

Panel data analysis of foreign direct investment, control of corruption, and economic growth: Evidence from ASEAN-6 countries

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CHRONICLE

Article history:

Received: November 7, 2023

Received in revised format: November 30, 2023

Accepted: January 8, 2023

Available online: January 8, 2024

Keywords:

FDI Inflows

Generalized Method of Moments

Host Country

Institutions

Panel Vector Autoregressive

ABSTRACT

This research is to examine the role of management of foreign direct investment and control of corruption in economic growth. The research data were collected from the ASEAN-6 countries including Indonesia, Malaysia, Thailand, Singapore, Philippines, and Vietnam during the period of 2002-2021. The research utilizes the panel vector autoregressive (PVAR) method developed by Abrigo and Love (2015) [Abrigo, M. R. M., & Love, I. (2016). Estimation of panel vector autoregression in Stata.] to estimate the research model. The estimation results show that foreign direct investment and corruption control play an important role in promoting economic growth in the ASEAN-6 countries. Furthermore, foreign direct investment and corruption control are closely related to each other, indicating that economic growth is not only directly affected by foreign direct investment and corruption control but also indirectly influenced by each of these factors. This is a new finding of this research compared to previous studies. These findings provide significant empirical evidence for the ASEAN-6 countries, particularly in managing foreign direct investment and controlling corruption to promote economic growth. The implication of these results is that these countries identify appropriate policies to manage FDI and corruption control in order to maximize the level of economic growth.

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1. Introduction

Foreign direct investment (FDI) refers to investments made to gain long-term benefits and is typically defined when an investor acquires a capital stake of 10% or more in a business operating in an economy different from his home one (Ayanwale, 2007; Nguyen, 2022). FDI plays a crucial role in meeting capital needs for economic growth (EG), and in fact, FDI can be much more effective than domestic investment in fostering EG in the host country (Gregorio, 2005). More than that, FDI is instrumental in narrowing the technology gap between countries, specifically by facilitating technology transfer from developed to developing countries (Gui-Diby, 2014; Herzer et al., 2008). This demonstrates that FDI is a vital resource for promoting EG in many countries, as it does not only fulfill capital requirements but also stimulates technological innovation in the host country (Adegbite & Ayadi, 2010). However, FDI can hinder the EG process when it exceeds the optimal level and is not utilized efficiently (Hayat, 2019; Okada & Samreth, 2014).

Corruption is a pervasive phenomenon that has been increasingly powerful worldwide recently (Qureshi et al., 2021). It can be understood as the abuse of public office for personal gain, i.e., the misuse of entrusted power for private gain (D'Agostino et al., 2016; Nguyen et al., 2022). In contrast to corruption, corruption control aims to restrict its occurrence. When corruption increases, the allocation of resources within the economy becomes wasteful and inefficient (Cieslik & Goczek, 2018). Therefore, control of corruption can improve the efficiency of resource allocation, thereby promoting EG (Blackburn et al., 2006; Hayat, 2019; Miao et al., 2021).

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ISSN 2561-8156 (Online) - ISSN 2561-8148 (Print)

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doi: 10.5267/j.ijds.2024.1.006

Control of corruption also increases the extent of investment profitability certainty (Blackburn et al., 2006; Nguyen et al., 2021), thereby enhancing the ability to attract investment, particularly from the private sector (D'Agostino et al., 2016). Alternatively, corruption control creates favorable conditions for the host country to enhance its capacity to attract FDI, improve the absorptive capacity of FDI, and thus promote EG (Aizenman et al., 2013; Hayat, 2019; Jilenga & Helian, 2017; Miao et al., 2021). However, some argue that excessive levels of corruption control may impede the spillover effect of FDI on EG (Hayat, 2019; Okada & Samreth, 2014). Conversely, FDI can serve as an important motivation for countries to improve their level of corruption control, leading to the creation of a favorable environment to promote EG. Nevertheless, there is a significant research gap in exploring the relationship between FDI and corruption control by analyzing the impact of these two factors on EG, which represents a big gap in empirical research.

It can be observed that analyzing the importance of FDI management and corruption control in promoting EG is an intriguing research topic that has been addressed in numerous empirical studies. However, there are still significant gaps, particularly in examining the relationship between FDI and corruption control when analyzing their respective roles. Recognizing these gaps, this research is expected to make certain contributions to the existing literature. Furthermore, this research is based on data from the ASEAN-6 countries, which are the leading economies in the ASEAN region and share many similarities, with their GDP accounting for approximately 95% of the ASEAN's GDP (Ha et al., 2020). Therefore, the findings are essential for the ASEAN-6 countries, especially in managing FDI and controlling corruption to promote EG.

