated under President Shavkat Mirziyoyev, Uzbekistan has intensified efforts to improve its investment climate, liberalize trade, and attract foreign capital. Despite notable progress, structural constraints—including its double-landlocked geography, institutional inefficiencies, and labor market pressures—continue to shape the effectiveness of investment-led growth.

Using recent time-series data, the study applies a Vector Autoregressive (VAR) model to examine the dynamic interrelationships between FDI, domestic investment, employment, trade openness, and GDP growth. The methodology captures lagged and bidirectional effects among variables, allowing for a comprehensive assessment of short- and long-run dynamics. In addition, hypothesis testing and complementary economic justification methods are employed to strengthen the robustness of the findings.

Introduction

Developing Uzbekistan faces several challenges that hinder sustainable economic growth and investment flows in Central Asia. First and foremost, The country's double- landlocked geographical character limits its opportunities to join the competitive global market. Moreover, increasing population growth burdens the

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economy with greater demand for jobs and infrastructure. Currently, half of Central Asia's population, over 36.5 million, lives in Uzbekistan (Worldometer, 2025). However, a high unemployment rate persists, which is common in populous countries. This necessitates government efforts to attract more investors to create job opportunities by establishing export-oriented factories. Furthermore, the country's export potential is lower than its import, which challenges the current scenario (Kechagia and Metaxas, 2016). It is highly important to accelerate special economic zones with tax incentives for investors, thereby exporting finished products to neighboring countries. Additionally, free trade agreements with neighboring countries can expand the trading relations with inclusive tax policies, which further impacts trade potential and sustainable growth. Therefore, The study of FDI and its impact on Uzbekistan's economic progress raises significant concern among researchers. The purpose of the current research is to investigate this area using advanced econometric techniques and provide a comprehensive outlook on Uzbekistan's investment landscape. The study applies a Vector Autoregressive (VAR) model and hypothesis testing to analyze the relationship between variables and economic growth. Based on the findings of the research, policy implications are provided below. The article is structured as follows: section 2 discusses the related literature on the topic with research gap, section 3 provides the methodological framework of the study, while section 4 interprets the results of the analysis. The study ends with conclusion section with potential policy recommendations.Key investment forms in Uzbekistan include equity contributions to charter funds, the establishment of foreign-owned enterprises, acquisition of intellectual property, and investments in infrastructure and industrial assets. These forms are crucial to understanding the multifaceted impact of investment. For instance, FDI serves as a catalyst for economic growth by providing capital infusion, facilitating technology transfer, enhancing managerial capabilities, and strengthening export competitiveness. Pulatova (2016) and Imomkulov (2023) have highlighted the role of FDI in

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enhancing industrial sophistication and diversifying economic outputs in Uzbekistan (Pulatova, 2016). Special economic zones (SEZs), which attract significant FDI, have emerged as focal points for economic transformation, with researchers like Odilbekov (2024) identifying a strong correlation between FDI inflows into SEZs and improvements in governance, infrastructure, and export performance.

Domestic investments complement FDI by fostering innovation and supporting local industries. Mamatov (2020) underscores the critical role of innovation-oriented investments in driving intensive economic growth. Investments in fixed assets, particularly in manufacturing and technology sectors, have been linked to sustainable GDP growth in Uzbekistan (Mamatov, 2020). Rajapova (2020) projects a significant increase in research and development (R&D) investments by 2030, emphasizing their role in creating intellectual property and advancing sustainable development goals. Such findings underscore the importance of aligning domestic investment strategies with innovation-driven growth policies (Rajapova, 2020).

The interplay between investment, employment, and economic growth is another vital dimension of analysis. Empirical evidence, such as the study by Rakhmatillo et al. (2021), demonstrates a bi-directional relationship where investment inflows stimulate employment, which in turn enhances GDP growth, creating a virtuous cycle (Rakhmatillo et al., 2021). The VAR model is particularly suited to capturing these dynamics, as it accounts for lagged effects and interdependencies between variables. For instance, FDI- induced job creation may lead to higher consumption and savings rates, which subsequently drive further investment and growth.

