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# The Impact of Foreign Direct Investment on Economic Growth: An Evidence from Asian Countries 1995-2021

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## Abstract

This study investigates the impact of foreign direct investment (FDI) on the economic growth of Asian countries. Using panel data from 1995 to 2021 (27 years) covering 45 Asian countries, the study employed the PP-Fisher and Fisher-ADF tests for the unit root test. In all cases, the null hypotheses propose that series have a unit root, in contrast to the alternative hypothesis that state series is stationary. After checking the stationarity of the variables, various panel static models such as Pooled Ordinary Least square (POLS), Random Effect Model (REM), and Fixed Effects Model (FEM) have been carried out. Furthermore, in order to ensure and correct the problem of heterosedesticity, the robustness of the findings has also been done. Finally, to solve the problem of endogeneity issue, this study used the two system GMM approaches. The findings of this study contribute to the growing literature of FDI and provide more compressive conclusions and recommendations on the impact of FDI on economic growth particularly in the context of Asian countries.

## Keywords

Foreign Direct Investment, Economic Growth, Asian Countries

## 1. Introduction

A long time has passed since emerging economies have been widely acknowledged the importance of foreign direct investment (FDI). Furthermore, FDI helps developing nations by transferring technology, know-how, and information while also cutting production costs. In the same way, FDI promotes domestic investment, job creation, and economic growth (Hakimi & Hamdi, 2017; Herzer, 2010; Crespo & Fontoura, 2007). The United Nations Conference on Trade and Development reports that FDI flows have decreased by 13 percent in 2018 to $1.3 trillion, according to UNCTAD (2019). Foreign direct investment has grown very little since the global financial crisis of 2008 and this indicates that growth has been slow. Meanwhile, FDI flows to developing countries enhanced by 2 percent in the same year, in view of the rise in FDI in developing countries and the unusual decline in FDI in developed countries.

In spite of this, FDI flows to developing countries declined sharply during the pandemic crisis. Even though FDI flow is predicted to grow year after year, it has declined in recent years. In comparison with the post-global financial crisis period, this is the lowest number since 2005. Companies have reevaluated their future investments due to global lockdowns during the COVID-19 pandemic, and the risk of a recession has stopped them from continuing their present investments. In contrast to economic growth and international trade, FDI declined much more pronouncedly (UNCTAD, 2019). Therefore, it can be said that during the past few years, FDI has been adversely affected and drastically decreased. Throughout this pandemic crisis, and especially in 2020, emerging nations have received a sizable quantity of foreign direct investment. For instance, the amounts received by China, India, and the United Arab Emirates were $64.1, $19.9, and $149.3 billion, respectively; these amounts represent increases of 26.7, 11.2, and 5.7 percent over the prior year.

There have been some empirical investigations carried out, such as time series analysis and panel analyses (Hayat, 2019; Shetewy & Jiang, 2019; Adams, 2009; Shabbir, 2013). A number of empirical studies have suggested that when analyzing FDI's impact on economic growth, the host country's characteristics should be taken into consideration, including its financial system, human capital development, institutional quality, and trade policy (Hayat, 2019; Jude & Levieuge, 2017). There have been a number of studies examining the impact of FDI on economic growth in developing countries in general and in Asia in particular, but the conclusions reached by different researchers have varied.

Since foreign direct investment has many positive effects, both direct and indirect, on the economies of developed countries, the literature continues to debate and analyze its role. In addition to the increase in foreign direct investment flows following globalization and an intensifying link between financial markets, globalization and the intensifying links between them have also contributed to the increase in foreign direct investment flows. Neoclassical economic growth models presume that angularity in capital accumulation and employment contribute significantly to economic growth (Solow, 1956). In the new theory of growth, technological advancements are considered endogenous factors and foreign direct investment plays an important role in economic growth by transferring technology. Therefore, FDI will lead to an increase in domestic capital formation and facilitate financing for local firms, thereby facilitating overall technological progress and productivity spillovers and speeding up economic growth (de Mello, 1997; Carkovic & Levine, 2005).

The difference in results can be attributed to a number of factors, including the different estimation methods, the types of data used in regression (panel, time-series, and cross-sectional data), the short time periods and the omission of important variables, as well as the unit of analysis (looking at one country, one company, or one sector) (Awunyo-Vitor & Sackey, 2018; Derado & Horvatin, 2019; Osei & Kim, 2020). A wide range of empirical studies have focused exclusively on Asian countries (Halliru et al., 2020; Aluko & Obalade, 2020; Ngepah et al., 2021; Zekarias, 2016) and examined the relationship between FDI and economic growth. There are very few studies on the effect of foreign direct investment on economic growth in Asian countries (Ngepah et al., 2021; Acquah & Ibrahim, 2019). The majority of previous studies did not cover the majority of countries in the region, so it is hard to draw a general conclusion that covers all countries in the region.

The aim of this study is to investigate the effects of foreign direct investment on economic growth in Asian countries. In order to fill a gap in the literature, the current study examined the effects of foreign direct investment on 45 Asian economies between 1995 and 2021.

## 2. Literature Review

As a result of an exogenous increase in FDI, capital per capita and GDP would temporarily rise without having an effect on long-term growth (Solow, 1956). Technological developments and growth in the labor force are the only factors that can influence long-term economic growth rates (Bazán Navarro & Álvarez-Quiroz, 2022). As stated in Kurtishi-Kastrati (2013), theoretical studies that focus on foreign direct investment have demonstrated a thorough understanding of economic mechanism and behavior of economic representatives on both a macro and micro level, opening up new research opportunities in economics theory. FDI plays a core role in economic growth in host countries, according to an economic growth study based on FDI's theoretical relationship with economic growth.

This is noted that FDI contributes indirectly and directly through endogenous and exogenous growth analysis and FDI affects economic growth through encouraging technological spillovers in the production process and also FDI may stimulate knowledge transfer (Mahembe & Odhiambo, 2014). The theoretical relationship between economic growth and FDI can be analyzed by two main theories. Through the theory of neoclassical growth argues that growth was affected by FDI in augmenting the per capita capital (Solow, 1956). However, the theory shows that FDI's potential impact on economic growth is limited in the short run due to diminishing marginal returns (de Mello, 1997) and unchanged in the long run. Assuming exogenous factors only determine population growth and technological progress in a neoclassical framework, long run growth depends only on growth in population and technological progress.

An FDI policy that leads to technological progress is the only way that FDI can boost economic growth according to Tanaya and Suyanto (2022). It has been reported that foreign direct investment (FDI) makes a significant contribution to technology transfer from the perspective of endogenous growth (Romer, 1986; Lucas, 1988; Barro, 1990).

As far as technology is concerned, new growth theory differs significantly from neoclassical theory. A comparison between the former and the latter suggests that technological advancement is a result of spillovers caused by tangible capital expenditures, human capital expenditures, or R&D expenditures. According to the endogenous growth theory, policies that promote international trade, change, competitiveness and innovation will contribute to growth. By contrast, policies that slow growth over time are likely to restrict or slow down change by favoring or protecting particular existing industries.

