Scientific Research Publishing

American Journal of Industrial and Business Management, 2025, 15(1), 175-223
https://www.scirp.org/journal/ajibm
ISSN Online: 2164-5175
ISSN Print: 2164-5167

The Joint Impact of Industrialization and Foreign Direct Investment on Economic Growth: Evidence from Asian Countries

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How to cite this paper: Bahodurov, J., Khoshimov, V., & Alsaoub, N. (2025). The Joint Impact of Industrialization and Foreign Direct Investment on Economic Growth: Evidence from Asian Countries. *American Journal of Industrial and Business Management, 15,* 175-223.
https://doi.org/10.4236/ajibm.2025.151010

Received: December 13, 2024
Accepted: January 28, 2025
Published: January 31, 2025

Abstract

This study investigates the joint impact of industrialization and foreign direct investment (FDI) on the economic growth of Asian countries, using panel data from 1995 to 2021 (27 years) covering 45 Asian countries. In this study, panel unit root tests, descriptive statistics, multicollinearity, and other per-estimation and post-estimations have been carried out. Indeed, the main finding of this study is mainly on fixed effect regression with robust option. To overcome the issue of endogenity which may not be handled by POLS, RE and FE, this study used the two-system GMM. Furthermore, the study robustness checks were also employed to strength the main finding of the study. The findings of this study contribute to the growing literature on FDI and provide more compressive conclusions and recommendations on the joint impact of industrialization and FDI on economic growth, particularly in the context of Asian countries.

Keywords

Industrialization, Foreign Direct Investment, Economic Growth, Asian Countries

1. Introduction

Investments from foreign countries and industrialization are the major drivers of economic growth in developing countries. Additionally, these factors such as industrialization and foreign direct investment contribute to economic growth. A lot of governments' transformational policies are driven by a desire to develop the industrial sector since industrialization is regarded as one of the most important engines of economic growth (Wong & Yip, 1999). While Asian economies have achieved

industrialization, the statistics are not as impressive as those of Western countries. As Asia's manufacturing sector has grown in size over the last five decades, other important developments have occurred, such as the continent's growing share of global trade and urbanization.

As a whole, Asian countries have industrialized quicker than the worldwide mean during that time, but most startlingly, East Asia, which was marginally industrialized in 1970, has become the world's largest "core" industrial region by 2015. FDI can stimulate domestic investment, job creation, and economic growth (Hakimi & Hamdi, 2017; Agrawal, 2015; Herzer, 2010; Crespo & Fontoura, 2007). A UNCTAD investment report for 2019 shows that global/international FDI flows were weaker than expected in 2018, falling by 13 percent to $ 1.3 trillion. A significant amount of foreign direct investment has been directed towards developing countries throughout this pandemic crisis, particularly in 2020.

There is a large body of empirical literature that examines the separate roles of industrialization and foreign direct investment in economic development, but cross-country studies that examine their effects on economic growth are unusually limited in their attention to the complementarities between industrialization and foreign direct investment. The relationship between FDI and economic growth in Asian sub-regions has been explored in several empirical studies focusing entirely on Asian countries (Halliru et al., 2020; Aluko & Obalade, 2020; Ngepah et al., 2021). Due to the fact that most of the previous studies did not cover all of the countries in the region, it is difficult to draw general conclusions that will fully reflect the entire picture of the continent as a whole (Zekarias, 2016).

Similarly, several studies were conducted to assess the impact of industrialization and economic growth using time series as well as panel data in developing countries (see Tiwari & Mutascu, 2011; Wang et al., 2018). According to Attiah (2019), who examined the impact of manufacturing and service sectors on economic growth in developing countries, a similar observation was made. In addition, the results show that manufacturing shares are positively correlated with economic growth and that these effects are more pronounced in poorer countries where services are not correlated with growth. It was found in Kapoor's (2015) study on creating jobs in India's arranged manufacturing sector that were limiting product market regulations and infrastructure bottlenecks that contributed to poor manufacturing sector execution even though manufacturing growth fueled economic growth. The contributions of the study are:

- The study provides a more accurate picture of the region because it focuses on the impact that industrialization and foreign direct investment have on economic growth in Asian countries. Thus, as a result, the study offers significant implications for the entire continent of Asia.
- It demonstrates how industrialization and foreign direct investment can significantly impact Asian economic growth, the research comes up with suggestions for attracting foreign direct investment. In this way, the policy suggested can be used by individual countries to modify their own policies for

industrialization and foreign direct investment to increase their economic development.

- Study evaluates joint impact of industrialization and foreign direct investment (MFVA * FDI), and it makes a valuable contribution to existing literature. As long as the joint impact of industrialization, which is proxied by manufacturing value added (MFVA) and foreign direct investment (MFVA * FDI) is considered in this study, it will fill the existing gaps in the literature, analytics and readers in developing nations in general and Asia specifically. The contribution of this study will be important in this case as such an idea is not explicitly mentioned or addressed in previous studies.

All of the relevant documents have examined in detail the effects of industrialization on economic growth and foreign direct investment on economic growth in developing countries in general and Asian countries in particular.

The study showed that the joint impact of **Foreign Direct Investment (FDI)** and **Industrialization**, as well as their interaction, involves illustrating how these factors influence economic outcomes both independently and in combination.

As result showed, **FDI alone** brings foreign capital, technology, expertise, and market access.

It can stimulate economic growth by improving productivity, creating jobs, and fostering innovation. However, the effectiveness of FDI often depends on local conditions, such as infrastructure and workforce skills.

As well industrialization alone reflects the structural transformation of an economy from agriculture to manufacturing and other high-value activities. It leads to job creation, higher incomes, and enhanced export capacity. However, industrialization requires substantial investment, infrastructure, and technology, which FDI can provide.

The **interaction term** in the model (FDI * Industrialization) captures the **joint impact** or **synergy** between these two factors. Positive interactions between the benefits of FDI are amplified in economies with a higher level of industrialization, like an established industrial base, which allows FDI to integrate more effectively into supply chains, enhancing productivity and exports.

It is shown in study that the joint impact of FDI and industrialization is greater in economic growth than the sum of their individual effects. Policies that promote industrial development (e.g. infrastructure, workforce training) can enhance the returns from FDI.

Therefore, the aim of this study is to examine the joint impact of foreign direct investment and industrialization of Asian countries between 1995 and 2021.

2. Literature Review

It has been empirically proven that industrialization (manufacturing industry) is related to economic growth in developing states in general and in Asian countries specifically. While there is a mixed evidence base in the literature, several empirical

studies support the assertion that industrialization increases economic growth. Literature from more recent times tends to emphasize the importance of the service sector rather than industrial development in terms of developing the economy. Recent studies also suggest that developing countries rely more on industry for growth than high-income countries.

Even though India's organized manufacturing sector displays economic growth driven by manufacturing growth, Kapoor (2015) states that restrictive market regulations and infrastructure bottlenecks harm its performance. According to Herman (2016), manufacturing played an important role in Romania's economy for over two decades following industrialization. As a result, Romanian industry and economy as a whole remained largely manufacturing-based after the intensity of the deindustrialization process decreased. As evidenced by Su et al. (2019), whose study examines manufacturing's role in middle-income development, this view is supported. According to the study, manufacturing, together with all other sectors, including the service sector, continues to drive economic growth for middle-income economies during the middle-income phase. The study focusing on the link between economic growth and industrialization examines the contribution of industrialization to economic growth and the results show that natural gas and crude petroleum, solid mineral and manufacturing, significantly have the positive impact on economic growth additionally it recommends that creating an interesting environment to achieve best performance of the industrial sector (Angahar & Kida, 2020). Using different econometrics methods, the impact of industrialization on economic growth was examined and in both long and short-run the empirical results positively reveals an increase in industrialization associated with economic growth (Bokosi, 2022). In Africa, Thirlwall and Wells (2003) studied 45 countries.

As a conventional rule, the first definition above should be used in an article of this nature. According to O'Sullivan and Sheffrin (2007), way to industrialize the country is closely connected with societal and economical differences which turn people mind from agrarians into industrials.

Three ways are regarded as being responsible for driving difference in industries: first is modernization, the second is the development of large-scale energy and metallurgy production, and the last is technological advancement. Abovementioned fields are strongly connected to economic growth. As well in their report states that industrialization comes along with sociological process of rationalization.

The industrialization of the world has been justified by a variety of empirical and theoretical arguments in Bolaky's (2011) paper. Development countries' industrialization levels correlate positively with their per capita income, according to him. It has been demonstrated empirically that the marginal product of labor in the industrial field is higher than that in the agricultural sector, so transferring resources from the agricultural sector to the industrial sector results in a rise in total productivity (Olajide et al., 2012). There are studies relating to

industrialization and economic growth. Various studies have suggested that industrialization via foreign direct investment make an affirmative impact to economic growth (Blomstrom et al., 1994). Furthermore, they assured about proportion of industrialization to economic growth is relied upon the initial income.

Based on data from 1965 to 2012, Mercan and Karakaya (2015) found a positive causal relationship between the increase in manufacturing production and GDP growth in South Africa, Mexico, Brazil, China, India, Indonesia, Malaysia, Philippines, Thailand, and Turkey by applying a panel cointegration approach. Time series and panel data analyses using both time series and panel data have also demonstrated the positive link between Chinese economic growth and Latin American economic growth (Jeon & Kaya, 2006) and Latin American countries for 1983-2001 (Libanio & Moro, 2006). A study by Cantore et al. (2017) found that the generalized method of moments failed to refute the hypothesis that industrialization is positively associated with economic growth between 1980-2013 in 80 countries. The authors of Su and Yao (2017) used panel granger causality techniques to examine data between 1950 and 2013 and found a significant correlation between economic development and industrialization.

Kaldor's growth rules have always provided a framework for studying industrialization and economic growth (Kaldor, 1966). Kaldor's growth laws state that there is a positive connection of manufacturing and economic growth. This is broadly confirmed that manufacturing is the economy's primary driver of economic growth, or it is "engine of development".

It was found by Mamgain (1999) that high manufacturing growth in newly industrialized countries, such as Thailand, Singapore, Indonesia, Malaysia, South Korea, and Mauritius, did not lead to economic growth in those countries, but it had a positive impact on the South Korean economy. In contrast, the empirical impact of manufacturing as a growth engine is mixed (Szirmai & Verspagen, 2015). Furthermore, Kniivilä (2007) found inconsistent results, but even so he concluded that the most important factor in the development of Korea's, China's, and Indonesia's economies was industrialization. A comparison of manufacturing and economic growth has been conducted between Russia and China using data from 1995 to 2008. Data from China and Russia showed conflicting findings, with the Chinese data supporting a positive relationship between manufacturing and economic growth, and the Russian data supporting a positive relationship between services and economic growth.

The economic development of China between 1995 and 2008 can be compared to that of Russia during the same period, say Zhao and Tang (2017). A large portion of China's economic growth over time has been attributed to manufacturing, while a lesser amount has been attributed to services. Although the primary sector was the largest contributor to Russian growth, the service sector was the second largest.