Despite these benefits, Uzbekistan faces challenges in maximizing the efficiency of its investment strategies. Structural inefficiencies, such as poor allocation of resources and lack of transparency, remain barriers to optimal investment utilization. Studies by Nazarov (2019) and Burkhanov et al. (2015) identify these

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factors as deterrents to foreign investors. Addressing these challenges requires robust policy measures, including the modernization of regulatory frameworks, improvement of governance quality, and enhancement of digital infrastructure. ICT investments, as highlighted by Shodiev et al. (2021), play a pivotal role in reducing unemployment and fostering business expansion, thereby amplifying the impact of traditional investments (Nazarov, 2019; Burkhanov et al. 2015; Shodiev et al., 2021). For instance, Mukhsimova (2020) and Grabara et al. (2021) emphasize the multiplier effects of investments in manufacturing, textiles, and renewable energy. These sectors not only contribute to GDP growth but also enhance Uzbekistan's export competitiveness and energy security. Such findings are consistent with global empirical research, which demonstrates the positive spillover effects of investments on productivity, innovation, and employment (Mukhsimova, 2020).

The study's methodological rigor is further enhanced by incorporating dynamic methods of economic justification, such as discounted cash flow (DCF) analysis, to evaluate the efficiency of investments over time. This approach ensures that investment decisions are aligned with long-term economic objectives. Moreover, the integration of trade openness indicators, as discussed by Chakrabarti (2001), and macroeconomic stability measures, as outlined by Strat et al. (2015), provides additional layers of analytical depth. Trade openness, proxied by the ratio of trade volume to GDP, is positively correlated with FDI inflows, highlighting the importance of liberal trade policies in attracting foreign capital (Chakrabarti, 2001). In Uzbekistan, the development of financial markets, improvement of institutional quality, and enhancement of human capital are essential absorptive capacities for reaping the full benefits of investment.

As noted earlier, a number of researchers have studied the role of investment in economic growth across various countries. However, a gap remains in the in-depth analysis of investment flows' impact on economic growth using a fresh dataset for developing Uzbekistan. Therefore, this study aims to investigate the

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impact of FDI on Uzbekistan's economic growth using the latest dataset and advanced econometric techniques. The author believes the article will significantly contribute to the existing literature on the economic growth of Central Asian countries.

Theoretical Framework

The relationship between direct investment—namely foreign direct investment (FDI) and domestic direct investment (DDI)—and economic growth is a significant area of research, particularly for transitioning economies like Uzbekistan. Since President Shavkat Mirziyoyev came to power in 2016, Uzbekistan has implemented wide-ranging economic reforms to create a favorable environment for both FDI and DDI. Under the slogan "The state should not serve the people, but the people should serve the state," these reforms have encompassed nearly all sectors of the economy (ISDP, 2023). President Mirziyoyev's statement, "By New Uzbekistan, we mean a society that cares for each of its citizens, and is open and just," defines the core principles of the reforms being implemented in the country (Gazeta, 2022). In 2023, Uzbekistan's economy recorded a growth rate of 6% and attracted over $7.2 billion in foreign direct investment, nearly double the amount compared to 2022 (U.S. State Department, 2023). These figures demonstrate the positive impact of direct investment on economic growth. Direct investment contributes to economic growth through various channels, such as capital formation, technology transfer, job creation, and productivity enhancement. In the context of Uzbekistan, these mechanisms need to be analyzed in conjunction with classical and modern economic theories while taking into account the country's unique socio-economic dynamics.

One of the foundational theories relevant to this analysis is the neoclassical growth model, which posits that economic growth results from increases in capital, labor, and technological progress. Direct investment contributes to capital

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accumulation, thereby raising output and fostering growth (Solow, 1956). In Uzbekistan, where domestic savings alone are insufficient to meet the capital demands of large-scale infrastructure and industrial projects, both FDI and DDI play a pivotal role in filling this gap. However, recent literature emphasizes that the growth effects of capital accumulation depend on complementary factors such as institutional quality and human capital (Acemoglu and Robinson, 2012). Uzbekistan's ongoing reforms to liberalize its economy, such as easing foreign exchange controls and reducing bureaucratic barriers, aim to enhance the effectiveness of direct investment in driving growth.