## 3. Methodology

### 3.1. Model Specification

A significant amount of foreign direct investment is required to reduce the income gap between developing countries and developed countries and to reduce the capital gap. The endogenous growth theory can be applied here as it provides a theoretical foundation for understanding the role of technological advancement, labor, and physical capital in expanding economies (Solow, 1956; Romer, 1986). A wide range of studies have suggested that FDI leads to economic growth by rising the productivity of both domestic and foreign resources (De Mello, 1997; Alege & Ogundipe, 2013b; Zekarias, 2016). In this regard, the Cobb-Douglas augmented production function can be used to explain FDI's relationship with economic growth as follows:

$$Y = f\left(K_d, K_f, L, E\right) = AL^a K^{\beta(1-a-\beta)} \tag{1}$$

where; $Y$ is the growth of output, $K_d$, and $K_f$, stand for domestic and foreign investment respectively. Whereas, $L$ and $E$ refer labour and he spillover effect from FDI respectively as we can see from the above equation. Lastly, $a$ and β stand for the elasticity of labor and capital to output ($Y$) respectively and $A$ refers efficiency of production. It has also been suggested that the rate at which the economy grows is affected by a number of constituent, including inflation (INFL), domestic investment (DI), foreign trade (TRO), population (POG), infrastructure (INFRST), unemployment (UNEPL), government expenditures (GE), and exchange rates (Zekarias, 2016; Alege & Ogundipe, 2013b). As a result of the endogenous growth assumption, Equation (1) is modified to regard the following growth determinants:

$$Y = f\left(\text{FDI}, \text{DIN}, \text{INFL}, \text{TRO}, \text{POG}, \text{INFST}, \text{UNEPL}, \text{GE}, \text{EX}, \varepsilon\right) \tag{2}$$

where FDI stands for foreign direct investment, DIN is domestic investment, INFL is inflation, TRO refers trade openness, POG is population growth, INFST is infrastructure, UNEPL is unemployment; GE is government expenditure, EX is exchange rate and $\varepsilon$ is the general error term. In order to demonstrate that there is a non-linear relationship between growth of output (dependent variable) and independent variables, Equation (2) can be rewritten as follows:

$$Y = Af\left(\text{FDI}^{\beta_1}\text{DIN}^{\beta_2}\text{INFL}^{\beta_3}\text{TRO}^{\beta_4}\text{POG}^{\beta_5}\text{INFST}^{\beta_6}\text{UNEPL}^{\beta_7}\text{GE}^{\beta_8}\text{EX}^{\beta_9}\varepsilon\right) \quad (3)$$

where, $\beta_1 - \beta_2$ are different factor contributions to growth; $\varepsilon$ is error term. Because panel models combine longitudinal and cross-sectional data, time, space, and variables (Wooldridge, 2005). The cross-country data consists of 45 countries, 27 years, and 9 variables. In this regard, Equation (3) has been further modified so that cross sectional units and time horizons are explicitly included. In this way, the dynamic cross-country growth model can be expressed as follows:

$$Y_{it} = Af\left(\text{FDI}_{it}^{\beta_1}\text{DIN}_{it}^{\beta_2}\text{INFL}_{it}^{\beta_3}\text{TRO}_{it}^{\beta_4}\text{POG}_{it}^{\beta_5}\text{INFST}_{it}^{\beta_6}\text{UNEPL}_{it}^{\beta_7}\text{GE}_{it}^{\beta_8}\text{EX}_{it}^{\beta_9}\right) \quad (4)$$

where: $i$ stands cross-sectional units; i.e. countries; $t$ stands time units in years which scope from 1995-2021. $U_{it}$ is the composite disturbance term which considers: $\mu_{it}$ is the unobservable country specific effects; and $\varepsilon_{it}$ refers the idiosyncratic error term. To make computations easier and to understand, the non-linear equation is transformed as follows into a linear equation: Not only that the model for the country particular fixed effects and unnoticed time-invariant is also specified as follows:

$$\begin{aligned}\text{GDPP}_{it} = {} & \beta_0 + \beta_1\text{FDI}_{it} + \beta_2\text{DIN}_{it} + \beta_3\text{INFL}_{it} + \beta_4\text{TRO}_{it} + \beta_5\text{POG}_{it} \\ & + \beta_6\text{INFST}_{it} + \beta_7\text{UNEPL}_{it} + \beta_8\text{GE}_{it} + \beta_9\text{EX}_{it} + a_i + \delta_t + \varepsilon_{it}\end{aligned} \quad (5)$$

where; GDPPG is GDP per capita growth dependent variable); $\beta B_0$ is the intercept; $\beta B_2$, $\beta B_3$, ..., $B_9\beta$ are coefficients of respective explanatory variables; $a_i$ is an undetected country-specific effect, $\delta_t$ year fixed effect and $\varepsilon_{it}$ indicates error term. In fact, the rest notations have already been explained in previous equations.

## 3.2. Data Type and Source

In this study, unbalanced panel data were used from 45 Asian countries between 1995 and 2021. A database of world development indicators for 2021 was used to collect all the data. These 45 countries in Asia are chosen based on data availability. The countries which covered in current study are Afghanistan, Armenia, Azerbaijan, Bhutan, Bangladesh, Bahrain, Brunei Darussalam Cyprus, Cambodia, China, Georgia, India, Indonesia, Iraq, Iran, Israel, Japan, Jordan, Kazakhstan, Korea Rep, Kuwait, Kyrgyz Republic, Lao PDR, Lebanon, Malaysia, Mongolia, Maldives, Myanmar, Nepal, Pakistan, Oman, Philippines, Qatar, Saudi Arabia, Singapore, Sri Lanka, Syrian Arab Republic, Tajikistan, Timor-Leste, Thailand, Turkmenistan, Türkiye, United Arabic Emirates, Uzbekistan, Yemen, Rep. and Vietnam. The study used GDP per capita growth (GDPGR) as the dependent variable and foreign direct investment (FDI) as the main explanatory variable, inflation (INFL), domestic investment (DIN), trade openness (TRO), government expenditure (GE), population growth (POG) and unemployment (UNEPL) are control variables. Table 1 shows the variable descriptions, measurements, and expected signs.

Table 1. Summary of the variable description and data sources.

| List of Variables | Symbols | Measurement | Source of Data |
|---|---|---|---|
| **Dependent variable** | | | |
| Economic growth | GDPGR | GDP per capita growth (annual %) | WDI |
| **Independent variable** | | | WDI |
| Foreign Direct Investment | FDI | Foreign direct investment, net inflows (% of GDP) | WDI |
| Inflation | INFL | Inflation, consumer prices (annual %) | WDI |
| Unemployment | UNEPL | Unemployment, total (% of total labor force) (modeled ILO estimate) | WDI |
| Domestic Investment | DIN | Gross fixed capital formation (% of GDP) | WDI |
| Government Expenditure | GE | General government final consumption expenditure (annual % growth) | WDI |
| Trade Openness | TRO | Imports of goods and services (% of GDP) | WDI |
| Population growth | POG | Population growth (annual %) | WDI |
| Exchange rate | EX | Exchange rate (%) | WDI |
| Infrastructure | INFST | mobile cell phone subscribers per 100 people | WDI |

**Source:** Author's design from world development indicators.

**Economic Growth (GDPPG):** It is used as a dependent variable and defined by GDP per capita growth rate, and the result of this empirical finding is a positive relationship. The real GDP per capita has been used in a number of studies in order to measure economic growth since it encapsulates GDP associated with a country's population (Adams, 2009; Macias et al., 2010; Aizenman et al., 2013).

**Foreign Direct Investment (FDI):** The policymakers in underdeveloped countries are increasingly aware of the importance of FDI in moving regional economic growth, especially in Asian nations. In addition to providing Africa with international capital, FDI is also a major source of economic growth. The link between FDI and economic growth and development has been demonstrated in numerous studies (Jude & Levieuge, 2017; Nguyen, 2017). Foreign direct investment, however, has been found to negatively affect economies by some scholars (see Dinh et al., 2019). As a proxy for foreign direct investment (FDI), this study uses net inflows of foreign direct investment as a percentage of GDP. As a result, they have attracted more foreign direct investment, which has contributed to the growth of their economies. Thus, we will consider this variable to be a main variable and expect this variable to have a positive coefficient in our analyses.

**Inflation (INFL):** Is examined as an explanatory variable that is proxies by consumer prices (annual %). The end result of this study expects the negative relationship in macroeconomic analysis, it is used to determine a country's stability. The lower the inflation rate, the more stable the economy, which leads to higher economic growth, while the higher the inflation rate, the more uncertain the economy will be, which will lead to economic contraction. Furthermore, research suggests that both economic growth and inflation rates are uncorrelated between the variables (suggesting a trade-off). Further, as the results show, there is also no causal relationship between the variables. Moreover, previous papers have illustrated that inflation is positively related to economic growth. It has been noted here that the literature has mixed findings. According to this study, economic growth will be negatively affected. Consumer price indexes are used to measure inflation in this study.