Manufacturing output growth is an important component of fostering economic

growth and productivity, according to Marconi et al. (2016). A similar conclusion has been reached by Haraguchi et al. (2017), who demonstrate how industrialization influenced growth rates of developing countries over the past quarter century. As a result of manufacturing activities being concentrated in relatively few developing countries, the authors have demonstrated that manufacturing value-added and employment have decreased. In order to catch up with their economic backwardness, industrialization can result in low increases to integrate advanced industrialization phases.

A related finding was reported in Attiah's (2019) investigation into the contribution of the manufacturing and service sectors to economic expansion in emerging nations. The findings indicate that the proportion of manufacturing in GDP is positively correlated with economic growth, and that this correlation is stronger for less developed nations when it does not exist for services. Olamade and Oni (2016) conducted a study in which they investigated the significance of manufacturing for economic growth across 28 African nations. According to their analysis, Africa's growth is mostly driven by the industrial sector. A similar conclusion was reached in a study by Opoku and Yan (2019) on the role of industrialization as a catalyst for sustained economic growth in 37 African nations, namely that trade openness increases the influence of industrialization on economic growth. However, Mijiyawa's (2016) study on the factors driving structural transformation in the manufacturing sector in 53 African nations discovered a U-shaped relationship between the manufacturing GDP share and per capita GDP, suggesting that industrialization would not inevitably result in higher incomes unless the underlying obstacles to the growth of manufacturing are removed.

Furthermore, the existing literature is summarized as follows in **Table 1**. Moreover, the literature is organized from the recent to the earlier finding.

Table 1. Empirical literature review on industrialization and economic growth.

Authors	Study Period	Regions/Countries	Method of Estimation	Main Findings
Lugina et al. (2020)	1970-2017	Tanzania	VAR Model	Positive relationship between industrialization and Economic growth
Olamade and Oni (2016)	1981-2015	African Countries	Ordinary Least squares, fixed effect, and GMM	Positive relationship between the two variables
Söderbom and Teal (2006)	1981-2004	African Countries	GMM, FE, and RE	No relationship
Egüez (2014)	1991-2011	119 worldwide countries	FE, RE and GMM model	Manufacturing continues to be an engine of growth in both low and middle-income
Su and Yao (2016)	1950 & 2013	Middle- and low-income countries	Granger causality test	Negative relationship between manufacturing and economic growth

Continued

Szirmai and Verspagen (2015)	1950-2005	67 developing countries and 21 advanced economies	Descriptive statistics analysis	Manufacturing has been important for growth in developing countries
Timmer and Szirmai (2000)	1963-1993	Developing countries	conventional shift-share analysis	The results do not support the structural-bonus hypothesis
Ibbih and Gaiya (2013)	1999-2011	54 African countries	Cross sectional analysis and OLS	There is a linear relationship between industrial development and economic growth
Herman (2016)	2000-2012	Romania	OLS analysis	There is positive correlation of industrialization to economic growth
Su and Yao (2016)	1950-2013	Middle income economies	conventional ordinary least squares	Manufacturing sector is an engine for economic growth in middle income countries
Attiah (2019)	1950-2015	10 advanced economies and 40 developing countries	FE and RE analysis	Economic growth is positively correlated with the manufacturing sector's share of the GDP
Moyo and Jeke (2019)	1990 & 2017	African Countries	System-GMM Model	Positive relationship between manufacturing and economic growth
Opoku and Yan (2019)	1980-2014	37African Countries	System-GMM Model	Industrialization is important to boost economic growth
Mijiyawa (2016)	1995-2014	53 African countries	System GMM	U-shape relationship between economic growth and manufacturing
George and Ijeoma (2023)	2013-2019	10 African countries	System GMM	Positive correlation between industrialization and economic growth
Bokosi (2022)	1978-2019	6 Southern African countries	ARDL	An increase in industrialization is positively associated with economic growth
Libanio and Moro (2006)	1980-2000	Latin American	FE and RE analysis	Manufacturing is the engine of growth
Nguyen (2022)	2002-2019	6 countries	GMM	Have positive impact of FDI on economic growth

Literature suggests that FDI inflows have different effects on economic growth within individual countries (Ramirez, 2006; Kohpaiboon, 2003). Additionally, different methodological approaches, sample sizes, and other factors have led to

different conclusions in previous studies. For instance, Jugurnath et al. (2016) report that foreign direct investment is positively correlated with economic growth in SSA for a panel of 32 countries between 2008 and 2014. In the Organization of Eastern Caribbean States (OECS) countries the study focused on the relationship between foreign direct investment and economic growth from 1988-2013 by using the GMM model and the empirical finding implies that FDI have the positive impact on economic growth (Mamingi & Martin, 2018).

Asiedu (2002) explored the cores that impact FDI in developing countries affect countries in Sub-Saharan Africa (SSA) totally differently. According to her empirical results, higher return on investment and better infrastructure have a positive impact on FDI to non-Sub-Saharan African countries, however there is no significant impact on FDI to SSA. In her paper, she concluded that Africa is different—suggesting that policies that have been successful in one regions may not been equally successful in other regions of African continent.

On the other hand, Williams (2015) analyzed whether Latina American countries and non-Latina American countries differ in terms of determinants of FDI inflows. In general, his main findings suggest that the stock of infrastructure attracts FDI inflows to Latina American countries, high debt discourage FDI inflows to non-Latina American countries.

However, some researchers, such as Makun (2016) found that GDP, trade openness have significant impact of FDI inflow, but there is negative impact of exchange rate, GDP per capita and political instability on FDI inflows in Fiji Islands and the author also observed that infrastructure development, inflation and financial markets have no impact on its FDI inflows.

Sattarov (2012) investigated the determinants (factors) of FDI inflows in two transition economies: Kazakhstan and Uzbekistan by using dataset from 1996-2010. According to his results, GDP, economic stability and stock of FDI were important factors for FDI inflows in these countries during this period. However, trade openness was not significant for the case of Kazakhstan.

Makiela and Ouattara (2018) used data from both developed and developing nations between 1970 and 2007 to perform their analysis. According to their study, host countries' economies grew as a result of foreign direct investment. Muse and Mohd (2021) carried out a study in Ethiopia from 1981 to 2017 utilizing the VAR model. According to the study, foreign direct investment significantly and positively affects economic growth over the long run. Based on cross-country observations from 91 nations, a study conducted in Malaysia between 1975 and 2014 by Alzaidy et al. (2017) and Azman-Saini et al. (2010) terminated that foreign direct investment had a positive and statistically significant effect on economic growth throughout the period 1975-2005. But the degree of financial development establishes.

Furthermore, the existing literature is summarized as follows in **Table 2**. Moreover, the literature is organized from the recent to the old finding.

Table 2. Literature of impact of foreign direct investment on economic growth.

Authors	Study Period	Regions/Countries	Method of Estimation	Main Findings
Saqib et al. (2013)	1981 to 2010	Pakistan	PMG	The results indicated a negative and significant relationship between FDI and dependent variable GDP
Richardson and Rana (2018)	1991-2009	Togo	Granger-causality	There was a unidirectional relationship between FDI and GDP.
Mun et al (2008)	1980-2017	Malaysia	Ordinary Lest Square (OLS) regression analysis	Malaysian economic growth and foreign direct investment are positively related, based on the results
Antwi and Zhao (2013)	1980-2010	Ghana	A Cointegration Analysis	Study findings show that FDI and GDP and GNI are causally related in the long run through a long-run equilibrium and causal relationship
Onu (2012)	1986-2007	Nigeria	multiple regression analysis	There is a positive relationship between foreign direct investment and economic growth
Umeora (2013)	1986 to 2011	Nigeria	Ordinary Least Squares (OLS) and Multiple Regression analysis	FDI does not make the GDP grow
Duarte et al. (2017)	1987-2014	Cabo Verde	ARDL	has a positive effect
Alfaro et al. (2004)	1975-1995	Developing Countries	Multiple regression analysis	It is unclear what role FDI plays in contributing to economic growth alone.
Ayenew (2022)	1988 to 2019	SSA Countries	PMG/ARDL	The long run has positive impact and has negative impact ins short run.
Baliamoune-Lutz (2004)	1973-1999	Morocco	Granger causality test	FDI causes GDP growth
Hagan and Amoah (2020)	1998 to 2012	African Countries	2SLS-IV and GMM	FDI has a significant positive impact on economic growth
Hobbs et al. (2021)	1992 and 2016	Albania	Granger causality test	FDI has a significant impact
Khan et al. (2019)	2001 to 2012	34 Asian Countries	generalized method of moments (GMM), fixed effect and random, and OLS regression, effect	FDI contributed to economic growth in positively
Ullah et al. (2022)	1996-2016	80 developing countries	GMM	FDI has insignificant impact of economic growth

Continued

Nguyen (2017)	1986-2015	Vietnam	ARDL model	The author found a positive and significant impact of FDI on economic growth
Odhiambo (2021)	1980-2018	Kenya	ARDL bounds testing approach	An unidirectional causal relationship exists between economic growth and foreign direct investment
Popescu (2014)	1993 & 2013	Central and Eastern Europe	GMM	Economic growth is positively affected by FDI
Abdulsalam et al. (2021)	2007 to 2016	25 Asian and North African countries	Johansen Fisher Panel Cointegration Test, Panel Dynamic Ordinary Least Squares (PDOLS) model, and the Toda and Yamamoto technique for testing causality	Unidirectional causality between FDI and Economic growth
Koojaroenprasit (2012)	1980-2009	South Korea	OLS Regression	South Korean economic growth is strongly influenced by foreign direct investment

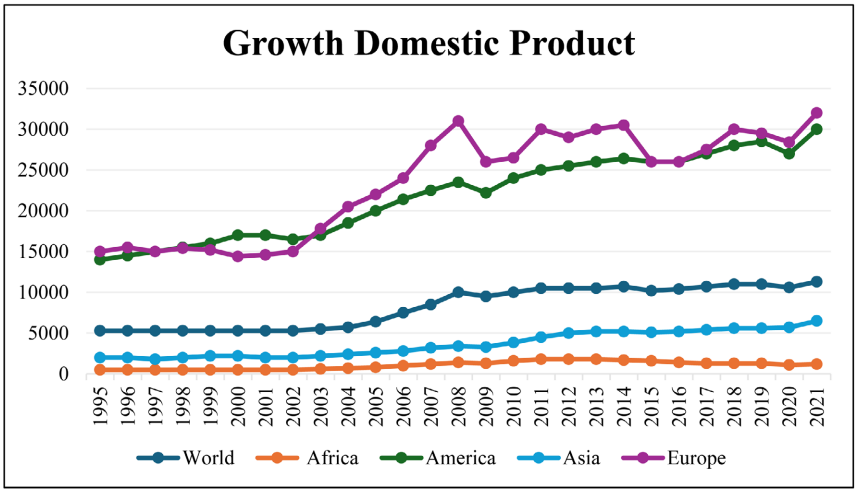
3. Overview of Industrialization and Fdi in Asia

3.1. An Overview of Asian Economic Growth

This part assesses the economic growth in the world in general and other regions, including the Asian region. Thus, in Figure 1, below shows GDP growth in developing and Asian from 1995 to 2021. Despite variations between nations and over time, Figure 1 illustrates how Asia's growth rate from 1995 to 2021 was below average when compared to other regions. Nonetheless, as the picture illustrates, despite other regions outperforming this one, economic growth is increasing from 1995 to 2021.