Building on the neoclassical framework, the endogenous growth theory provides a more dynamic lens by highlighting the role of innovation, knowledge spillovers, and human capital in sustaining long-term growth. According to Aghion and Howitt (2009), direct investment, particularly FDI, can facilitate technology transfer and innovation by exposing domestic firms to advanced production techniques and managerial practices. In Uzbekistan, the government has prioritized economic diversification from agriculture and natural resources toward manufacturing and services. FDI in technology-intensive sectors could generate significant spillovers (Aghion and Howitt, 2009). However, the extent of these benefits depends on the absorptive capacity of local firms, which is often constrained by limited skills and inadequate vocational training in the country.

A more critical perspective is offered by dependency theory, which cautions against over-reliance on foreign capital. Modern interpretations of this theory, such as those by Chang (2019), argue that FDI can lead to economic dependency if not managed properly, with multinational corporations repatriating profits rather than reinvesting them locally. In Uzbekistan, where FDI has historically been concentrated in extractive industries like oil and gas, there is a risk of enclave economies emerging, limiting the benefits of investment to the broader economy (Chang, 2019). This underscores the need for policies that encourage

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reinvestment and ensure that FDI aligns with national development goals, such as job creation and poverty reduction.

Institutional quality is another critical factor mediating the relationship between direct investment and economic growth, as emphasized in recent literature. Kaufmann et al. (2010) argue that governance indicators such as rule of law, control of corruption, and regulatory quality significantly influence the attractiveness of a country to investors and the subsequent growth outcomes. In Uzbekistan, despite reforms since 2016 to improve the investment climate, challenges like corruption and weak property rights enforcement persist, potentially undermining the growth-enhancing effects of direct investment (Kaufmann et al., 2010). High-quality institutions can amplify the positive impacts of FDI by ensuring investor confidence and facilitating the efficient allocation of resources.

Recent empirical studies provide further insights into the theoretical mechanisms at play. For instance, Iamsiraroj and Ulubaşoğlu (2015) find that FDI contributes to economic growth more significantly in countries with well-developed financial systems, as these systems enable efficient resource allocation. Uzbekistan's financial sector, although undergoing reforms, remains underdeveloped, with limited access to credit for small and medium enterprises (SMEs). This constraint could limit the ability of domestic firms to absorb the benefits of FDI, such as technology spillovers and increased competition (Iamsiraroj and Ulubaşoğlu, 2015). Similarly, Farla (2014) highlights the importance of targeting FDI toward sectors with high growth potential, such as manufacturing and renewable energy, rather than extractive industries, to maximize its impact on economic growth. In Uzbekistan, where the government has set ambitious targets for renewable energy development, directing FDI into this sector could create backward and forward linkages, fostering broader economic growth.

The sectoral composition of direct investment also matters, as discussed in modern development economics literature. Hirschman's (1958) theory of

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unbalanced growth, revisited by Murphy et al. (2019), suggests that investments in key industries can stimulate growth in related sectors through demand and supply linkages. For Uzbekistan, encouraging direct investment in manufacturing, information technology, and tourism— sectors prioritized in the government's Uzbekistan Vision 2030 strategy—could generate such linkages, reducing reliance on volatile commodity exports like cotton and natural gas (Murphy et al., 2019). However, the success of this approach depends on the government's ability to address structural bottlenecks, such as inadequate infrastructure and energy supply, which deter investment in non-extractive sectors.

Moreover, the role of human capital in mediating the impact of direct investment on growth has gained increasing attention in recent studies. Carkovic and Levine (2018) argue that FDI contributes to growth only when the host country has a sufficient stock of human capital to absorb and utilize new technologies effectively. In Uzbekistan, while literacy rates are high, the quality of education and vocational training lags behind global standards, potentially limiting the growth effects of direct investment (Carkovic and Levine, 2018). Policies that enhance education and skills development could therefore amplify the benefits of FDI by enabling local firms and workers to adopt advanced technologies and compete in global markets.