**Unemployment:** Proxied by total (% of total labor force) (modeled ILO estimate). In this study, unemployment is used as the explanatory variable that the result will expect negative interaction.

**Trade Openness (TRO): a**s an independent variable, trade openness (TRO) is defined as the quantity of goods and services imported (percentage of GDP). In countries with a higher degree of trade openness, the more goods and services are driven into the country and, in turn, there will be more inputs available for investment, resulting in an increase in foreign direct investment, which leads to economic growth (see Adhikary, 2011).

**Population growth (POG):** The population growth rate (POG): is used as an independent variable and is proxied by the population growth rate (annual%). It is expected that population growth and GDPGR will be positively correlated. The findings of Cohen (1993) show a clear connection among population progress and economic progress, suggesting that the greater the population, the better the investment chances. Additionally, it is also important to note that most population flow up contributes to promoting economic growth and increasing market size in developing regions along the lines of Africa in recent years (Fraj et al., 2018).

**Domestic Investment (DIN):** by utilizing gross fixed capital formation (% of GDP) as a proxy for domestic investment, DIN is used as an explanatory variable. As an essential component of increasing economic growth and its impact on multiple economic variables, domestic investment is of great significance to global economies (Adams, 2009).

**Government Expenditure (GE):** The government expenditure (GE) variable represents the total amount of final consumption expenditure in the government (annual growth rate). Generally speaking, government expenditures are defined as final general consumption. In Findley, 2018 and Adams, 2009, researchers often used this measure as a proxy for government expenditure. The government sector in competitive markets is far less efficient than the private sector, according to several economists and noted that government outputs are normally more expensive than those produced by the private sector, in part because of centralized decision-making, a lack of profit motivation, and a lack of competitive motivation.

**Infrastructure (INFST): Infrastructure** Is measured as fixed telephone subscriptions (per 100 people). There have been numerous studies using this variable, including Findley, 2018, and Najat & Masoud (2014). A stronger economy must have better infrastructure so that the country can grow faster and integrate with the rest of the world. There has been a great deal of attending paid to the impact of infrastructure development on output since the contribution of Aschauer (1989), who showed a major contribution of public investments to U.S. growth. This variable is foreseen to have an affirmative impact on Asian economies in this study.

**Exchange rate (EX):** To determine how economic growth uncertainty influences growth, we use this variable in the model. This variable has been used to measure the impact on economic growth by several previous researchers, including Anetor et al. (2020), and Fraj et al. (2018). Despite the fact that a stable exchange rate promotes economic growth, most countries' exchange rates are unstable for various reasons. As an outcome, the coefficient of the variable is projected to be negative for this study.

### 3.3. Descriptive Statistics

Description statistics (name, mean, standard deviation (SD), minimum and maximum values) from 1995 to 2021 are presented in the following table. In accordance with this, **Table 2** presents the descriptive statistics of the variables used in this empirical study. The variables noted in column 1 are GDP per capita growth rate, and foreign direct investment (FDI), which proxied for inflows of FDI (% of GDP), inflation, domestic investment, trade openness, government expenditure, population growth, and unemployment rate, exchange rate and infrastructure. Moreover, the descriptive statistics indicate that GDP per capita growth varies greatly from −38.5% to 49.03%. Similarly, this study's main variable of interest (targeted variable) foreign direct investment which, proxied by inflows of FDI (% of GDP), varies from −37.13% to 279.347%.

**Table 2.** Descriptive statistics.

| Variables | Observation | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| GDPPG | 1,189 | 3.914127 | 6.486912 | −38.56172 | 49.03164 |
| FDI | 1,185 | 5.5846 | 14.6728 | −37.1726 | 279.3473 |
| INFL | 1,124 | 12.1821 | 27.5807 | −16.11733 | 411.7596 |
| DIN | 1,124 | 25.75157 | 9.152717 | 0.7344631 | 70.33143 |
| TRO | 1,099 | 82.46376 | 73.82147 | −45.52468 | 442.62 |
| GE | 1,026 | 9.907011 | 15.26671 | −75.98516 | 93.096 |
| POG | 1,188 | 1.643278 | 1.949737 | −6.852118 | 19.36043 |
| UNEMPL | 1,213 | 5.999825 | 4.227214 | 0.102 | 21.206 |
| lnEX | 1,177 | 3.8558 | 2.9374 | −3.0824 | 10.6454 |
| INFST | 1,206 | 66.1512 | 57.5185 | 0 | 319.4263 |

**Note:** FDI, lnEX, INFST stand for foreign direct investment, exchange rate, and infrastructure respectively, whereas, the rest variables are explained before.

### 3.4. Pre-Estimation Tests

#### 3.4.1. Correlation Matrix

In correlation analysis, variables are compared to determine the degree to which they are linearly related. By observing the correlation coefficient table, we can determine how the variables in our model are related, how strong they are, and in what directions they are directed. There is a positive correlation coefficient of 1 to a negative correlation coefficient of 1. There is a strong correlation between the numbers 1, −1, and 0, respectively, whereas there is no correlation between the numbers 1, −1, and 0. When a variable moves in the same direction, then it is considered a positive correlation; on the other hand, when a variable moves in the opposite direction, it is considered a negative correlation. All variables exhibit a statistically significant positive correlation with the dependent variable at a level of 5 percent significance according to Table 3. Furthermore, none of the correlation statistics exceeded 0.80, indicating that there is no linear relationship between the explanatory variables. It can be concluded from this that the explanatory variables are not multicollinearity. Additionally, all variables except inflation, exchange rates, and unemployment are positively related to dependent variables, as we can see from Table 3.

#### 3.4.2. Variance Inflation Factor (VIF)

This study also examined whether the model had a multicollinearity problem using variance inflation factor (VIF). Therefore, Table 4 illustrates the variance inflation factor (VIF). According to Table 4, the VIF ranges from 1.05 to 1.23, with a mean value of 1.11.

Therefore, a multicollinearity problem does not exist in the regression. It should also be noted that the inverse of the VIF (1/VIF) should be greater than 0.2 in order to confirm the absence of multicollinearity. In any case, each variable in the regression had a value greater than 0.2 in the regression (Table 4). A similar result can be found in Table 4, which reveals an inverse variance inflation factor (VIF) range of 0.816 to 0.951 within the acceptable range.

**Table 3.** Correlation matrix of the variables.

| Variables | GDPPG | FDI | INFL | DIN | TRO | GE | POG | UNEPL | lnEX | INFST |
|---|---|---|---|---|---|---|---|---|---|---|
| GDPPG | 1.000 | | | | | | | | | |
| FDI | 0.0761 | 1.0000 | | | | | | | | |
| INFL | −0.1414 | −0.0325 | 1.0000 | | | | | | | |
| DIN | 0.0742 | 0.0260 | −0.0940 | 1.000 | | | | | | |
| TRO | 0.0973 | 0.3077 | −0.0672 | 0.0303 | 1.000 | | | | | |
| GE | 0.0786 | −0.0376 | 0.1514 | 0.1216 | 0.0351 | 1.000 | | | | |
| POG | 0.1205 | −0.0560 | 0.0093 | 0.0690 | 0.0050 | 0.1392 | 1.0000 | | | |
| UNEPL | −0.0353 | 0.0929 | 0.0783 | −0.1866 | −0.0823 | 0.0102 | −0.1475 | 1.000 | | |
| LnEX | −0.0636 | −0.0193 | −0.0007 | −0.0580 | −0.1440 | 0.0060 | −0.1688 | −0.0636 | 1.0000 | |
| INFST | 0.0778 | 0.1778 | −0.1358 | 0.0958 | 0.2924 | −0.0483 | 0.0131 | −0.0778 | −0.1173 | 1.0000 |