3.2 An Overview of Industrialization in Asia

In this section, we want to show the development of industrialization in the Asian region. Indeed, the study also tried to compare the development of industrialization in other regions apart from Asia and uses to for the purpose of comparation, although the target is to assess the development of industrialization in Asia Countries. Accordingly, the researcher aimed to assess the data from 1995 to 2021, as shown in Figure 2. As we can see from the figure below, the development of industrialization in different Asian countries is different from country to country due to countries' differences in policy regarding the development of industrialization. Therefore, this study implemented data from the World Bank database development indicator to point out this. Accordingly, as shown in Figure 2 below, Asian countries have experienced industrialization.



Source: Authors' calculation depending data on united nations conference on trade and development statistics.

Figure 1. GDP growth of Asia and other regions from 1995 to 2021.

Source: Own designed depending on world bank database.

Figure 2. An overview of industrialization in Asian countries from 1995-2021.

3.2.1. Development of Industrialization in Asia by Region

All the Asian subregions indeed had faster growth than the rest of the world, but there were some differences as well. East Asia led the continent, contributing about two-thirds of the increase in Asia's share of the global GDP and an even greater share of manufacturing value added (MVA) and global exports. Southeast Asia was generally in the middle of the pack, with South Asia generally lagging behind in all aspects. According to Nagesh (2020), South Asia also lagged behind in industrialization. Furthermore, there was a more than double-digit increase in the share of manufacturing value added in GDP, with substantial increases in East Asia, moderate increases in Southeast Asia, and marginal increases in South Asia.

Throughout East Asia, industrialization and continuous upgrading played a crucial role in the transformation. For instance, structural transformation in successful

East Asian countries, such as Japan, Singapore, Thailand, Malaysia, and China, followed the classical pattern from agriculture through manufacturing or industry. In contrast, the South Asian countries, including India, Pakistan, Sri Lanka, and Bangladesh, as well as some Southeast Asian countries, moved away from agricultural-based economies and focused on services. In addition to their higher rates of economic growth and growing export shares, East Asian countries have also been able to reduce poverty and create decent jobs due to these divergent paths to structural transformation. In addition, During the first half of the twentieth century, East Asian countries benefited from the effects of globalization. Besides using high- and medium-technology products as their main exports, East Asian countries have also successfully upgraded their product structures such that high- and medium-technology goods dominate their exports (Chang & Zach, 2019).

Furthermore, according to Vos (2019), as a result of industrialization, decent jobs were created, poverty was alleviated, and human development was achieved. Moreover, rapid industrialization created millions of decent jobs in East Asian countries. According to the author, the poor rate of job creation in secondary and tertiary sectors explains the slow rate of decline in the employment share of agriculture in India, much of South Asia, and, to a lesser extent, in Indonesia, Thailand, Vietnam, and the Philippines. In addition, East Asian countries have opted for heterodox approaches when it comes to macroeconomic management, focusing more on job creation than price stability (Nayyar, 2019). The Nayyar volumes attribute the stunning success of East Asian industrialization in building a competitive manufacturing base to the role played by industrial policy. This covers strategic interventions by the governments to foster industrialization through protection or industrial promotion. It is the East Asian countries that have successfully used both markets and the state in complementary ways in order to explode the myth that it is either markets or the state that needs to drive economic activity.

For South Asia as a region to grow at continuously high rates, industrial development, particularly the growth of manufacturing in countries with a population of more than 20 million, such as India, Bangladesh, Pakistan, Nepal, and Sri Lanka, is critical. Services can spur economic growth, as evidenced by India's information technology (IT) industry and tourism in Nepal. Still, most developed countries became advanced economies largely because of manufacturing and industrial development. South Asian countries should, therefore, pay more attention to expanding their labor-intensive manufacturing sectors. Forward- and backward-linked production in labor-intensive industries, such as textiles, footwear, and various consumer goods, will help countries reduce poverty by creating jobs for unskilled workers and provide the basis for further industrial development by offering opportunities for human resource development and technology upgrading. It is important that South Asia continues to advance economic reform so that a more open and liberalized economy can thrive and that foreign and domestic companies enhance their manufacturing investments as well.

Central Asian countries today practice a "concentration model" of urbanization, under which population and economic growth are centered in big cities, as the region becomes increasingly cognizant of the need to shift from an agrarian to an industrial-agrarian type of economy. Cities and their agglomerations under this new economic model must act as drivers of growth, but they are having trouble handling the massive influx of people from underdeveloped areas. This economic transition requires better management of urbanization and industrialization processes. In fact, most of Central Asia's modern cities developed during the Soviet era and were subordinated to the Moscow-directed command economy. After the collapse of the USSR in 1991, Central Asian countries were primarily agro-industrial economies with predominantly rural populations.

Southeast Asia is home to several promising industries across its regional economy that will report quicker than the global average growth in 2023. Despite a concerning macroeconomic backdrop, various factors will continue to pull investment and businesses into the region. The region of Southeast Asia, also known as the ASEAN region (the Association of Southeast Asian Nations), has one of the highest rates of economic growth in the world. As per the Asian Development Bank (ADB), Southeast Asian economies are expected to grow 5.5 percent in 2022. However, many reports are critical of traditional industrial policy in South Asia, using the term "license-permit raj" for the regime in India.

Asian industrialization exhibits distinct characteristics compared to the industrialization processes in the US or Europe. One significant aspect is the latecomer advantage. Many Asian countries have leveraged this advantage by adopting and adapting technologies from more developed nations, thus accelerating their industrial growth without reinventing the wheel (Gerschenkron, 1962). This approach has allowed them to leapfrog certain stages of development and rapidly catch up with more advanced economies.

Another notable characteristic is the adoption of export-led growth models. Unlike the import-substitution industrialization strategy initially used in Latin America, many Asian economies focused on developing industries that produced goods for export, benefiting from global demand. This strategy was successfully implemented by countries like Japan, South Korea, and China, leading to significant economic growth (Amsden, 2001). Additionally, Asian industrialization has often been characterized by significant government intervention. Governments in countries like Japan, South Korea, and China have played active roles in directing industrial policy, supporting key industries, and providing subsidies and incentives for industrial development (Wade, 1990). This strategic intervention has been crucial in fostering rapid industrialization.

Furthermore, many Asian countries initially focused on labor-intensive industries such as textiles and electronics assembly, leveraging their large, low-cost labor force to gain a competitive edge in global markets (Lall, 2001). This focus on labor-intensive industries provided employment opportunities and laid the foundation for further industrial diversification. Finally, industrialization in Asia has

been accompanied by rapid urbanization, with large populations moving from rural to urban areas, creating megacities that serve as industrial and economic hubs (Henderson, 2002). This urbanization has supported industrial growth by providing a concentrated labor force and facilitating economies of scale.

Industrialization has played a crucial role in shaping the economic trajectories of various regions in Asia from 1995 to 2021. The impact on GDP has varied significantly across different countries due to a range of factors, including initial conditions, policy choices, levels of development, and integration into the global economy. Here, we'll discuss the heterogeneous impacts of industrialization on GDP in key Asian regions and countries.

3.2.2. East Asia: Rapid Industrialization and High GDP Growth

1) China

- Impact on GDP: China's industrialization has been a cornerstone of its economic miracle, driving GDP growth at an average annual rate of around 9-10% from 1995 to 2010. This rapid industrialization was fueled by heavy investments in manufacturing, infrastructure, and urbanization.
- Factors: Policies such as the Open Door Policy, Special Economic Zones (SEZs), and WTO accession in 2001 facilitated foreign direct investment (FDI) and export-led growth.
- Outcome: China's GDP rose from approximately $0.7 trillion in 1995 to $17.7 trillion in 2021, transforming it into the world's second-largest economy.

2) South Korea

- Impact on GDP: South Korea's continued industrialization, particularly in high-tech industries, contributed to stable GDP growth, averaging around 4% - 5% annually from 1995 to 2021.
- Factors: Government policies focused on technology and innovation, strong education systems, and chaebol (large family-owned business conglomerates) played significant roles.
- Outcome: South Korea's GDP increased from about $0.5 trillion in 1995 to $1.8 trillion in 2021, establishing it as a high-income economy with a significant global industrial presence.

3.2.3. Southeast Asia: Diverse Industrial Growth and Varied GDP Impacts

1) Vietnam

- Impact on GDP: Vietnam experienced rapid industrialization, particularly post-2000, leading to an average GDP growth rate of around 6% - 7% per year.
- Factors: Economic reforms under Đổi Mới, integration into global supply chains, and favorable demographics supported this growth.
- Outcome: Vietnam's GDP grew from $20 billion in 1995 to over $350 billion in 2021, significantly improving living standards.

2) Indonesia

- Impact on GDP: Indonesia saw moderate industrialization, with GDP growth averaging about 4% - 6% annually.

- Factors: Rich natural resources, a large domestic market, and gradual improvements in infrastructure and regulatory frameworks were key contributors.
- Outcome: Indonesia's GDP rose from around $200 billion in 1995 to over $1.1 trillion in 2021, making it the largest economy in Southeast Asia.

3.2.4. South Asia: Mixed Results in Industrialization and GDP Growth

1) India

- Impact on GDP: India's industrialization has been slower compared to East Asia but significant, with GDP growth averaging around 6% - 7% annually.
- Factors: Economic liberalization starting in 1991, growth in IT and service sectors, and demographic dividend contributed to industrial and economic growth.
- Outcome: India's GDP increased from about $0.4 trillion in 1995 to $3.2 trillion in 2021, becoming the world's sixth-largest economy.

2) Bangladesh

- Impact on GDP: Bangladesh's industrialization, particularly in the textile and garment industry, drove GDP growth averaging around 5% - 6% annually.
- Factors: Competitive labor costs, favorable trade policies, and export-led growth strategy played critical roles.
- Outcome: Bangladesh's GDP grew from $35 billion in 1995 to over $400 billion in 2021, lifting millions out of poverty.

3.2.5. Central Asia: Resource-Driven Industrialization and Economic Volatility

1) Kazakhstan

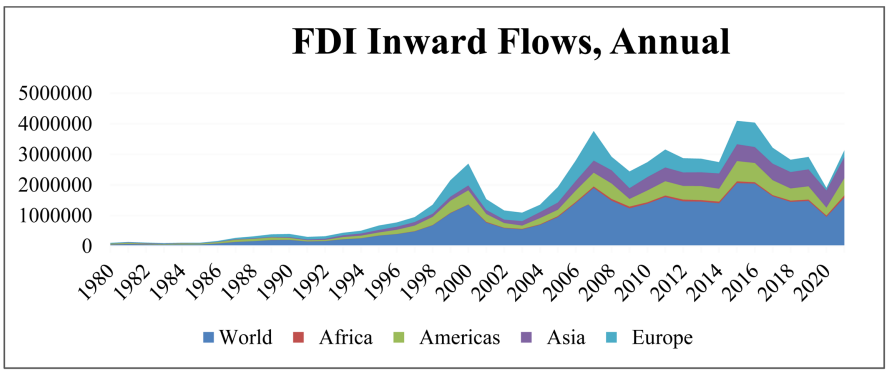
- Impact on GDP: Kazakhstan's industrial growth, heavily reliant on oil and gas, led to substantial GDP growth averaging around 4% - 5% annually.
- Factors: Abundant natural resources, strategic investments in energy infrastructure, and economic reforms were pivotal.
- Outcome: Kazakhstan's GDP rose from $22 billion in 1995 to about $180 billion in 2021, though it faced volatility due to fluctuating oil prices.