Empirical framework

This section employs advanced econometric methods—Ordinary Least Squares (OLS) and Vector Autoregressive (VAR) models—to analyze the relationship between investment and economic performance, offering insights into both short-term and long- term effects. OLS is a fundamental econometric tool that estimates the linear relationship between investment variables and key economic indicators such as GDP, employment, and exports. By determining the marginal impact of factors like FDI and domestic capital, OLS provides a clear foundation for

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assessing investment effectiveness. For instance, policymakers can use these insights to prioritize strategies that yield the highest growth returns (Zayniddinov et al., 2023).

Complementing this, the VAR model captures the dynamic interactions between investment and economic growth over time. Unlike OLS, VAR treats all variables as interdependent, allowing for the analysis of feedback loops and lagged effects. This is particularly valuable in Uzbekistan's evolving economic landscape, where investment- driven growth can, in turn, attract further capital inflows. For example, increased FDI may initially boost employment and infrastructure while fostering long-term improvements in export competitiveness and technological innovation (Cavicchioli, 2020).

Together, these econometric approaches offer a comprehensive understanding of Uzbekistan's investment-growth dynamics, equipping policymakers with data-driven insights to craft effective economic strategies (Zayniddinov et al., 2023; Cavicchioli, 2020). In practical terms, a VAR model for Uzbekistan might include variables such as:

FDI inflows: To measure the impact of foreign investment;

Domestic investment: To capture the contributions of local capital formation;

GDP growth rate: As the primary indicator of economic performance;

Employment levels: To understand how investments create jobs;

Trade openness: To assess how integration with global markets interacts with investment.

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Table 1: Description of the variables

Variable Name	Conventional Designation	Variable Type	Description
Foreign Direct Investment	FDI	Independent	Total inflow of foreign direct investment into Uzbekistan.
Portfolio Investments	PI	Independent	Capital invested in Uzbekistan through financial markets.
Gross Capital Formation	GCF	Independent	Represents the total investment in physical assets such as infrastructure, equipment, and machinery.
Gross Domestic Product Per Capita	GDPPC	Dependent	Proxy for economic growth, indicating the living standards of the population.

Source: processed by author.

By analyzing the interactions among these variables, the VAR model can identify not only the direct effects of investment on GDP but also the indirect effects mediated through employment and trade. For example, the model might show that FDI initially increases GDP through job creation but has an even larger long-term effect by enhancing export performance and innovation capacity. Another advantage of VAR is its ability to perform impulse response analysis and variance decomposition. These techniques allow researchers to simulate how shocks to one variable (e.g., a sudden increase in FDI) propagate through the system over time and to quantify the relative contributions of each variable to changes in GDP (Mbulawa and Ogbenna, 2019). For Uzbekistan, this could provide valuable insights into how policy measures—such as tax incentives for foreign investors or subsidies for domestic R&D—are likely to impact economic growth in the short and long run.

This study employs a quantitative approach utilizing a multi-factor time-series model to analyze the impact of investment on economic growth in Uzbekistan. The primary objective is to determine the extent to which various forms of investment influence the country's economic performance and living standards

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over time. The model incorporates a range of variables to capture the multifaceted nature of investment and its influence on economic growth:

The following hypotheses will be tested:

Relationship between FDI and Economic Growth (GDPPC):

H10: There is no relationship between FDI and economic growth (GDPPC);

H11: There is a relationship between FDI and economic growth (GDPPC).

Relationship between Portfolio Investments and Economic Growth (GDPPC):

H20: There is no link between portfolio investments (PI) and economic growth (GDPPC);

H21: There is a link between portfolio investments (PI) and economic growth (GDPPC).

Relationship between Gross Capital Formation and Economic Growth (GDPPC):

H30: There is no relationship between gross capital formation (GCF) and economic growth (GDPPC);

H31: There is a relationship between gross capital formation (GCF) and economic growth (GDPPC).