**Table 4.** Variance Inflation Factor (VIF).

| Variable | VIF | 1/VIF |
|---|---|---|
| TRO | 1.23 | 0.8161 |
| FDI | 1.15 | 0.8733 |
| INFST | 1.14 | 0.8789 |
| UNEPl | 1.11 | 0.9002 |
| lnEX | 1.10 | 0.9059 |
| GE | 1.08 | 0.9234 |
| POG | 1.08 | 0.9272 |
| DIN | 1.06 | 0.9398 |
| INFL | 1.05 | 0.9514 |
| **Mean VIF** | **1.11** | |

### 3.4.3. Unit Root Test Results

**First-Generation Unit Root Test Results**

In order to estimate the reliability of a regression, it is crucial to confirm the stationarity of each series before performing the regression. Due to the fact that the study period (T) is relatively short, unit root testing is essential since the level form of some variables isn't stationary. It also prevents non-stationary series from producing spurious results during estimation when using unit root tests. Therefore, several approaches to unit root testing were used in this study. Stationarity was tested using various tests, including Fisher-ADF and Phillips-Perron-Fisher tests (Table 5). These two approaches to unit root tests are only effective for unbalanced systems due to the fact that they are both appropriate. Accordingly, to investigate the effect of FDI and other explanatory variables on economic growth in Asian, the stationarity position of all series in the study was determined. Two unit root tests, namely the Fisher-ADF and Phillips-Perron-Fisher tests, were carried out to validate the stationary of the series in this study. In all tests, the alternative hypothesis of stationary is tested against the null hypothesis of non-stationary.

The growth of GDP per capita, FDI, inflation (INFL), exchange rates (EXR), domestic investment (DIN), government expenditure (GE) and unemployment (UNEPl) are all stationary at a level form. On the other hand, trade openness (TRO), and population growth (POG), and infrastructure (INFST) are stationary at first-difference. Thus, the null hypothesis, which states that series are not stationary (has a unit root) is rejected. This suggests that all variables are stationary. As a result, this empirical chapter does not contain any variables that are non-stationary at the first difference.

**Second Generation Unit Root Tests**

It is possible to relax the hypothesis of cross-sectional independence by using the second generation of unit root tests. The challenge lies in identifying these cross-sectional dependencies. Additionally, all of the first-generation panel unit

**Table 5.** ADF and PP-fisher unit toot test results.

| Variables | Levels | | | |
|---|---|---|---|---|
| | Constant | | Constant and trends | |
| | ADF-Fisher statistics | *P*-values | ADF-Fisher statistics | *P*-values |
| GDPPG | 695.0669*** | 0.0000 | 516.0356*** | 0.0000 |
| FDI | 544.6626*** | 0.0000 | 368.9513*** | 0.0000 |
| INFL | 883.8787*** | 0.0000 | 727.9237*** | 0.0000 |
| DIN | 312.3602*** | 0.0000 | 152.9040*** | 0.0000 |
| TRO | 273.9609*** | 0.0000 | 106.7530 | 0.0848 |
| GE | 673.8677*** | 0.0000 | 554.5450*** | 0.0000 |
| POG | 297.8407*** | 0.0000 | 110.0679 | 0.0558 |
| UNEPl | 269.4524*** | 0.0000 | 115.5682*** | 0.0360 |
| lnEX | 526.6889*** | 0.0000 | 393.9678*** | 0.0000 |
| INFST | 169.3793*** | 0.0000 | 56.7533 | 0.9976 |
| **First Difference** | | | | |
| **Variables** | **Constant** | | **Constant and trends** | |
| | ADF-Fisher statistics | *P*-values | ADF-Fisher statistics | *P*-values |
| D.GDPPG | 959.5716*** | 0.0000 | 857.0709*** | 0.0000 |
| D.FDI | 890.7320*** | 0.0000 | 743.8197*** | 0.0000 |
| D.INFL | 879.9896*** | 0.0000 | 800.4916*** | 0.0000 |
| D.DIN | 579.8322*** | 0.0000 | 328.0424*** | 0.0000 |
| D.TRO | 636.0322*** | 0.0000 | 450.7265*** | 0.0000 |
| D.GE | 829.4746*** | 0.0000 | 711.3134*** | 0.0000 |
| D.POG | 685.1209*** | 0.0000 | 505.4675*** | 0.0000 |
| D.UNEPl | 620.9044*** | 0.0000 | 466.7251*** | 0.0000 |
| D.lnEX | 462.4079*** | 0.0000 | 217.1158*** | 0.0000 |
| D. INFST | 460.9620*** | 0.0000 | 213.0966*** | 0.000 |
| Variables | **Levels** | | | |
| | **Constant** | | **Constant and trends** | |
| | Phillips-Perron-Fisher statistics | *P*-values | Phillips-Perron-Fisher statistics | *P*-values |
| GDPPG | 589.7840*** | 0.0000 | 516.0356*** | 0.0000 |
| FDI | 389.4080*** | 0.0000 | 368.9513*** | 0.0000 |
| INFL | 783.2837*** | 0.0000 | 727.9237*** | 0.0000 |
| DIN | 160.1961*** | 0.0000 | 152.9040*** | 0.0000 |
| TRO | 109.0913 | 0.0633 | 106.7530 | 0.0848 |
| GE | 650.0415*** | 0.0000 | 554.5450*** | 0.0000 |
| POG | 166.8725*** | 0.0000 | 110.0679 | 0.0558 |
| UNEPl | 127.0189*** | 0.0062*** | 115.5682** | 0.0360 |
| LnEX | 478.7562*** | 0.0000 | 393.9678*** | 0.0000 |
| INFST | 53.9536 | 0.9991 | 56.7533 | 0.9976 |

Continued

| First Difference | | | | |
|---|---|---|---|---|
| Variables | Constant | | Constant and trends | |
| | Phillips-Perron-Fisher statistics | *P*-values | Phillips-Perron-Fisher statistics | *P*-values |
| D.GDPPG | 1714.6504*** | 0.0000 | 1418.0794*** | 0.0000 |
| D.FDI | 388.8405*** | 0.0000 | 370.9968*** | 0.0000 |
| D.INFL | 792.3014*** | 0.0000 | 741.2310*** | 0.0000 |
| D.DIN | 156.2064*** | 0.0000 | 143.7850*** | 0.000 |
| D.TRO | 112.8766** | 0.0000 | 112.6498** | 0.000 |
| D.GE | 679.1523*** | 0.0000 | 580.7771*** | 0.0000 |
| D.POG | 154.4857*** | 0.0000 | 106.3666*** | 0.0000 |
| D.UNEPl | 126.4197*** | 0.0000 | 118.6576*** | 0.0000 |
| D.lnEX | 459.0485*** | 0.0000 | 387.3724*** | 0.0000 |
| D.INFST | 109.8763*** | 0.0000 | 97.8893*** | 0.0000 |

**Source:** Author's computation. ***, ** and * stands for stationarity at a 1%, 5% and 10% significance level.

root tests discussed in the previous section are based on the postulation that cross-sectional individuality exists. There is a substantial amount of cross-sectional dependency in macroeconomic time series. The results of first-generation panel unit root tests may not consider cross-sectional dependence, so it is crucial to conduct second generation panel unit root tests. Based on Table 6, all variables are stationary at the level form except for trade openness (TRO) and unemployment rate (UNEPl). Conversely, the empirical variables addressed in this chapter, however, are all stationary after taking into account first differences.