2. Literature review and hypothesis development

Several classical theories, including the endogenous growth theory and the neoclassical growth theory, can be used to describe the role that foreign direct investment (FDI) and corruption control play in fostering EG. According to Solow (1956), the three main forces behind EG are labor, capital, and technology in the neoclassical growth theory. To be sure, the neoclassical growth theory provides a useful framework for understanding how foreign direct investment affects EG. This hypothesis highlights the role of exogenous technology in economic progress in addition to capital. Meanwhile, the endogenous growth theory suggests that endogenous factors such as physical capital, human capital, and other country-specific characteristics are the main drivers of EG (Romer, 1990). These factors indicating country-specific characteristics are primarily concentrated in government policies, such as control of corruption. Therefore, the endogenous growth theory can provide a clearer explanation of the spillover effects of FDI on the EG of host countries.

2.1. The impact of FDI on EG

FDI is a significant source of funding for many nations (Adegbite & Ayadi, 2010) and happens when a company invests resources in business activities outside of its own country (Yavas & Malladi, 2020). FDI significantly contributes to increasing the financial resources of a country, especially for those facing a lack of domestic investment capital (Noorzoy, 1979). Furthermore, FDI helps host countries improve technology and increase employment, thereby promoting EG (Gui-Diby, 2014). The positive effect of FDI on EG has been found by many empirical researchers, such as Aizenman et al. (2013) analyzing data from around 100 countries before the financial crisis, Mehic et al. (2013) analyzing data from 7 countries in Southeast Europe, Gui-Diby (2014) analyzing data from 50 countries in Africa, Okada and Samreth (2014) analyzing data from low and middle-income countries, Doku et al. (2017) analyzing data from 20 countries in Africa, Hayat (2019) analyzing data from low and middle-income countries, Okwu et al. (2020) analyzing data from the top 30 world economies, Appiah-Otoo et al. (2023) analyzing data from 15 countries in West African.

Although a large number of empirical studies have found the positive impact of FDI on EG, some argue the former can impede the latter. Accordingly, when FDI exceeds a certain threshold and is not efficiently utilized, it can bring disadvantages to the host country, thereby hindering EG. This aligns with the findings of Okada and Samreth (2014) and Hayat (2019) when examining data from high-income countries.

In addition, some other studies suggest that the impact of FDI on EG can be ambiguous and insignificant, such as the one by Adams (2009) analyzing data from 42 countries in Sub-Saharan Africa. This may happen if the receiving nation does not set up the necessary framework to absorb and promote the positive spillover benefits of FDI on EG (Ibhagui, 2019). Therefore, home-specific characteristics of the host country play an important role in stimulating the spillover effects. On the other hand, if foreign investors do not possess technological advantages or special strategies, they may not generate significant spillover effects (Blomstrom & Kokko, 2003). Stated differently, FDI only has a noteworthy impact on the EG of the host nation when the investors are endowed with unique strategy or technological advantages.

Based on the literature, FDI has a significant impact on EG, with the predominantly positive trend. Following this, the research hypothesis can be proposed as follows:

H₁: *FDI has a positive impact on EG.*

2.2. The impact of control of corruption on EG

Corruption is the abuse of public office for personal gain, or the misuse of entrusted power for personal benefit (D'Agostino et al., 2016). Conversely, control of corruption contributes to limiting corruption. In fact, corruption is a phenomenon emerging in many countries (Cieslik & Goczek, 2018), and has been the subject of numerous empirical studies. Most of them have found the positive effect of corruption control on EG. This is because corruption raises investors' uncertainty and undermines

confidence in investment returns (Blackburn et al., 2006), reducing the motivation to invest for individuals. Corruption also reduces the efficiency of resource allocation within the economy (D'Agostino et al., 2016). In other words, in a condition with widespread corruption, resources are wasted and inefficiently allocated (Cieslik & Goczek, 2018; Dokas et al., 2023). Therefore, control of corruption can encourage new investments and provide the motivation to boost EG (Blackburn et al., 2006). This impact has been reported by Hayat (2019) when analyzing data of high-income countries, as well as Miao et al. (2021) when analyzing data of 44 African countries.