The impact of industrialization on GDP across Asian regions from 1995 to 2021 demonstrates a heterogeneous pattern influenced by country-specific factors such as resource endowments, policy frameworks, and global economic integration. East Asian economies like China and South Korea achieved high GDP growth through rapid and diversified industrialization. Southeast Asian countries like Vietnam and Indonesia also saw significant GDP increases, albeit with varying industrial strengths. In South Asia, India and Bangladesh experienced substantial growth, driven by different industrial sectors. Meanwhile, Central Asian countries like Kazakhstan showed the impact of resource-driven industrialization with associated economic volatility.

This varied impact underscores the importance of tailored economic policies that consider each country's unique context and strengths to harness the full potential of industrialization for GDP growth.

3.3. An Overview of Foreign Direct Investment in Asian Countries

The inflow of foreign direct investment into Asian economies may help to close the savings gap (Quazi, 2007). In 2016, developing nations in Asia and developing countries worldwide received 25 percent and 37 percent of global foreign direct investment (FDI), respectively, according to UNCTAD's 2017 investment report. In comparison with other regions like the African region, the inflows of FDI to Asian countries are far better. As reported by the United Nations Conference on Trade and Development report, 2016, the inflows of FDI to the African region are far less than those of Asia, which is only 9 percent. The broad patterns of inward foreign direct investment (FDI) in developing nations, particularly in Asia, between 1980 and 2020 are depicted in **Figure 3** below. Two imperative things are revealed in **Figure 3**. Firstly, a similar trend has been observed with FDI to developing countries since the 1980s, reaching its high point between 2011 and 2020. In contrast, developing countries receive a very small amount of foreign direct investment as compared to highly developed nations. Secondly, Asia's FDI flows fluctuated less than those of other regions between 1980 and 2020 due to the region's good investment policy structure. As clearly indicated in **Figure 3**, except in the European region, the flow of FDI to Asian countries is very high. Thus, the Asian continent has a relatively low share of foreign direct investment compared with other continents. The region of Asia received the highest flows of foreign direct investment during the 2014s and 2018s when compared with other developing countries/other continents. Thus, **Figure 3** shows the flows of FDI to the Asian region, including other regions.



Source: The authors' calculation depends on the data from the United Nations Conference on Trade and Development statistics.

Figure 3. Foreign direct investment: Inward flows and stock, annual from 1980 to 2020.

Regional Distribution of Foreign Direct Investment in Asia

At the end of 1960s, majority developing countries, as well countries in Asia, adopted closed macroeconomic policies in the line with import substitution industrialization policies. At the same time, a dominant role was assigned to the state in the development process. These import substitution strategies and large public sectors resulted in rent-seeking activities and uncompetitive production processes (Bhagwati & Srinivasan, 1975).

Most Asian countries, including the great country in the economy in the world and in Asia China, have opened their door to foreign investors since 1978 to attract foreign direct investment by introducing new policies that encourage foreign investors to invest in the countries. As the countries started inviting foreign investors, tremendous progress was observed in different regions, including China, Singapore, and South Korea, leading the progress. After different reforms and policies were introduced, several foreign direct investment inflows came to this region from different parts of the world, especially Africa and Europe.

The East Asian countries adopted a selective approach to FDI to achieve their industrial policy objectives. RoK and Taiwan region, following Japan, relied on non-equity modes to tap the resources of multinational enterprises (MNEs) such as technology licensing managerial and technical assistance from Japanese companies such as Nippon Steel and Kawasaki Shipbuilding to build world-class industries. RoK and Taiwan region also extensively used the special economic zones (SEZs) or export processing zones (EPZs) in a strategic manner to leverage FDI for building export capabilities but ensured domestic linkages by imposing local content requirements (Kozul-Wright & Poon, 2019).

For instance, looking at the FDI flows to developing East Asian economies, Japan, followed by Korea and Taiwan region, has shifted labor-intensive production stages to lower-wage areas by leveraging the regional diversity in development levels and locational advantages. An example of this type of FDI is traditional vertical FDI (Helpman, 1984), in which production stages are dispersed to capitalize on international differences in competitive advantages. On the other hand, over 10% of global direct investment flows have gone to countries in the Association of Southeast Asian Nations (ASEAN). They have benefited enormously from the globalization of value chains as the global economy's center of gravity shifts towards the Asia Pacific region. The United States continues to be the leading investor country in the region, accounting for 19% of the foreign direct investment (FDI) stock in ASEAN countries, compared with just 3% for China (8% if Hong Kong SAR is included). However, Chinese investment is ramping up: according to ASEAN balance of payments data, in 2021, China accounted for 8% of FDI flows (13% if Hong Kong SAR is added), compared with 23% of total flows for the United States (Banque de France, 2023).

During the first decade after the collapse of the Soviet Union, more foreign businesses entered Central Asia due to the expansion of market reforms and the availability of travel opportunities for foreigners. Central Asian countries have also received investments from international financial institutions (IFIs) since independence. After attracting considerable FDI in the hydrocarbon and manufacturing sectors of Central Asian countries during the first two decades of their independence, foreign investments in most of the region's countries stagnated or declined in the period 2010-2018. In addition, many Central Asian governments have expressed interest in attracting more foreign companies and bringing more Western technology to the region. Growth in direct foreign investments was fueled and attracted by extractive industries in entire Central Asia until 2009.

However, the development was highly volatile during the entire period studied. Foreign investments overall declined between 2009 and 2020. Furthermore, foreign direct investment (FDI) inflow into the Central Asia region (Uzbekistan, Kazakhstan, Tajikistan, Kyrgyzstan, and Turkmenistan) has significantly increased since the collapse of the Soviet Union. The region's inward FDI stock totals $211 billion; in 2021, its foreign trade in goods totaled $165.5 billion, representing a sixfold increase over the last 20 years (United Nations Conference on Trade and Development, 2023a).

In the 1990s and early 2000s, South Asian countries liberalized their economies. As a result, foreign investors have begun to show interest in this region. Consequently, in recent years, many South Asian countries are experiencing a high volume of FDI inflows. Brewer (1993) also emphasized government policies that can directly or indirectly affect the flows of FDI. In general, even though it varies from region-to-region year to year, there is progress in FDI inflows in each region based on the favorable conditions and efforts of the regions. For instance, **Table 3** shows a rise in foreign direct investment inflows in all regions. Specifically, between 2017 and 2022, tremendous growth of FDI inflows was observed in Asian regions, except for high fluctuations in West and Central Asia. However, overall, the inflows to each region declined from 2021 to 2022 except South Asia (see **Table 3**).

Table 3. Inflows of FDI to asia by region (in millions of dollars).

Region	2017	2018	2019	2020	2021	2022
Asia	504,352	497,309	503,480	516,465	662,137	661,807
East and South-East Asia	410,728	403,426	399,020	403,447	546,333	5,416,129
East Asia	253,391	254,455	232,335	284,850	333,522	323,561
South-East Asia	157,336	148,971	166,685	118,596	212,812	222,568
South Asia	51,644	52,262	59,090	71,050	52,683	57,370
West Asia	33,183	34,989	37,147	35,429	55,911	48,268
Central Asia	8797	6633	8223	6539	7210	10,041

Source: Compiled by author based on United Nations Conference on Trade and Development (2023b).

4. Methodology

4.1. Econometric Methodology

We developed the following basic model to explore the joint impact of industrialization and foreign direct investment in Asian Countries from 1995 to 2021. The functional relationship between and impact of joint of FDI and MFVA can be expressed as follows.

$$\text{GDPGR} = f\left(X_1, X_2, X_3, X_4\right) \tag{1}$$

or

$$\text{GDPGR} = f\left(\text{MFVA}, \text{FDI}, \left(\text{MFVA} * \text{FDI}\right), \text{INFL}, \text{DIN}, \text{TRO}, \text{UNEPL}, \text{INFST}\right) \quad (2)$$

As a result of the mathematical operations developed, it can be determined that the relationship between joint variables can be expressed as follows. With another explanatory variables the following model was developed to analyze the consequence of joint industrialization and FDI on economic growth of designated Asian countries.

$$\begin{aligned}\text{GDPGR}_{it} = {} & \beta_0 + \beta_1 \text{MFVA}_{it} + \beta_2 \text{FDI}_{2?} + \beta_3 \left(\text{MFVA}_{it} * \text{FDI}_{it}\right) + \beta_4 \text{INFL}_{it} \\ & + \beta_5 \text{DIN}_{it} + \beta_6 \text{TRO}_{it} + \beta_7 \text{UNEPL}_{it} + \beta_8 \text{INFST}_{it} + U_{it}\end{aligned} \quad (3)$$

The next equation including unobserved time-invariant country-specific characteristics is:

$$\begin{aligned}\text{GDPGR}_{it} = {} & \beta_0 + \beta_1 \text{MFVA}_{it} + \beta_2 \text{FDI}_{2?} + \beta_3 \left(\text{MFV}_{it} * \text{FDI}_{it}\right) + \beta_4 \text{INFL}_{it} \\ & + \beta_{5?} \text{DIN}_{it} + \beta_6 \text{TRO}_{it} + \beta_7 \text{UNEPL}_{it} + \beta_8 \text{INFST}_{it} + a_i + \delta_t + \varepsilon_{it}\end{aligned} \quad (4)$$

where GDPPG is denotes economic growth, MFVA indicates industrialization, FDI indicates foreign direct investment, MFVA * FDI refers the joint effect of industrialization and foreign direct investment, INFL, DIN, TRO, UNEPL, and INFST indicates inflation, domestic investment trade, openness, unemployment, and infrastructure respectively, these all are control variables in the equation. a_i and δ_t are an unobserved country-specific effect and time effect, respectively. Whereas ε_{it} indicates error term.

4.2. 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 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 4** shows the variable descriptions, measurements, and expected signs.

4.3. Descriptive Statistics

The following table displays description statistics (name, mean, standard deviation (SD), lowest and maximum values) for the years 1995 through 2021. The undescriptive statistics of the variables used in this investigation are shown in **Table 5**. Inflation, domestic investment, trade openness, government spending, population growth, unemployment rate, infrastructure, GDP per capita growth rate, and foreign direct investment (FDI), which served as proxies for FDI inflows (as a percentage of GDP), are the variables listed in column 1. Furthermore, the descriptive figures show a wide range of GDP per capita growth, from −38.56% to 49.03%. In a similar vein, foreign direct investment (FDI), as measured by FDI inflows as a percentage of GDP, ranges from −37.13 percent to 279.347 percent. Moreover, industrialization which is proxies MFVA by also varies −42.13% to 92.955 with min and max respectively. In

addition, the descriptive statistics of other variables in also mentioned in table below.