Table 6. Pesaran's CADF test results.

| Variables | Levels | | | |
|---|---|---|---|---|
| | Constant | | Constant and trends | |
| | Z[t-bar] | *P*-values | Z[t-bar] | *P*-values |
| GDPPG | −9.493*** | 0.0000 | −7.714*** | 0.0000 |
| FDI | −6.232*** | 0.0000 | −5.137*** | 0.0000 |
| INFL | −7.182*** | 0.0000 | −5.467*** | 0.0000 |
| DIN | −4.224*** | 0.0000 | −2.253*** | 0.0000 |
| TRO | 0.314 | 0.623 | −1.341* | 0.090 |
| GE | −6.158*** | 0.0000 | −5.698*** | 0.0000 |
| POG | −2.213*** | 0.001 | −2.765 | 0.001 |
| UNEPl | 3.100 | 0.999 | 1.752 | 0.960 |
| LnEX | −1.271 | 0.102 | −2.932*** | 0.002 |
| INFST | −1.407 | 0.080 | −1.170 | 0.121 |

**Continued**

| Variables | First Difference | | | |
|---|---|---|---|---|
| | Constant | | Constant and trends | |
| | Z[t-bar] | *P*-values | Z[t-bar] | *P*-values |
| D.GDPPG | −19.669*** | 0.0000 | −16.313*** | 0.0000 |
| D.FDI | −17.687*** | 0.0000 | −14.342*** | 0.0000 |
| D.INFL | −17.737*** | 0.0000 | −14.168*** | 0.0000 |
| D.DIN | −10.709*** | 0.0000 | −8.368*** | 0.0000 |
| D.TRO | −12.715*** | 0.0000 | −9.726*** | 0.0000 |
| D.GE | −17.369*** | 0.0000 | −14.513*** | 0.0000 |
| D.POG | −3.593*** | 0.0000 | −3.685*** | 0.0000 |
| D.UNEPl | −7.782*** | 0.0000 | −6.407*** | 0.0000 |
| D.lnEX | −6.729*** | 0.0000 | −4.371*** | 0.0000 |
| D.INFST | −8.695*** | 0.0000 | −6.635*** | 0.0000 |

*indicates 10%, ** 5%, *** 1%. Source: Author's design based on the data.

## 4. Estimation Techniques

This study employs balanced panel data 45 Asian countries to canvass the outcome of foreign direct investment on Asian economies from 1995 to 2021. There are three main approaches to regression analysis of panel data for this study. The use of panel data also allows researchers to isolate dynamic effects that cannot be detected by cross-sectional analyses by controlling for heterogeneity across individuals (firms, countries, etc.). It is possible to model behavioral differences more easily using panel data sets than cross-sectional data because they allow researchers to model differences across individuals. The model is based on the following framework:

$$Y_{it} = V'_{it}\beta + \delta'_{it}\theta + \varepsilon_{it} \tag{6}$$

$$Y_{it} = V'_{it}\beta + \varphi_i + \varepsilon_{it} \tag{7}$$

There are $Y_{it}$ regressors in $V'_{it}$ not with a constant term. The individual effect or heterogeneity, denoted as $\delta_i$, it consists of one or more observable or unobservable variables, as well as a constant term (time-invariant). The entire model can be fitted using least squares fit if $\delta_i$ it can be assumed that the model is linear for each individual in the datasets. As is the case with most applications, the majority of $\varphi_i$ applications are unseen, which poses a challenge (Greene, 2012: pp. 343-398).

### 4.1. The Pooled Ordinary Least Square Model

Using ordinary least squares offers reliable and effective estimates for the common $\alpha$ and the slope vector $\beta$ if $\delta_i$ only has a constant term (Greene, 2012). As there is no special technique required in order to perform the pooled (OLS), it is very simple and straightforward. All entities are assumed to behave in the same manner over time. The disadvantage of this approach is that it does not consider the differences in time variation among entities. In addition, the time effect and country heterogeneity are ignored, which can result in erroneous conclusions. A variety of differences exist within entities, which can be taken into account by the Random Effect (RE) and the Fixed Effect (FE) methods. As a result, the pooled (OLS) approach is not as effective as the method of (RE) or (FE) in taking into account changes in time (entity-specific and time-specific variables) as well as variability within particular countries.

## 4.2. Fixed-Effect (FE) Model

When $\delta_i$ remains unseen and exhibits a correlation with $X_{it}$, the least squares estimator of $\varphi_i$ becomes biased, leading to conflicting results due to an omitted variable. This time around, the model is:

$$Y_{it} = V_{it}'\beta + \theta_i + \varepsilon_{it} \tag{9}$$

where, $\theta_i = \delta_i'$ embodies all the observable effects and specifies an estimable conditional mean. These fixed effects approach takes, $\theta_i$ to be a group-specific constant term in the regression model. It should be noted that the term "fixed" as used here signifies the correlation of $\varphi_i$ and $V_{it}$ not that $\varphi_i$ non stochastic. The fixed-effect approach assumes a correlation between the country-specific effect ($\varphi_i$) and the predictors $E\left(\varphi_i / V_{it} + \neq 0\right)$. According to this model, time-invariant characteristics will be unique to each country and will not be correlated with any other characteristic of the country. In a panel model with time-invariant variables but not country-variant variables, the fixed effect regression technique accounts for omitted variables. The fixed-effects method controls for time-invariant individual-specific variables that vary across countries but don't change over time.

Due to this, the fixed-effect method is able to account for your time-invariant differences between the individual entities, so no omitted variable bias is introduced into the fixed-effect coefficient. A fixed-effect regression model resulting in different intercepts for different countries is calculated. After that, the binary intercepts are used to acquire the country-specific, time-invariant causes of each leave-out variable. An endogeneity problem and biased coefficient estimate are likely to occur with variables that are not observed as entity-specifics or time-invariant (Ci). The method resolves this problem using entity-demean. A two-step approach to addressing endogeneity uses a subtraction method for each variable, and a projection method for entity-demonised variables. By eliminating the entity-specific effect from the model, the entity-demean process results in a mean value of the error term (i) that matches the value of the country-specific error terms (ii) since errors do not change over time. Heteroscedasticity in panel regression models can be handled using (FE) estimation, which assumes differing error terms across countries. In dissimilar pooled (OLS) estimation, fixed effects are controlled for in order to address the bias that occurs when omitted variables are not included (Greene, 2012).

### 4.3. The Random Effect (RE) Model

If the undetected single heterogeneity, nevertheless, developed, can be acknowledged to be unrelated with the included variables ( $E(\mu_i \setminus X_{it}) = 0$ ), then the model may be formulated as:

$$Y_{it} = X'_{it}\beta + E[Z'_i a] + \{Z'_i a - E[Z'_i a]\} + \varepsilon_{it} \tag{10}$$

$$Y_{it} = X'_{it}\beta + a + \mu_i + \varepsilon_{it} \tag{11}$$

Assumes a random alteration from one entity to another and that it is unrelated to variables within the model. As part of the Random Effect conceptualization, nominative determinations of those undetected variables must be included in the regression model, even though the variable determined by them is uncorrelated with the explanatory variables. The RE, therefore, utilizes the entirety of the data available and generates impartial parameter estimates and the lowest standard errors, but an omitted entity-specific variable bias would result from the unnoticed time-invariant variable. (RE) includes variables that are time-invariant, which makes it more advantageous than (FE). An intercept is used to absorb the time-invariant variables in the (FE) specification. Random-effects assume that *i* is a group-specific random element, much like (except that, for each group, a single entertainer appears identically in each regression period A random effect or a fixed effect depends more on whether the unnoticed individual effect correlates to the regressors in the model than on their stochasticity (Greene, 2012: pp. 343-398). In order to determine whether the FE or RE specification is better, the Hausman test is used for the country-specific effect to be correlated with the regressors, a Hausman specification test must be carried out. A null hypothesis is that the country-specific effect is uncorrelated with the regressors, whereas the alternate hypothesis is that the country-specific effect is correlated. In conclusion, the null hypothesis suggests that random effects are preferred, whereas fixed effects are supported by the alternative hypothesis.