Following model was developed to analyze the interaction between dependent and independent variables in the context of investment and economic growth in Uzbekistan:

$$GDPPCi = \beta 0 + \beta 1FDIi + \beta 2PIi + \beta 3GCFi + \beta 4Inflationi + \beta 5ExchangeRatei + \beta 6Unemploymenti + \beta 7TradeBalancei + \epsilon i, \quad (1)$$

where:

β0: Model intercept;

β1, β2, ..., β7: Coefficients for respective independent variables;

ϵi: Conditional error term.

Vector autoregressive (VAR) model

To explore the relationships over time and capture dynamic interactions, we applied a VAR model:

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$$Y_t = \alpha + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \ldots + \beta_p Y_{t-p} + \epsilon_t, \qquad (2)$$

where:

α: Intercept, a constant term;

$\beta_1, \beta_2, \ldots, \beta_p$: Coefficients for lagged values of Y_t;

p: Number of lags used in the model;

ϵ_t: Error term.

The VAR model is employed to forecast the impact of FDI, PI, and GCF on economic growth and other macroeconomic variables. Using STATA software, this multivariate time-series analysis enables the prediction of future trends and identification of key determinants of economic performance.

Stationarity and cointegration analysis

To ensure valid inferences, the following steps were undertaken:

Stationarity Testing: • Unit Root Test: Augmented Dickey-Fuller (ADF) test was applied to check stationarity.

$$\Delta Y_t = \delta Y_{t-1} + \alpha + \beta t + \epsilon_t \qquad (3)$$

Hypotheses: – H0: $\delta = 0$ (Data has a unit root, non-stationary); – H1: $\delta < 0$ (Data is stationary).

Cointegration testing:

Even if variables are non-stationary individually, a linear combination may be stationary. Johansen cointegration tests were applied to evaluate long-term equilibrium relationships.

Additional Analysis were conducted as well:

Variance Decomposition: Identifies the contribution of each variable to forecast error variance.

Impulse Response Functions: Analyzes the dynamic impact of shocks in one variable on others over time.

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The model thus offers a comprehensive framework to investigate both short- and long-term relationships between investments and economic growth in Uzbekistan.

The Johansen cointegration test, conditions for cointegration The components in the vector Yt are said to be cointegrated to the degree CI(d, b) if:

All components of Yt are integrated of order d, I(d):

$$Yt = [Y1t, Y2t, ..., Ykt]' \quad (4)$$

Each variable in Yt must be non-stationary but integrated of the same order d, meaning they exhibit a stochastic trend.

There exists a non-zero cointegration vector (β):

$$\beta Yt = \beta 1Y1t + \beta 2Y2t + ... + \beta n\ Ynt, \quad (5)$$

such that the linear combination of the variables is stationary of order d–b, where b > 0. This implies that while the individual variables are non-stationary, their relationship remains stable over the long term.

Model representation

Vector Autoregressive Model (VAR):

Consider a p-lag VAR model for a vector of k endogenous variables:

$$Yt = A1Y\{t-1\} + A2Y\{t-2\} + ... + ApY\{t-p\} + \varepsilon t, \qquad (6)$$

where:

Yt is a k × 1 vector of endogenous variables;

Ai are k × k coefficient matrices for i = 1, 2, ..., p;

εt is a k × 1 vector of white noise errors.

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Vector Error Correction Model (VECM): The VAR model can be rewritten in a difference form to capture both short-term dynamics and long-term relationships:
$\Delta Yt = \Pi Y\{t-1\} + \sum(\Gamma i \Delta Y\{t-i\}) + \varepsilon t$, (7)
where:
$\Delta Yt = Yt - Y\{t-1\}$ (first differences);
$\Pi = \sum(Ai) - I$, representing the long-term cointegration relationships;
$\Gamma i = -\sum(Aj)$ for $j = i+1$ to p, representing short-term dynamics.

Decomposing Π: • The rank of Π determines the number of cointegration relationships (r):
If $0 < \text{rank}(\Pi) = r < k$, there are r cointegrating relationships.
The matrix Π can be decomposed as: $\Pi = \alpha\beta'$, where α is the $k \times r$ matrix of adjustment coefficients, indicating the speed of adjustment toward equilibrium, β is the $k \times r$ matrix of cointegration vectors, representing the long-term equilibrium relationships.