Table 4. Summary of the variable description and data sources[1].

List of Variables	Symbols	Measurement	Source of Data
Dependent Variable			
Economic Growth	GDPPG	GDP per capita growth (annual %)	WDI
Independent Variable			WDI
Industrialization[2]	MFVA	Manufacturing, value added (annual % growth)	WDI
Foreign Direct Investment	FDI	Foreign direct investment, net inflows (% of GDP)	WDI
Joint of MFVA and FDI	MFVA * FDI	The joint of Manufacturing, value added (annual % growth) and 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
Trade Openness	TRO	Imports of goods and services (% of GDP)	WDI
Infrastructure	INFST	mobile cell phone subscribers per 100 people	WDI

Source: Author's design from world development indicators.

Table 5. Descriptive statistics.

Variables	Observation	Mean	Std. Dev.	Min	Max
GDPPG	1189	3.914127	6.486912	−38.56172	49.03164
MFVA	1043	5.212516	9.544528	−42.13279	92.95009
FDI	1185	5.5846	14.6728	−37.1726	279.3473
INFL	1124	12.1821	27.5807	−16.11733	411.7596
DIN	1124	25.75157	9.152717	0.7344631	70.33143
TRO	1099	82.46376	73.82147	−45.52468	442.62
UNEMPL	1213	5.999825	4.227214	0.102	21.206
INFST	1206	66.1512	57.5185	0	319.4263

Note: GDPPG, MFVA, INF, DIN, TRO, FDI, UNEPL, and INFST refer GDP per capita growth, manufacturing value added, inflation rate, domestic investment, trade openness, unemployment, and infrastructure respectively.

[1]Details of variable fully motioned in first published article "impact of foreign direct investment (FDI) on the economic growth of Asian countries".

[2]Industrialization (MFVA): It is proxied by manufacturing, value added (annual % growth), and is used as the independent variable. In this study it also represents industrialization, which have expected positive result.

4.4. Pre-Estimations

4.4.1. Correlation Matrix

In correlation analysis, the degree of linear relationship between variables is ascertained by comparing them. We may ascertain the relationship between the variables in our model, their strength, and their directions of direction by looking at the correlation coefficient table. A correlation coefficient of one exists between a positive and negative correlation. While there is no association between 1, −1, and 0, there is a substantial correlation between 1, −1, and 0, respectively. A correlation is said to be positive when two variables move in the same direction; a negative correlation is said to exist when two variables move in opposite directions. All variables exhibit a statistically significant positive correlation with the dependent variable at a level of 5 percent significance according to Table 4. 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 the table below. According to the results of the correlation analysis in Table 4, all variables other than inflation rate (INFL) and unemployment (UNEPL) are statistically significant positive correlated with the dependent variable. In addition, none of the correlation statistics are equal to or higher than 0.80, indicating that the explanatory variables do not have a linear relationship. More specifically, relatively, there is a high positive correlation between industrialization proxied by manufacturing value added (MFVA), and economic growth proxied by GDP per capita (GDPPG). In contrast, unemployment rate and economic growth have a relatively high negative correlation. Our results generally indicate that the explanatory variables do not show multicollinearity. All variables except the inflation rate and unemployment rate are positively correlated with the dependent variable (economic growth) as shown in Table 6.

4.4.2. Variance Inflation Factor (VIF)

Using the variance inflation factor (VIF), this study also investigated if the model had a multicollinearity issue. Thus, the variance inflation factor (VIF) is shown in Table 7. According to the table below, the VIF has a mean value of 1.14 and ranges from 1.04 to 1.24. Multicollinearity is not an issue with the regression. Verifying the absence of multicollinearity also requires comparing the inverse of VIF (1/VIF) with a value higher than 0.2. Since every variable in the regression has a value higher than 0.2, the regression is regarded as legitimate. Similarly, the inverse of the variance inflation factor (1/VIF) falls between 0.807 and 0.964 within the necessary limits, as indicated by the results in Table 7.

Table 6. Correlation matrix of the variables.

Variables	GDPPG	MFVA	FDI	MFVA * FDI	INFL	DIN	TRO	UNEPL	INFST
GDPPG	1.0000								
MFVA	0.2627	1.0000							

Continued

FDI	0.0820	0.0333	1.0000						
MFVA * FDI	0.1768	0.3644	0.1497	1.0000					
INFL	−0.1421	0.0047	−0.0321	−0.0448	1.0000				
DIN	0.0750	0.0298	0.0246	0.0751	−0.0940	1.0000			
TRO	0.0965	0.0127	0.3056	0.1467	−0.0672	0.0303	1.00000		
UNEPL	−0.0257	−0.1238	0.0889	−0.0484	0.0783	−0.1866	−0.0823	1.0000	
INFST	0.0575	0.1268	0.1748	0.0023	−0.1358	0.0958	0.2924	0.0778	1.0000

Note: GDPPG, MFVA, MFVA * FDI, INF, DIN, TRO, FDI, POG, UNEPL, and INFST refer to GDP per capita growth, manufacturing value added, the interaction between manufacturing value added and FDI, inflation rate, domestic investment, trade openness, population growth, unemployment rate, and infrastructure respectively.

Table 7. Correlation matrix of the variables.

Variable	VIF	1/VIF
MFVA * FDI	1.24	0.80736
TRO	1.23	0.81367
FDI	1.19	0.83944
MFVA	1.19	0.84614
INFST	1.13	0.88277
UNEPL	1.06	0.94346
INFL	1.04	0.96076
DIN	1.04	0.96461

Mean VIF: 1.14.

4.4.3. Unit Root Test Results

First-Generation Unit Root Test Results

Verifying the stationarity of each series prior to running the regression is essential for estimating its reliability. Unit root testing is necessary since the level form of some variables isn't steady and the study period (T) is somewhat short. Additionally, it keeps non-stationary series from generating erroneous estimation results when unit root tests are used. As a result, this study employed a variety of unit root testing methodologies. Several tests, such as the Fisher-ADF and Phillips-Perron-Fisher tests, were used to assess stationarity (Table 8). These two approaches of unit root tests are only effective for unbalanced systems due to the fact that they are both appropriate.

Table 8 shows that industrialization (MFVA), unemployment (UNEPl), inflation (INFL), domestic investment (DIN), GDP per capita growth, and foreign direct

investment (FDI) are all stagnant at the present level. However, the infrastructure measure (INFST) and the trade openness measure (TRO) are stationary at the first difference. As a result, it is impossible to accept the null hypothesis, which claims that series are not stationary (have a unit root). This leads us to the conclusion that every variable is stationary. As a result, there is no variables which are not stationary at the first difference.

Table 8. ADF and PP-Fisher unit toot test results.

(a)				
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
MFVA	511.7662 ***	0.000	346.7354***	0.000
TRO	273.9609***	0.0000	106.7530	0.0848
UNEPl	269.4524***	0.0000	115.5682***	0.0360
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.MFVA	900.6395***	0.000	881.1953***	0.0000
D.TRO	636.0322 ***	0.0000	450.7265***	0.0000
D.UNEPl	620.9044***	0.0000	466.7251***	0.0000
D.INFST	460.9620***	0.0000	213.0966***	0.000

Continued

(b)				
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
MFVA	156.2064***	0.0000	143.7850***	0.0000
TRO	109.0913	0.0633	106.7530	0.0848
UNEPl	127.0189***	0.0062***	115.5682**	0.0360
INFST	53.9536	0.9991	56.7533	0.9976
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	1793.9442***	0.0000	1499.5615***	0.0000
D.MFVA	610.4810***	0.0000	558.5843***	0.0000
D.TRO	112.8766**	0.0382	112.6498**	0.0394
D.UNEPl	126.4197***	0.0069	118.6576***	0.0000
D.INFST	109.8763***	0.0000	97.8893***	0.0000

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

Second-Generation Unit Root Test Results

The postulate of cross-sectional independence is relaxed using the second generation of unit roots tests. Finding these cross-sectional relationships is the difficult part. Furthermore, the existence of cross-sectional independence is a prerequisite for all first-generation panel unit root tests covered in the preceding section. Macroeconomic time series exhibit a significant degree of cross-sectional dependency. It is essential to do second generation panel unit root tests since the findings

of first generation panel unit root tests might not take cross-sectional dependence into account. Table 9 shows that all of the variables are stationary at the level form, with the exception of trade openness (TRO), the unemployment rate (UNEPl), and infrastructure (INFST). On the other hand, all of the variables examined in this study are stationary after first differences.

Table 9. 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
MFVA	−5.793***	0.000	−4.703***	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
INFST	−1.407	0.080	−1.170	0.121
	First Difference			
Variables	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.MFVA	−16.678***	0.0000	−12.311***	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.INFST	−8.695***	0.0000	−6.635***	0.0000

Source: Author's construction based on the data. ***, ** and * stands for stationary at a 1%, 5% and 10% significance level. Only standardized z [t-bar] statistic was calculated for some variables. So, the table displays only the z [t-bar] statistic value of the table.

5. Estimation Techniques

For the period 1995-2021, this study examines the impact of the joint impact of industrialization and foreign direct investment on Asian economies exploitation unbalanced panel data from 45 Asian countries. There are three main approaches to regression analysis of panel data for this study. As an additional benefit, panel data enables researchers to study economic practice in the context of heterogeneity among individuals (firms, countries, etc.), as well as dynamics that are hard to detect in cross-sectional analyses. Panel data sets are primarily beneficial because they enable the researcher to model differences in behavior across individuals more easily than cross-sectional data.

Panel data sets offer the investigator significant advantages in modeling deviations in behavior across individuals since they are easier to analyze than cross-section data sets. The model is based on the following structure:

$$Y_{it} = Y_{it}'\beta + \delta_{it}'\theta + \varepsilon_{it} \tag{5}$$

$$Y_{it} = V_{it}'\beta + \varphi_i + \varepsilon_{it} \tag{6}$$

There are Y_{it} regressors in V_{it}', not with a constant term The individual effect or heterogeneity is. where δ_i is made up of one or more observational or unobservational variables and a constant term (time-invariant). The entire model can be fitted using least squares fit if δ_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 φ_i applications are unseen, which poses a challenge (Greene, 2012: pp. 343-398).

5.1. The Pooled Ordinary Least Square Model

Using ordinary least squares, offers reliable and effective estimates for the common α and the slope vector β if δ_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 substances are accepted to act within the same way over time. The drawback of this approach is that it does not consider the contrasts in time variety among substances. In expansion, the time impact and nation heterogeneity are disregarded, which can result in incorrect conclusions. An assortment of differences exist inside substances, which can be taken into consideration by the Irregular Impact (RE) and the Settled Impact (FE) strategies. As a result, the pooled (OLS) approach isn't as viable as the strategy of (RE) or (FE) in taking into consideration changes in time (entity-specific and time-specific factors) as well as changeability inside specific nations.