#### Pooled OLS Regression Results

We can see in **Table 7** column (2) that at a 1 percent significance level, the regression model fits the data well with F values with a *P*-value of 0.00000. The results of all variables in column 1 are presented in **Table 7**, which is similar to model 2. Therefore, variables such as foreign direct investment (FDI), trade openness (TRO), government expenditures (GE), domestic investment (DIN), population growth (POG), and infrastructure (INFST) are expected to have positive coefficients. In contrast, inflation, unemployment, and exchange rate have negative coefficients. However, the chief findings of this study mostly depend on the consequence of model 2 of **Table 14** even though all the variables have the expected sign.

Table 7. OLS estimation results.

| | (Model-1) OLS without robust | (Model-2) OLS with robust |
|---|---|---|
| Variables | GDPPG | GDPPG |
| FDI | 0.0362*** | 0.0362*** |
| | (0.00682) | (0.00608) |
| INFL | −0.495*** | −0.495*** |
| | (0.128) | (0.146) |
| DIN | 0.0330 | 0.0330* |
| | (0.0219) | (0.0190) |
| TRO | 0.00280 | 0.00280 |
| | (0.00300) | (0.00267) |
| GE | 0.0410*** | 0.0410 |
| | (0.0129) | (0.0267) |
| POG | 0.5178*** | 0.5178*** |
| | (0.1297) | (0.1465) |
| UNEPL | −0.0786* | −0.0786* |
| | (0.0459) | (0.0413) |
| lnEX | 0.0813 | 0.0813 |
| | (0.0658) | (0.0627) |
| INFST | 0.00662 | 0.00662 |
| | (0.00619) | (0.00681) |
| Constant | 128.7 | 128.7 |
| | (124.3) | (134.4) |
| Observations | 992 | 992 |
| R-squared | 0.158 | 0.158 |

Standard errors in parentheses; *** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$.

### 4.4. Post-Estimation Diagnostic Tests

Following pooled regression (OLS), we performed the following diagnostic tests to determine if estimation results were biased. In this study, four tests were used: Heteroscedasticity, Wald test, residual normality, and Hausman specification.

#### 4.4.1. Heteroscedasticity

It is assumed that (OLS) will have constant variances of the error term, however, this assumption does not hold for panel regression analyses due to unseen variables that differ across countries yet remain constant over time. It is impossible for heteroscedasticity to maintain the variance of unobservable error over time. It is possible to specify the variance based on independent variables in the following way:

$$Var\left(\theta_{it} X_{it}\right) = y^2 h\left(X_i\right) \tag{12}$$

There is no impact of heretoscadistics on the unbiasedness of (OLS) but it minimizes parameter estimations and causes variances in efficiency. Several tests are performed to determine whether heteroscedasticity exists, including the Breusch-Pagan and White's tests. In fact, the problem of heteroscedasticity is common in panel data. (VCE) option is used when using STATA to control the standard error of heteroscedasticity (correlation between cross-sections). In panel data, there is also expected to be serial correlation within an entity. As a result, we can control serial correlation within the entity by using the cluster option.

**Breusch-Pagan test for heteroscedasticity**

In this model, we assume residuals follow a normal distribution with the same variance irrespective of the level of the predictor. This premise is termed homoscedasticity. It follows that residuals are not heteroscedastic once this assumption is violated. It is at this point that the regression results become unreliable. Using the Breusch-Pagan test, a regression error's variance is checked for heteroskedasticity, whether independent variables influence the error variance (Table 8).

Table 8. Outputs of (B-P) test for heteroskedasticity.

| Type of Test | Chi-Squares | *P*-Value | Remarks |
|---|---|---|---|
| Breusch-Pagan/Cook-Weisberg test for heteroskedasticity | 11.67 | 0.0006 | Existences of heteroskedasticity |

Using the (B-P) test, the *P*-value for the latest results is less than 5 percent, which confirms the existence of heteroscedasticity. It is evident that the model does not provide sufficient results. As a result, a robust estimate of the standard errors is useful in controlling heteroskedasticity in the random-effects model.

### 4.4.2. Ramsey RESET Test

Using the Ramsey reset test, researchers can determine whether the model is over-identified. It is therefore indicative that the model has been over-identified when the p-value is significant. Table 9 clearly demonstrates the model's over-identification as shown in the result.

Table 9. Ramsey reset test for over identification of the model.

| Type of Test | Chi-Squares | *P*-Value | Remarks |
|---|---|---|---|
| Ramsey RESET test | 2.62 | 0.0496 | Existences over identification |

### 4.4.3. Test for Residual Normality

The regression estimation results may be impacted by extreme data values (outliers). In order to determine whether residuals are outliers or not, a residual normality analysis is carried out. By validating the model, and by inferring from it, the residuals must be normal. Despite this, large panel data regression analysis, for which the normality condition is relaxed, may not be problematic (Hossain & Rahman, 2021).

#### 4.4.4. Modified Wald Test

To determine if the model contains a group-wise heteroscedasticity problem, the Modified Wald test is performed. There is a possibility that heteroscedasticity in the estimates can cause bias in the standard errors (**Table 10**).

**Table 10.** Group-wise heteroscedasticity test result.

| FE model with independent variables | chi2 (40) | Prob > chi2 | Remarks |
|---|---|---|---|
| GDPPG FDI INFL DIN TRO GE POG UNEPl lnEX INFST | 6.4e+05 | 0.0000 | There is heteroscedasticity in the model |

Also, it is arguable to assume that underdeveloped countries are powerfully interconnected. In this way, developing countries are highly vulnerable to the financial and economic shocks of their neighbors. In light of this, most scholars agree that cross-sectional dependence (CSD) occurs when there is a large panel containing data from 20 - 30 years ago (Baltagi, 2008). This empirical chapter deals with this issue by using a test developed by Pesaran (2004). We can see from **Table 11** that Pesaran's test for cross-sectional independence was used to determine whether the panel is independent across sections. Based on the results of Pesaran's cross-sectional independence test, we can conclude that the data are cross-sectionally dependent in the sense that its p-value is greater than zero. As a solution to this problem, this empirical chapter employed the VCE option in the principal finding of the study (by utilizing the VCE option, the cross-sectional dependence was corrected).

#### 4.4.5. Pesaran's Test for Cross-Sectional Independence

It has been suggested that cross-sectional dependence is a phenomenon that occurs in macropanels containing data over a period of 20 to 30 years (Baltagi, 2008, as cited by Hossain & Rahman, 2021). A cross-sectional independence test by Pesaran (2004) was used to test whether the panel units were independent across time. Thus, as one can see from **Table 11**, there is a cross-sectional in dependence in the data.

**Table 11.** Pesaran's test for cross-sectional independence result.

| Test | Statistics | *P*-value | The average absolute value of the off-diagonal elements | Remarks |
|---|---|---|---|---|
| Pesaran's test of cross-sectional independence | 3.158 | 0.0458 | 0.346 | Cross-sectional dependence in the data |

It is evident from Pesaran's cross-sectional independence test that cross-sectional dependence exists in the data. (The cross-sectional dependence has been corrected using the vce option.)

#### 4.4.6. Wooldridge First-Order Serial Correlation Test

Serial correlation makes the coefficient standard errors smaller and the R-squared larger than they would actually be, since it reduces the standard errors and increases the R-squared. The serial correlation of random error terms describes the relationship between them over time for a given entity. It is said that the error terms are autocorrelated if the correlation coefficient for $(i, j) = 0$ when it is for $i \neq j$. When a model is mis-specified, the data are manipulated, and events are spatially arranged, autocorrelation can be induced. Depending on whether the model has a country-specific time-invariant effect, longitudinal data might result in autocorrelation. Clearly, serial correlation exists in the sources of persistence, making OLS parameter estimates unsuitable for unbiased linear estimation. A Wooldridge first order serial correlation test was conducted, and the results are shown in Table 12. The test statistics for the first-order serial correlation test are 11.583, and the *P*-value is 0.0016. In the fixed-effect model, the option cluster is used to correct this serial correlation issue.