Hypothesis testing
Johansen's method uses two likelihood ratio tests to determine the number of cointegrating vectors (r):

Trace Test:
$LRtrace(r) = -T \sum(\ln(1 - \lambda i))$ for $i = r+1$ to k;
T: Sample size;
λi: Eigenvalues of the Π matrix, ranked in descending order;
Null Hypothesis (H0): There are at most r cointegration relationships.
Maximum Eigenvalue Test:
$LRmax(r, r+1) = -T \ln(1 - \lambda\{r+1\})$
Null Hypothesis (H0): The number of cointegrating relationships is equal to r.
The empirical background of the current research is provided above. These advanced techniques facilitate an in-depth analysis, with results presented in the next section.

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Empirical results and discussion

The graphical illustrations in Figure 1 underscore Uzbekistan's robust economic growth, increased foreign investment inflows, and strategic focus on long-term development, positioning the country for sustained progress in the global economic landscape.

The graphical analysis of the variables reveals consistent patterns of non-stationarity across all series. The dependent variable, GDP per capita, displays a clear upward trend over the observed period, indicating that its mean and variance are not constant over time. This suggests that the economic growth, as represented by GDP per capita, is systematically influenced by long-term factors rather than short-term fluctuations. Similarly, the independent variables—FDI, Portfolio Investments, and GCF—exhibit noticeable upward trends. FDI and Portfolio Investments steadily increase year over year, reflecting a growing inflow of investments into Uzbekistan. This trend underscores an expanding role of external capital in the country's economic framework.

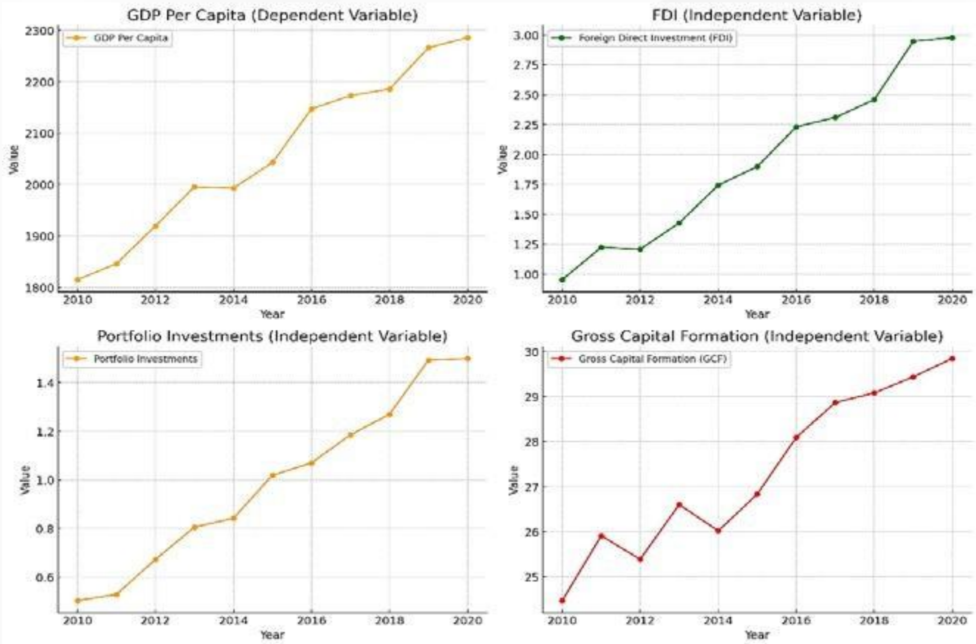

Figure 1: Results of testing dependent and independent variables for stationarity using the graph method

Source: processed by author.

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However, the presence of a trend in these variables signals non-stationarity, as their values are not reverting to a fixed mean or maintaining constant variance. Gross Capital Formation, while demonstrating some fluctuations, follows a predominantly upward trajectory, suggesting ongoing investments in infrastructure, machinery, and other physical assets. The variations within GCF could imply periodic shifts in investment strategies or economic policies but do not detract from its overall non-stationary behavior.

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