5.2. Fixed-Effect (FE) Model

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

$$Y_{it} = V_{it}'\beta + \theta_i + \varepsilon_{it} \tag{7}$$

where, $\theta_i = \delta_i'$ embodies all the observable effects and specifies an estimable conditional mean. These fixed effects approach takes, θ_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 φ_i and V_{it} not that φ_i is non-stochastic. The fixed-effect approach assumes a correlation between the country-specific effect (φ_i) and the predictors ($\boldsymbol{E}(\frac{\varphi_i}{V_{it}} \neq 0)$). According to this concept, each country's time-invariant characteristics will be distinct from all other national characteristics. The fixed effect regression technique takes into consideration factors that are not included in a panel model that has time-invariant variables but no country-variant variables. Even though these variables differ between nations but remain constant over time, they are taken into account by using the fixed-effect method.

As a result, no omitted variable bias is incorporated into the fixed-effect coefficient because the fixed-effect approach can account for the time-invariant variances between the different entities. Different intercepts for various countries are calculated using a fixed-effect regression model. The country-specific, time-invariant causes of each leave-out variable are then obtained using the binary intercepts. An endogeneity problem and biased coefficient estimate are likely to occur with variables that are not observed as entity-specifics or time-invariant (C_i). The entity-demean approach is used to overcome this issue. Endogeneity is addressed in two steps: for each variable, a subtraction method is used, and for entity-demonized variables, a projection method. Since mistakes do not vary over time, the entity-demean method removes the entity-specific effect from the model, resulting in a mean value of the error term 1) that is equal to the value of the country-specific error terms 2) (FE) estimation, which makes the assumption that error terms vary by country, can be used to manage heteroscedasticity in panel regression models. The bias that arises when omitted variables are excluded is addressed by controlling for fixed effects in dissimilar pooled (OLS) estimate (Greene, 2012).

5.3. The Random Effect (RE) Model

In the event that the unnoticed individual heterogeneity still developed, then the model may be developed as follows.

$$Y_{it} = X_{it}'\beta + E\left[Z_i'a\right] + \left\{Z_i'a - E\left[Z_i'a\right]\right\} + \varepsilon_{it} \tag{8}$$

$$Y_{it} = X_{it}'\beta + \alpha + \mu_i + \varepsilon_{it} \tag{9}$$

Assume that changes between entities occur at random and have nothing to do with the variables in the model. Even if the variable they decide is uncorrelated with the explanatory variables, the regression model must include the nominative determinations of those undiscovered variables as part of the Random Effect conceptualization. Therefore, the RE makes use of all available data and produces unbiased parameter estimates and the lowest standard errors; nonetheless, the unobserved time-invariant variable would lead to an omitted entity-specific variable bias. RE has the benefit over FE because it contains time-invariant variables.

The time-invariant variables in the FE specification are absorbed by an intercept.

With the exception of the fact that one performer occurs in each regression period for every group, random-effects assume that *i* is a group-specific random element. Whether an impact is random or fixed depends less on the stochasticity of the regressors in the model and more on whether the unobserved individual effect is correlating to them (Greene, 2012: pp. 343-398). The Hausman test is used to assess which specification—the FE or the RE—is superior. A Hausman specification test must be performed in order to connect the country-specific effect with the regressors. The alternative hypothesis is that there is a correlation between the country-specific effect and the regressors, while the null hypothesis is that there is no correlation.

5.4. Pooled OLS Regression Outputs

From the regression output, Table 10 columns (2), we can see the model fits the data well at a 1 percent significance level with the values of F (34, 934) is 5.24 and a *p*-value of 0.0000. The R-squared is 0.19. As a result, the explanatory variables used in this model explain 19 percent of the total variance in Asia (GDPPG). The main variable of this study joint (the interaction MFVA * FDI) is positively associated with economic growth and statistically significant at a 1 percent significant level. The regression coefficient of (MFVA) indicates that manufacturing value added positively impacts economic growth (GDPPG) in Asia, and it is statistically significant. Furthermore, variables such as foreign direct investment (FDI), trade openness (TRO), domestic investment (DIN), and infrastructure (INFST) are also postulate associated with economic growth during the study area. Other variables, such as inflation rate (INFL) and unemployment (UNEPL), are negatively connected to economic growth.

Table 10. Pooled OLS regression results.

	(Model-1) Pooled-OLS without Robust	(Model-2) Pooled-OLS with Robust
Variables	GDPPG	GDPPG
MFVA * FDI	0.00412***	0.00412***
	(0.00144)	(0.00159)
FDI	0.0236*	0.0236
	(0.0128)	0.0236
MFVA	0.111***	0.111***
	(0.0218)	(0.0340)
INFL	−0.0345***	−0.0345***
	(0.00672)	(0.00565)

Continued

DIN	0.0188	0.0188
	(0.0218)	(0.0232)
TRO	0.000397	0.000397
	(0.00305)	(0.00314)
UNEPl	−0.114**	−0.114***
	(0.0462)	(0.0402)
INFST	0.00601	0.00601
	(0.00609)	(0.00729)
Constant	92.98	92.98
	(123.0)	(137.9)
Observations	969	969
Robust	No	Yes
R-squared	0.186	0.186

Note: Standard errors in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Thus, in general, based on the pooled OLS regression result with robust variables such as industrialization (MFVA), the joint impact of industrialization (MFVA * FDI), FDI, and infrastructure (INFST) are statistically significant and positively impact economic growth. In contrast, the inflation rate (INFL) and unemployment (UNEPL) are statistically significant and negatively impact economic growth.

5.5. Post-Estimation Diagnostic Tests

Following pooled (OLS) regression, different scenarios that might bias the estimation results have been tested through the following post-estimation diagnostic tests. Testing has been performed on heteroscedasticity, Wald test, residual normality, and Hausman specification.

5.5.1. Heteroscedasticity

A panel regression analysis fails to meet the homoscedasticity assumption because of undetected variables that differ across countries and remain constant over time; when OLS is used, the variances of the error term are always constant. Unobservable errors in heteroscedasticity do not remain constant over time because their variance does not remain constant. There are several ways to express variance, which is a function of independent variables: Depending on the independent variables, variance may take the following form:

$$V_{ar}\left(\theta_{it}X_{it}\right) = y^2 h\left(X_i\right) \tag{10}$$

As a result of heteroskedasticity, OLS does not lose its unbiasedness, but it

reduces the accuracy of the parameter estimations and makes the variance estimations less efficient. White's test and Breusch-Pagan's heteroscedasticity test for heteroscedasticity are used to check for heteroscedasticity. The heteroscedasticity of panel data is a common problem, so we use the (vce) STATA option to reduce the standard error of heteroscedasticity. In panel data, it is also expected that there will be serial correlation within an entity. Thus, serial correlation within an entity can be controlled by using the cluster option.

Breusch-Pagan Test for Heteroscedasticity

To check whether the null hypothesis is stronger than the alternative hypothesis, the Breusch-Pagan test is used. Homoscedasticity is the assumption that the error variances will be the same for all variables, whereas heteroscedasticity is assuming that the error variances will be multiplicative functions of several variables. Using this approach, the null hypothesis of constant variance can be rejected at a 5% significance level when the probability value of the Chi-square statistic is less than 0.05. Relatives with heteroscedasticity are considered to be heteroscedastic.

Moreover, at each level of the predictor variable, the residuals are acknowledged to have an equivalent variance. Homoscedasticity is the assumption underlying this assumption. When this issue happens, it will lead to the result being unreliable. Using the Breusch-Pagan test for heteroskedasticity, we can trial whether the difference of the errors from the regression rely on the independent variables. Thus, Table 11 shows the regression result for this test.

Table 11. Outputs of (B-P) test for heteroskedasticity.

Type of Test	Chi-squares	*p*-value	Remarks
Breusch-Pagan/Cook-Weisberg test for heteroskedasticity	39.68	0.000	Existences of heteroskedasticity

The latest result of the (B-P) test with a *p*-value of less than 5 percent confirms the existence of the heteroscedasticity problem in the data. The result indicates that the model is not sufficient. So, to control this effect of heteroskedasticity in the random-effects model, we can employ a robust estimate of the standard errors.

White's Test for Heteroscedasticity

The white trial is one of the nearly commonly utilized statistical methods of detecting heteroscedasticity. It focuses on analyzing the residual from the regression models to check for heteroscadasticity. The test is supported on the Chi-square arrangement to test its hypothesis. Generally, it is utilized in conjunction with other methods such as graphic investigation to detect heteroscedasticity. In addition, White's test uses heteroscedasticity variances to check whether errors in a model have homoscedasticity variances. The results of the test confirmed heteroscedasticity in our model (imtest, white) (see Table 12).

Table 12. Heteroskedasticity result using the white test.

Kind of Test	Chi-squares	*p*-value	Remark
White's test for H0: Homoskedasticity against Ha: Unrestricted heteroskedasticity	194.09	0.0000	Existence of heteroskedastic-ity
Source	Chi^2	Df	*p*
Heteroskedasticity	194.09	43	0.0000
Skewness	10.04	8	0.2625
Kurtosis	6.04	1	0.0140
Total	210.16	52	0.0000

5.5.2. Ramsey RESET Test

The Ramsey reset test helps the researcher determine whether or not the model is over-identified. Accordingly, when the *p*-value is significant, it indicates the over-identification of the model. Thus, as clearly seen in the table below, the result shows an over-identification of the model. As we can see from Table 13, over-identification of the model is confirmed by the Ramsey Reset test. Meaning that once the *p*-value is significant, we can confirm the over-identification of the model.

Table 13. Ramsey reset test for over-identification of the model.

Type of Test	Chi-squares	*p*-value	Remarks
Ramsey RESET test	12.32	0.000	Existence over-identification

5.5.3. Test for Residual Normality

During regression estimation, extreme values (outliers) can have a significant impact on the final result. It is possible to determine whether residuals behave as outliers by viewing a residual normality graph. Residual normality is essential for determining the validity and interpretation of the model. Although the normality condition is relaxed in panel data regressions (see Hossain & Rahman, 2021), it may not pose a problem.

5.5.4. Modified Wald Test

In order to determine whether the model is heteroscedastic group-wise, the Modified Wald test is used. Having heteroscedasticity in the estimates can lead to bias in the standard errors.

It is, therefore, crucial to check the model for heteroscedasticity issues. In the case of an existing problem, it can be corrected using the robust option. An analysis of group-wise heteroskedasticity in a fixed effect regression model was carried out using the Modified Wald test. The test results are shown in Table 14. There is no heteroscedasticity in the test statistic 4914.17, which indicates the null hypothesis:

There is no heteroscedasticity. As a way to correct this heteroscedasticity issue, the fixed-effect model makes use of robust standard errors.

Table 14. Group-wise heteroscedasticity test result.