Table 12. Result of serial correlation test.

| Fixed Effects Model with main dependent variables | Woordridge test for autocorrelation in panel data Ho: No first-order autocorrelation | | Remarks |
|---|---|---|---|
| | Statistics | *P*-Value | |
| FDI INFL DIN TRO GE POG UNEPl lnEX INFST | 11.583 | 0.0016 | The model suffers from first-order autocorrelation… |

### 4.5. Model Specification

It has been necessary to conduct Wald test and Hausman specification tests in order to determine the best model for the data.

#### 4.5.1. Wald Test

Based on the Wald test, we determined whether the Pooled (OLS) model should be used for our data analysis. An OLS Pooled regression using 45 countries and N-1 dummies rejects the pooled (OLS) option with a P-value in combination with the fixed effect and random effect specifications when tests are conducted using test-parm. It was decided to use the Hausman test instead of the random effect specification (RE) in order to decide whether fixed effect or random effect were appropriate.

#### 4.5.2. Hausman Specification Test

As a result of the Hausman test, we can choose either a fixed effect or a random effect specification. It is possible to specify either fixed effects or random effects in the Hausman test. Hence, the country-specific effect is not correlated with the regressors, according to the null hypothesis. Regressors and country-specific effects are correlated, according to the alternate hypothesis. A random effect is the preferred method under the null hypothesis, while a fixed effect is preferred under the alternative hypothesis. The Hausman test rejected the random effect model with a P-value of 0.000. Then the alternative fixed effect specification model was selected. The outcome of the Hausman test confirms that the fixed effect model is suitable for estimating the principal finding of this empirical chapter's scrutiny, as Table 13 illustrates.

Table 13. Result of the Hausman test.

| | Coefficients |
|---|---|
| Chi-square test value | 14.17 |
| *P*-Value | 0.000 |

### 4.6. Fixed Effect Regression Results

The intention of this empirical chapter is to estimate the impinging of foreign direct investment (FDI) on economic growth (GDPPG). According to the study, all explanatory variables are tested in the first column without including robust options. According to Hausman test results, we only focus on fixed effects with the regression, even though we included the random effect model. According to Hausman test results, we only focus on fixed effects with the regression, even though we included the random effect model. After deciding to use the fixed-effect model, this empirical chapter only focuses on the fixed-effect model with robustness options. It follows that, even though they become significant at different levels of significance, including foreign direct investment (FDI), which is proxied aside foreign direct investment inflows (% of GDP), government expenditures (GE), population growth (POG), and unemployment rate are statistically significant.

As a result, the main empirical variable, foreign direct investment, positively impacted economic growth and statistical significance at the 5 percent significance level, while other factors held constant. The result demonstrates that the more FDI that flows into a region, the more job opportunities are created and the more opportunity to generate foreign currency is created. From Table 14, we can see that the inflation rate (INFL) is statistically significant at the 1% significance level; however, it negatively impacts economic growth during the study period. According to the results, Asian economic growth was negatively affected by inflation between 1995 and 2021. It is not surprising that economic growth fluctuates when there is a high inflation rate in any region; it will sometimes decrease rather than increase occasionally, depending on inflation rates.

Economic growth in Asian countries is also positively affected by government expenditure (GE), another key control variable. The results show that an increase of one unit in government expenditures (GE) results in an increase of 0.0599 in economic growth. Moreover, in contrast to the above, control variables, government expenditure is statistically significant at 1% of significance level. Furthermore, the result in column 2 also reveals the positive contribution of population growth (POG) on economic growth. Accordingly, a 1 unit increment in population growth causes 0.699 units of economic growth to increase. In contrast to other control variables, population growth is statistically significant at 1% significance level.

**Table 14.** Fixed effect result.

| VARIABLES | (Model-1) FE model without robust | (Model-2) FE model with robust |
|---|---|---|
| | GDPPG | GDPPG |
| FDI | 0.0711*** | 0.0707** |
| | (0.0248) | (0.0332) |
| INFL | −0.0358*** | −0.0348*** |
| | (0.00721) | (0.00604) |
| DIN | 0.0419*** | 0.0322 |
| | (0.0120) | (0.0197) |
| TRO | 0.0207*** | 0.000561 |
| | (0.00777) | (0.00958) |
| GE | 0.0477*** | 0.0599*** |
| | (0.0181) | (0.0211) |
| POG | 0.566*** | 0.699*** |
| | (0.131) | (0.258) |
| UNEPl | −0.432*** | −0.324*** |
| | (0.0868) | (0.0805) |
| lnEX | −0.436 | −0.187 |
| | (0.435) | (0.468) |
| INFST | 0.0153*** | 0.00162 |
| | (0.00332) | (0.00737) |
| Constant | 6.373*** | 38.16 |
| | (2.015) | (126.5) |
| Observations | 992 | 992 |
| R-squared | 0.103 | 0.232 |
| Robust SE | NO | YES |
| Number of Country ID | 40 | 40 |
| Country-effect | Yes | Yes |
| Year fixed effect | Yes | Yes |

Standard errors in parentheses; ***$P < 0.01$, **$P < 0.05$, *$P < 0.1$.

## 4.7. Robustness Check

Based on the main findings, the robustness of the conclusions was confirmed. This empirical chapter excluded one control variable from its main findings in order to ensure the main findings. As a result, Infrastructure proxied by (INFST) was excluded from Table 15. From the table below, we can see that all variables are statistically evidential and have the expected sign. It is statistically significant that foreign direct investment (FDI) positively impacted the economic growth during the study period, which is consonant with the main aggregation of the study. The growth of economic activity is also positively influenced by control variables, like domestic investment (DIN), government expenditures (GE), and population growth (POG). A negative relationship exists between economic growth and variables such as inflation (INFL), exchange rates (EXC) and unemployment (UNEPL). However, statistically inflation rate (INFL) and unemployment are statistically significant and negatively impact economic growth (Table 15).

Table 15. Robustness of the finding (excluding infrastructure from the regression).

| VARIABLES | (Model-1)<br>FE Model without Robust | (Model-2)<br>FE Model with Robust |
|---|---|---|
| | GDPPG | GDPPG |
| FDI | 0.0580** | 0.0707** |
| | (0.0249) | (0.0334) |
| INFL | −0.0350*** | −0.0348*** |
| | (0.00728) | (0.00620) |
| DIN | 0.0377*** | 0.0323 |
| | (0.0121) | (0.0197) |
| TRO | 0.0160** | 0.000866 |
| | (0.00778) | (0.00931) |
| GE | 0.0487*** | 0.0600*** |
| | (0.0183) | (0.0212) |
| POG | 0.552*** | 0.695*** |
| | (0.132) | (0.256) |
| UNEPl | −0.439*** | −0.325*** |
| | (0.0877) | (0.0824) |
| lnEX | −1.092*** | −0.194 |
| | (0.415) | (0.462) |
| Constant | 8.695*** | 22.55 |
| | (1.972) | (99.96) |
| Observations | 992 | 992 |
| R-squared | 0.083 | 0.232 |
| Number of C_Id | 40 | 40 |
| Robust SE | NO | YES |
| Country-effect | Yes | Yes |
| Year fixed effect | Yes | Yes |

Robust standard errors in parentheses; *** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$.

### 4.8. Endogeneity Test

As far as we are aware, endogeneity problems cannot be solved using traditional regression techniques such as OLS, RE, or FE. In this study, the generalized method of moments (GMM) for two systems is engaged to address the endogeneity problem. We employ a GMM strategy to address endogeneity-related problems as opposed to employing alternative techniques for dealing with big N and short T. To handle the endogeneity problem, this study employed the GMM technique. Further, as **Table 16** illustrates, the main variable—foreign direct investment—represented by FDI is also significant, supporting the research's previous main finding.