FE Model with Independent Variables	Chi^2 (39)	Prob > Chi^2	Remarks
MFVA FDI MFVA * FDI INFL DIN TRO UNEPl INFST	4914.17	0.0000	There is heteroscedasticity in the model

Pesaran's Test for Cross-Sectional Independence

In addition, it is implausible to conceive developing countries to be strongly interrelated. As a result, developing countries are highly probable to be impressed by the financial and economic shocks of one another. Consequently, most scholars agree that cross-sectional dependence (CSD) arises from large panels that contain 20 - 30-year data (see Baltagi, 2008). A test by Pesaran (2004) has been used in this study to address this issue. Based on the table below, we can see that Pesaran's test for cross-sectional independence was used to determine whether the panel is cross-sectionally independent. Thus, as we can see from Table 15, the *p*-value of Pesaran's cross-sectional independence test proves the creation of cross-sectional dependence in the data. However, to solve this trouble in the main finding, this study used the VCE option (The cross-sectional dependence has been corrected by utilizing the vce option in the study's main finding).

Table 15. Pesaran's test cross-sectional independence test result.

Test	Statistics	*p*-value	The Average Absolute Value of the Off-diagonal Elements	Comment
Pesaran's test of cross-sectional independence	11.691	0.0000	0.246	Cross-sectional dependence in the data

Similarly, the study used Friedman's test of cross-sectional independence. However, the Friedman test for cross-sectional dependence using Friedman's Chi-square distributed statistic. Moreover, for unbalanced panels Friedman's test usage only the discover acquirable for all cross-sectional units. Similar to the Pesaran's test, as we can see from Table 16, the Friedman test indicates the existences of cross-sectional dependence in the data.

Table 16. Cross-sectional independence test result using friedman tests.

Test	Statistics	*p*-value	Average Absolute Value of the Off-diagonal Elements	Comment
Friedman's test of cross-sectional independence	19.923	0.9931	0.620	Cross-sectional dependence in the data

5.5.5. Wooldridge First-Order Serial Correlation Test

When random error terms for an individual entity are correlated with random error terms for other entities, this is called correlation over time. In addition to reducing the standard errors of coefficients and increasing R-squared, serial correlations can also lower the standard errors of their coefficients.

The error terms are said to be auto-correlated if Cov (μ_i, μ_j) ≠ 0, for $_i \neq _j$. It may be a result of the model being misspecified, data influence, outcome inertia, or spatial arrangement that caused the autocorrelation to originate. A country-specific time-invariant effect can evidence to autocorrelation issues within a model when longitudinal data are present. It is possible that persisting sources of persistence suggest serial correlation, which means that OLS parameter estimation is not the Best Linear Unbiased Estimator (BLUE). The results of Wooldridge's test of first-order serial correlation in Table 17 confirm the proximity of first-order serial correlation with a test statistic of 9.380, a *p*-value of 0.0040, and the result of first-order serial correlation with Wooldridge's test statistics. As a result, the fixed-effect model corrected this serial correlation error using the option cluster.

Table 17. Result of serial correlation test.

Fixed Effects Model with Main Independent Variables	Wooldridge Test for Autocorrelation in Panel Data Ho: No First-order Autocorrelation		Remarks
	Statistics	*p*-value	
MFVA FDI MFVA * FDI INFL DIN TRO UNEPl INFST	9.380	0.0040	The model suffers from first-order autocorrelation

5.6. Model Specification

To find the best model that fits the data, Wald test and Hausman specification tests have been performed.

5.6.1. Wald Test

We decided whether to employ the Pooled (OLS) model for our data analysis based on the Wald test. When tests are performed using test-parm, an OLS Pooled regression with 45 countries and N-1 dummies rejects the pooled (OLS) option with a *p*-value in conjunction with the fixed effect and random effect parameters. To determine whether fixed effect or random effect was more appropriate, the Hausman test was chosen rather than the random effect specification (RE).

5.6.2. Hausman Specification Test

The purpose of this test is to evaluate whether the fixed effect specification or the random effect specification ought to be applied. We apply the Hausman specification test to ascertain if the regressors are linked to the country-specific effect. The country-specific effects and the regressors do not seem to be correlated when the null hypothesis is used as a basis; however, when the alternative hypothesis is used as a base, a correlation is evident. This can alternatively be stated as the

alternative hypothesis favoring the fixed effect and the null hypothesis favoring the random effect. With a *p*-value of 0.0273, the random effect model is rejected according to Hausman's test. In this instance, the fixed effect specification model was selected as an alternate specification model (see Table 18).

Table 18. The effect of the hausman test.

Coefficient	
The Value of Chi-squares Value	19.53
P-value	0.0273

5.7. Fixed Effect Regression Results

As mentioned earlier, in the Hausman test, this study's main finding mainly depends on the fixed-effect model. Accordingly, the main finding of this study mainly focused on fixed-effect regression with robust options, as mentioned in model-2 of Table 19. As previously mentioned, the essential variable in this study is the relationship between industrialization and foreign direct investment (MFVA * FDI). As a result, each coefficient can only be understood using Model 2 of Table 19. Consequently, variables like industrialization, which is proxied by manufacturing value added (MFVA), foreign direct investment (FDI), the fundamental interaction of industrialization and foreign direct investment (MFVA * FDI), domestic investment (DIN), trade openness (TRO), and infrastructure (INFST) are positively associated to economic growth during the study period, As can be seen from model-2 in Table 19, inflation rates (INFL) and unemployment (UNEPL) are negatively correlated with economic growth in Asia during the survey period.

As we can see from Model 2 of Table 19, the main variable of this study, the interaction of industrialization and foreign direct investment (MFVA * FDI), also has the expected positive sign. More specifically, as witnessed by the coefficient, a 1 unit increase in the interaction in industrialization and foreign direct investment (MFVA * FDI) increases the GDP per capita growth rate, which proxied for economic growth by 0.0275 units, holding other factors constant. Due to the fact that foreign direct investment and industrialization each contribute to economic growth separately, the result of the combined impact is not surprising. Furthermore, the result also suggests that the development of industrialization and FDI are essential in supporting the economic growth in developing countries in general and Asia. Meanwhile, the more the region develops in industrialization and FDI, the more the region's economic growth will also be.

As evidenced away the coefficient, a one-unit addition in industrialization increases the GDP per capita growth rate (economic growth) by 0.117 units, keeping different factors constant. At a level of significance of 1 percent, the coefficient is statistically significant. A positive and significant impact of industrialization manufacturing value added (MFVA) on economic growth is demonstrated in the results. A further finding indicates that Asia's economy is dependent on manufacturing

and value-added manufacturing to grow. Similarly, as witnessed by the coefficient of 0.0408, FDI is positively associated with economic growth. Accordingly, the coefficient is statistically significant at a 5 percent significance level. The outcome intimate that Asian economic growth was positively affected from 1995 to 2021 by foreign direct investment, which is proxied by foreign direct investment (FDI) inflows. According to this result, the Asia region has adequate infrastructure compared to other developing regions, allowing multinational enterprises to carry out their major operations effectively which is the main reasons for the FDI to flow to the region.

Similarly, as mentioned in Table 19 of Model 2 in the regression, domestic investment (DIN) and trade openness (TRO) are also positively associated with economic growth through the study period (from 1995 to 2021). Economic growth is positively related to domestic investment and trade openness, as shown by coefficients of 0.0555 and 0.00507, respectively. Even though these two variables are positively correlated with economic growth, they are not statistically significant at any level of significance. In contrast to the above variables, which had a positive impact on economic growth, two variables, namely inflation rate (INFL) and unemployment (UNEPL) had a negative impact on economic growth from 1995 to 2021, as expected. Indeed, these results are not surprising since it is a common fact that when there is a high inflation rate and unemployment, there would have a negative impact on economic growth. Specifically, in model 2 of Table 19, inflation is statistically significant and negatively impacts economic growth in Asian countries. In fact, a significant level of 1 percent signifies statistical significance for the coefficient. Furthermore, the unemployment coefficient shows statistical significance throughout the study period and negatively impacts economic growth. In fact, similar to that inflation, the coefficient of unemployment is statistically significant at a 1 percent significance level (see Table 19).

Table 19. Results of the fixed effect model.

	(Model-1) FE-without Robust	(Model-2) FE-with Robust
Variables	GDPPG	GDPPG
MFVA * FDI	0.0282***	0.0275***
	(0.00692)	(0.00487)
FDI	0.0480***	0.0408**
	(0.0119)	(0.0191)
INFL	−0.00336***	−0.00347
	(0.00118)	(0.00211)
MFVA	0.146***	0.117***
	(0.0183)	(0.0362)

Continued

DIN	0.0592**	0.0555
	(0.0243)	(0.0330)
TRO	0.0115	0.00507
	(0.00764)	(0.00951)
UNEPl	−0.410***	−0.338***
	(0.0849)	(0.107)
INFST	0.0120***	0.00335
	(0.00307)	(0.00675)
Constant	4.047***	79.60
	(1.076)	(114.9)
Observations	969	969
R-squared	0.174	0.267
Robust	No	Yes
Number of countries	39	39
Country-effect	Yes	Yes
Year fixed effect	Yes	Yes

Note: Standard errors in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

5.8. Robustness Tests

Alternative economic growth measures were used to conduct the robustness test. Thus, this study used gross domestic product annual (%), which is proxied by GDP, instead of gross domestic product per capita annual growth (%), which was proxied by GDPPG, in order to cheque the robustness of the outcome. Accordingly, the result of this has consistency with the main findings. Especially since the targeted variable (interested variable) in this study is the joint (interaction) between industrialization which proxied by MFVA and foreign direct investment (FDI), it positively impacts economic growth during the study period, which is consistent with the main findings. Apart from the main variable (interested variable), other control variables included in the regression are also consistent with the main finding.

5.9. Endogenity Test

As far as we are aware, traditional regression techniques like OLS, RE, and FE cannot resolve the endogenity problem. This study addressed the endogenity problem by employing the two-system generalized method of moments (GMM). In fact, the GMM strategy works best with big N and short T, which is highly relevant to our investigation, as opposed to employing alternative techniques to address

endogenity-related problems. To handle the endogenity problem, this study employed the two system GMM technique. Further, as Table 20 illustrates, the main variable—foreign direct investment—represented by FDI is also significant, supporting the study's previous main finding.

Table 20. Results of the fixed effect model.

	(Model-1) FE-without Robust	(Model-2) FE-with Robust
Variables	GDP	GDP
MFVA * FDI	0.0297***	0.0316***
	(0.00675)	(0.00534)
FDI	0.0252**	0.0165
	0.0252**	0.0165
INFL	−0.00379***	−0.00398**
	(0.00115)	(0.00193)
MFVA	0.166***	0.132***
	(0.0178)	(0.0389)
DIN	0.0833***	0.0722**
	(0.0237)	(0.0309)
TRO	0.0288***	0.0110
	(0.00745)	(0.00741)
UNEPl	−0.419***	−0.322***
	(0.0828)	(0.102)
INFST	−0.0120***	0.000766
	(0.00299)	(0.00728)
Constant	2.360**	33.97
	(1.048)	(107.2)
Observations	969	969
R-squared	0.221	0.340
Robust	No	Yes
Number of C-ID	39	39
Country-effect	Yes	Yes
Year fixed effect	Yes	Yes

Note: Standard errors in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Additionally, the estimation fit every diagnostic that was needed. The residual has first-order serial correlation, as contraindicate by the AR(1) *p*-value of 0.000; however, the AR(2) *p*-value of 0.268 shows that there is no second-order serial correlation issue. The Hansen test was also engaged in this study to exhibit the validness of the instruments. The result shows that Hansen's *p*-value of 0.5218 is entirely bigger than 0.05, indicating clearly that the regression's instruments are not over-identified. Additionally, as recommended by Roodman (2009), it is appropriate and feasible that the regression's instrument numbers are lower than the total number of countries included in the study (see Table 21).

Table 21. Estimation of two system GMM result.

Variables	GDPPG
GDPPG_lag1	0.111***
	(0.0376)
MFVA	0.132***
	(0.0195)
FDI	0.0337***
	(0.0115)
MFVA * FDI	0.00358***
	(0.00122)
INFL	−0.0390***
	(0.00753)
DIN	0.0253
	(0.0187)
TRO	−0.00191
	(0.00248)
UNEPl	0.0686*
	(0.0366)
INFST	0.00919*
	(0.00509)
Constant	0.522
	(1.075)
Diagnostics	
Observations	935
Number of Countries	45
Number of Instruments	39
AR(1) *p*-value	0.000

Continued

AR(2) *p*-value	0.268
F-test	7.71
F-*p*-value	0.0000
Hansen-test (*p*-value)	0.5218
Year Dummy	Yes

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

5.10. Discussion

As specified earlier, the study's main findings are merely on the fixed effect model (FE) in model-2. Indeed, before the principal findings, the scrutiny also carried out pre-estimation tests. Moreover, the study checked whether the fixed or random effects were more appropriate. For this purpose, the study used the Hausman test. The result favors the appropriateness of the fixed effect model preferably than the random effect model. Consequently, this study's main finding mainly depends on the fixed effect model in column two, which used the robust option to handle the heteroscedasticity problem, as mentioned in **Table 20**. In fact, this study's main objective is to examine the joint result of industrialization and foreign direct investment (MFVA * FDI) on economic growth in the 45 Asian countries from 1995 to 2021.

Accordingly, the result of the main variable of this conformable study, the joint impact of industrialization and foreign direct investment (MFVA * FDI), has the expected positive sign and is statistically significant at a 1 percent significance level. According to this finding, we have observed an increase in the amount of goods produced, the amount of leisure time and the economic growth of the region through FDI and industrialization. In addition, when industrialization and foreign direct investment develop rapidly in a region, the number of job opportunities will increase, which will contribute positively to the economic growth of the country/region. This finding is consistent with those reported in other regions of the world as well as in Asian countries (see Sindze et al., 2021; Zardoub & Abed, 2019; Carkovic & Levine, 2002). Furthermore, these authors figured out that they suggested that joint, as well as separately, there is a positive between industrialization, FDI, and economic growth. On the other hand, this present-day finding is inconsistent with previous findings that came out with the negative relationship between the joint impact of industrialization and foreign direct investment (MFVA * FDI) on economic growth.

In this study, industrialization (MFVA) was recovered to contribute postulate and statistically significantly to economic growth in Asia. The study found the positive effect of industrialization (manufacturing value added) in the Asian region. In addition, it realizes that industrialization is contributing to the rapid growth of Asian economies. Our current finding is consistent with the previous finding carried out by Rodrik (2009). Exploitation regression GDP for five-year periods, the author

also finds that growth rates of GDP and industry shares are significantly correlated. According to him, modern industrial activities serve as engines of growth. Furthermore, our current result supports previous research papers that have found an economic growth-industrialization relationship to be positive and significant. Previous studies have supported the positive and significant relationship between economic growth and industrialization, including (Lugina et al., 2020; Ndiaya & Lv, 2018).

The Asian inflows of foreign direct investment (FDI) also evidence a positive and significant consequence on economic growth. In the current study, the regression results indicate that Asia has benefitted from inflows of foreign direct investment, as it is better at attracting foreign direct investment. Additionally, adequate human capital and a stable macroeconomic environment have catalyzed FDI to contribute to economic growth. Furthermore, this finding is accordant with previous accumulation made by different individual in different countries. It has been found that, both in the short run and in the long run, foreign direct investment is positively correlated with economic growth (Parajuli, 2021). Our research shows that the better the FDI inflows to the region, the better it supports economic growth through job creation and other factors. In addition, the results are consistent with those found in Javid (2016), and Andinuur (2013). Hence, it implies that Asia's governments have implemented sound macroeconomic management to boost investment and growth.

As well as exhibiting a positive and significant impact on economic growth, Asian domestic investment (DIN) exhibits a significant effect. In spite of this, the coefficient does not appear to be statistically significant at any level of significance. A study establish that domestic investment can boost economic growth in a significant way. The likelihood of local investments increasing increases as local investment activities increase. A number of previous studies have shown that domestic investment promotes economic growth (see Bakari et al., 2019; Shabbir et al., 2020). Additionally, we find that economic growth and domestic investment are positively correlated, as previously reported by Ruranga et al. (2014) and Adams (2009).

In a similar fashion to domestic investment, trade openness had the expected positive sign, however due to its statistical insignificance, it is not statistically significant. The statistical insignificance of trade openness in study does not negate its theoretical importance. There is no surprise that trade openness is associated with economic growth in a positive and significant way. In Asia, where trade volumes are much higher compared to other developing regions, trade openness benefits the economy. Excluding variables like exchange rate volatility and government spending maybe distort the relationship between trade openness and economic outcomes. Trade openness might be influenced by factors like growth expectations, making it hard to disentangle cause and effect.

The result is that countries with high trade openness are more likely to be able to access a wide variety of goods and services, which will cause economic growth by providing essential services and goods. The results of this study are consistent with

previous studies that demonstrate that trade openness facilitates greater resource allocation and increases total factor productivity, thereby resulting in economic growth. There is evidence of significant economic growth associated with both of these factors (Kong et al., 2021, Raghutla & Chittedi, 2020, Omri & Kahouli, 2014).

Economic growth is associated with an inflation negative relationship, as expected. This variable has a very strong negative correlation, even when we focus on model 2. It is demonstrated that as inflation rates rise, economic performance declines due to rising prices of all products and services. This depresses investment and causes the economy to decline. Many Asian countries face similar problems as a result of highly variable inflation, which causes them to pay so much foreign exchange when their local currency falls compared to their trading partners. In this study, we confirm the findings of Thanh et al. (2015), who found negative relationships between economic growth and inflation rate.

In addition, unemployment has a perverse impact on economic growth, as shown by its coefficient. Results suggest that the higher the unemployment rate in a region, the greater the negative impact it has on economic growth. In spite of the fact that a large number of previous studies support our current finding, this study is not consistent with the findings of Seth et al. (2018), which conclude that unemployment and economic growth are unrelated. As a result, our findings are in line with those of Gyang et al. (2018), who observed a positive correlation between economic growth and unemployment.

6. Conclusion and Recommendation

6.1. Conclusion

Since most previous research has focused on sub-regions, there have been few studies on the relationship between industrialization, foreign direct investment, and economic growth in Asia as a region, despite the fact that foreign direct investment and industrialization play a crucial role in economic development. Also, previous studies in Asia either focused on industrialization or foreign direct investment, in order to examine the effect of industrialization on economic growth. To the best of the researcher's understanding, no research has been carried out to examine the joint impact of industrialization and foreign direct investment (MFVA * FDI) on economic growth in Asia as a region. As a result, using panel data from 45 Asian countries from 1995 to 2021, this scrutiny goal is to canvas the joint impact of industrialization and foreign direct investment on economic growth in Asia.

Accordingly, as many of the countries in Asia have developed rapidly through inflows of foreign direct investment and industrialization, there is a high likelihood that their economies will grow as well. Moreover, as foreign direct investment and industrialization in Asia continue to rise rapidly, this has had a positive impact on the economy through a variety of opportunities that contribute to economic growth. Finally, the robustness of the main assemblage is addicted by changing the measurement of the interdependent variable and confirming the result of the

main variable (the joint effect of foreign direct investment and industrialization (MFVA * FDI). In addition, the endogenity issue of this empirical study was also handled using the two-system GMM. As well the empirical results as illustered that the joint impact of FDI and industrialization on economic growth is profound, as both factors complement and reinforce each other. Enhanced productivity is one significant outcome of their interaction. FDI often brings in not just capital but also technology and management proficiency, significantly enhancing the productivity of domestic industries. Industrialization then scales up this productivity improvement across the economy, leading to sustained economic growth.

Based on Model 2 of Table 21, it is evident that the interaction between industrialization and foreign direct investment plays a significant role in economic growth. Industrialization, foreign direct investment, inflation, unemployment, and infrastructure are the most important factors driving economic growth. By changing the measurement of the dependent variable, the robustness of the findings can also be confirmed. In light of the findings, we have come to the following conclusion. According to the findings, the interaction between industrialization and foreign direct investment (MFVA * FDI) has an important positive impact on Asian countries. Moreover, industrialization, foreign direct investment, infrastructure, and domestic investment also had a positive impact on economic growth during the study period in Asian countries. As a result, economic growth was negatively affected by inflation and unemployment between 1995 and 2021.

Generally, a general conclusion of this study is that foreign direct investment and industrialization show a positive characterization in enhancing the economic growth of Asian countries separately and jointly.

6.2. Policy Recommendation

This dissertation suggests the following policies based on current empirical findings. Moreover, the findings of this study will also serve as a useful guide for governments, researchers, private sector companies, donors, non-governmental organizations, as well as other interested parties. Firstly, besides, the results of this study propose that Asian governments should invest more in industrialization than the current status, in order to increase the impact of industrialization on economic growth. Besides, a country with a strong manufacturing sector (e.g. Vietnam) attracts FDI in electronics. FDI brings advanced technology, which integrates seamlessly into existing industrial processes, boosting productivity and exports. High economic growth is due to the synergy between industrialization and FDI. Because the higher development of industrialization, the higher chance for the countries to have higher development is due to the fact that it creates a lot of opportunities, which promotes the development of economic growth. Secondly, the empirical findings of this thesis suggest that the Asian government should retain its existing policies on foreign direct investment to ensure that foreign direct investment continues to contribute positively to economic growth. As well, develop

industrial zones or clusters to attract and retain FDI in complementary sectors, provide incentives (tax breaks, subsidies) for FDI in industries aligned with the country's industrial strategy and enhance the absorptive capacity of the local economy through skills training and infrastructure investment. The existing policies on foreign direct investment in Asian countries are seen as successful in attracting more investment to the region, which, in turn, contributes to its economic growth. Thirdly, as suggested by positive contribution of the joint impact of industrialization and foreign direct investment (MFVA * FDI) to economic growth during the study period, due to the presence of high development, due to both industrialization and foreign direct investment, having good policies which encourage the development of this is very important. This means that the countries/regions that have good policies to attract more foreign direct investment and industrialization will have better economic growth. The result of this thesis suggests that governments in this region encourage policies that contribute to maintaining economic growth in this region through foreign direct investment and industrialization.

Conflicts of Interest

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

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