Additionally, the estimation fit every diagnostic that was needed. Although AR (1) has a *P*-value of 0.000, it contraindicates first-order serial correlation, but AR (2) has a *P*-value of 0.480 that indicates second-order serial correlation is absent. For the purpose of demonstrating the validity of the instruments, the Hansen test was also applied. Hansen's *P*-value of 0.216 is significantly higher than 0.05, contraindicating that the regression doesn't over-identify its instruments. It is also appropriate and feasible that the instrument numbers in the regression be lower than the total number of countries examined, as recommended by Roodman (2009). In this study, the regression instrument numbers were lower berth than the total number of countries included (see **Table 16**).

**Table 16.** Estimation of two system GMM result.

| VARIABLES | GDPPG |
|---|---|
| GDPPG_lag1 | 0.135*** |
| | (0.0386) |
| FDI | 0.0343*** |
| | (0.0119) |
| INFL | −0.0351*** |
| | (0.00785) |
| DIN | 0.0329* |
| | (0.0194) |
| TRO | 0.00120 |
| | (0.00252) |
| GE | 0.0420*** |
| | (0.0125) |
| POG | 0.509*** |
| | (0.112) |
| UNEPl | −0.00704 |
| | (0.0384) |
| lnEX | −0.0959* |
| | (0.0524) |

**Continued**

| | |
|---|---|
| INFST | 0.00845 |
| | (0.00556) |
| Constant | 4.041*** |
| | (1.173) |
| **Diagnostics** | |
| Observations | 957 |
| Number of countries | 45 |
| Number of instruments | 40 |
| AR(1) *P*-value | 0.000 |
| AR(2) *P*-value | 0.480 |
| F-test | 14.97 |
| F-value | 0.0000 |
| Hansen-test (*P*-value) | 0.216 |
| Year Dummy | Yes |

## 4.9. Discussion

It investigates the effects of foreign direct investment (FDI) on economic growth (GDPPG) by conducting an empirical study. According to the study, all explanatory variables are tested in the first column without including robust options. According to Hausman test results, we only focus on fixed effects with the regression, even though we included the random effect model. As a result, the chief variable of powerfulness in this chapter is FDI, which is positively correlated with economic growth throughout the study period. As a result of foreign direct investment, gross domestic product per capita grows at a positive rate in Asia and is statistically significant. A positive correlation between FDI and output should be expected, as demonstrated by our current finding. A high financial system, a strong human capital stock, and good institutions are all necessary for FDI to promote economic growth, according to Acquah & Ibrahim (2019). However, our current result differs from Acquah & Ibrahim (2019), who discussed FDI inflows as beneficial to host countries' economies. As highlighted in the literature review:

In **Table 16**, coefficient 0.3222 indicates a positive correlation between domestic investment and economic growth. Increased domestic investment also leads to more local job opportunities, lower import costs, and an increase in capital formation, which all contribute to economic growth. By reducing unemployment and creating jobs, domestic investment serves a penitentiary function in enhancing economic growth, as advocated by Alege & Ogundipe (2013a). The results of this study support Bakari et al.'s (2019) finding that domestic investment approvals are positively correlated with economic growth, but contrary to Bouchoucha & Bakari (2019) and Belloumi & Alshehry's (2020) findings, domestic investment does not significantly and positively contribute to economic growth.

Study results showed that economic growth and government expenditures (GE) were positively correlated. Even though we are focusing on model 2, this variable is positively correlated with economic growth across all regression models. Accordingly, the result from the regression in **Table 16** indicated that government expenditure is situate affiliated to economic growth in Asian countries during the study period. This result has consistent with previous studies which have been done in different regions/countries. For instance, a study in China, Singapore, and Malaysia showed a positive relationship between economic growth and government expenditure. Further, the research presented in this paper indicates that government spending in China, Malaysia, and Singapore has a long-term impact on GDP growth. In contrast, previous studies (Alexiou & Sofoklis, 2009) contrast with the findings of our current study.

From model 2 of **Table 16**, a positive relationship can be observed between population growth and economic growth, suggesting that population growth encourages economic growth. The contribution of population growth to economic growth can be understood by examining how technological advancements and labor supply are stimulated as a result of population growth. A country with a large number of people is probable to rely more on innovative ideas because of the large number of people. In addition, this result is in correspondence with previous surveys that have examined the relationship between population growth and economic growth (Peterson, 2017; Ukpolo, 2002). Despite this, the current finding stands in contrast to findings in Dhenesh Raj and Agarwal (2014), which showed that population growth negatively affects economic growth.

Similarly, in **Table 16**, the study indicates a positive correlation between trade openness and economic growth. As a result, an economy develops as more foreign currency is generated by trade of goods and services, supporting the purchase of productive intermediates, and thereby promoting economic growth. By facilitating global market access, increasing competitiveness, and encouraging the import of raw materials and capital goods, Asian trade also promotes economic development. As reported by Bakari et al. (2019), trade openness had a positive and substantial effect on economic growth in Gabon and Mexico, respectively, according to their research. The impact of trade on economic growth has also been reported by Alhakimi (2018).

Our outcome bespeaks a negative and statistically fundamental relationship between economic growth and unemployment during the study period in Asia. Indeed, the coefficient is statistically significant at a 5 percent significant level. This consequence is unshakable in Okun's law, claiming a reciprocal kinship between economic growth and unemployment. It can be argued that the destructive correlation between the unemployment rate and economic growth indicates that economic growth is a valuable tool for reducing unemployment and achieving employment goals. Accordingly, **Table 16** examines the relationship between Asia's unemployment rate and real gross domestic product per capita based on a fixed-effect model. In order to investigate this relationship, a regression is estimated using an explanatory variable, the real GDP growth rate per capita, as well as the dependent variable, unemployment rate. The more unemployment is present in a region or country, the less economic growth is possible.

## 5. Conclusion and Recommendation

The real GDP per capita has been the focus of several studies, because it encapsulates the country's real GDP that is correlated with its population (See Findley, 2018; Aizenman et al., 2013; Macias & Massa, 2010; Adams, 2009). It is not well documented whether foreign direct investment (FDI) affects economic growth in Asia, according to the researcher. An examination of foreign direct investment's impact on the economic growth of 45 Asian countries over the period 1995-2021 was undertaken in this study, utilizing panel data from these countries.

To address the purpose of this study, we used the fixed effect model with the robust option. World Development Indicators from the World Bank were the only source of data for this study. The GDP per capita growth rate (GDPPG) was utilized as a dependent variable. Foreign direct investment (FDI), as the main variable, domestic investment (DIN), inflation rate (INFL), trade openness (TRO), unemployment (UNEPL), population growth (POG), government expenditure (GE), infrastructure (INFST) and exchange rate (EX) are used as control variables in this study. Based on Model 2 of **Table 16**, it is evident that foreign direct investment plays a significant role in economic growth. Unemployment, domestic investment, trade openness, government expenditure, infrastructure and exchange rate are the nearly crucial factors impulsive economic growth. Likewise, the robustness of the findings is verified by dropping one explanatory variable from the regression of the main findings. Moreover, the study used the system GMM approaches to handle the issue of endogeneity.

In light of the findings, we have come to the following conclusion. According to the findings, the impact of foreign direct investment (FDI) has an important positive impact on Asian countries. Furthermore, domestic investment, trade openness, population growth, government expenditure and infrastructure also had a positive impact on economic growth through the survey period in Asian countries. In contrast, the inflation rate and unemployment had a negative impinge on economic growth from 1995 to 2021.

Taking into account the findings of this empirical study, the following recommendations were made: first, this study demonstrates that governments in this region should continue amending policies which sustain the positive impact of foreign direct investment (FDI). Governments should continue to modify their policies based on the findings in this study which indicate that foreign direct investment (FDI) is positively correlated with economic growth. Secondly, this study discovered that inflation and unemployment negatively affected economic growth in this region, so governments should formulate macroeconomic policies that will minimize the effects of inflation and unemployment.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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