Nevertheless, some argue that control of corruption can impede EG. In specific, controlling corruption may restrict the government's resource allocation and thereby hinder EG. This impact is particularly evident in the countries with weak institutional quality (Aidt et al., 2008). In other words, in these countries, corruption may promote EG by reducing administrative barriers and facilitating smoother and faster allocation of FDI, even though such allocation can involve the abuse of entrusted authority for personal gain (Li et al., 2000; Méon & Weill, 2010). The negative impact of corruption control on EG has been found in the studies by Kato and Sato (2015) when analyzing data from India, Huang (2016) when analyzing data from South Korea, and Jilenga and Helian (2017) when analyzing data from 36 countries in Sub-Saharan Africa.

Although there exist contradictory views on the extent of this impact, the predominant trend is positive. In fact, the ASEAN-6 countries are making efforts to improve their level of corruption control and have achieved high levels of EG in the region. Therefore, the next hypothesis is proposed as follows:

H₂: *Control of corruption has a positive impact on EG.*

2.3. The correlation between FDI and control of corruption

The theory of endogenous growth emphasizes that EG greatly depends on capital sources and other country-specific factors. Accordingly, the impact of FDI on EG is significantly influenced by the absorptive capacity and conditions of the host country, including the role of corruption control (Durham, 2004).

Indeed, under favorable domestic conditions, the absorptive capacity of the host country can be improved, leading to more effective spillover effects of FDI on the economy. Furthermore, corruption control also plays a decisive role in determining the scale of FDI inflows to the host country because it directly affects the cost and efficiency of FDI utilization (Dabour, 2000). Therefore, it does not only directly affect EG but also exerts an indirect effect through FDI. To prove this perspective, Aizenman et al. (2013) argue that control of corruption can enhance the positive impact of FDI on EG. In another study, Jilenga and Helian (2017) suggest that the level of corruption control stimulates the positive impact of FDI on EG in 36 countries in Sub-Saharan Africa. Similarly, Hayat (2019) concludes that corruption control stimulates the positive impact of FDI on EG in low- and middle-income countries. Recently, Miao et al. (2021) concludes that improvements in corruption control can promote the spillover effects of FDI on EG in 44 African countries. However, some argue that control of corruption may not stimulate the spillover effects of FDI on EG and may even hinder EG. For example, Okada and Samreth (2014) state that FDI can hinder EG in countries with high levels of corruption control. In another study, Hayat (2019) proves that FDI has a negative impact on EG in high-income countries, which persists even when corruption is better controlled.

Furthermore, FDI can be a big incentive for countries to improve their level of corruption control and create a favorable environment to promote EG. Although this issue may exist, there are only few empirical studies analyzing it. Moreover, there is a lack of empirical studies examining the relation between FDI and corruption control when examining the impact of these factors on EG. This is a significant gap in current empirical research.

Generally, there exists a close nexus between FDI and corruption control which can vary how each of them affects EG. Alternatively, EG is not only directly affected by FDI and corruption control, but also indirectly affected by their relation. Based on this, the final hypothesis is suggested as follows:

H₃: *FDI is related to control of corruption.*

3. Methodology

The paper collects data from ASEAN-6 countries, including Indonesia, Malaysia, Thailand, Singapore, the Philippines, and Vietnam in the period 2002-2021. These are the top six countries in the ASEAN region sharing many similarities, with their GDP accounting for about 95% of the ASEAN's GDP (Ha et al., 2020). Data on corruption control have been fully available since 2002, so the data are obtained from 2002 to 2021 to ensure that the variables are reliable.

The data on EG (Y) are measured through the logarithm of GDP per capita, which is in line with the previous measure of Ibhagui (2019).

FDI is measured by foreign direct investment net inflows (% of GDP), and this measurement approach has been used in previous studies of Aizenman et al. (2013), Mehic et al. (2013), Gui-Diby (2014), Okada and Samreth (2014), Doku et al. (2017), Hayat (2019), and Okwu et al. (2020).

COR represents the level of corruption control in a country (Ngare et al., 2014). This index is published in the World Governance Index (WGI), developed by the World Bank since 1996 (Hayat, 2019; Jilenga & Helian, 2017; Miao et al., 2021). It ranges from -2.5 (weak) to 2.5 (strong).

The control variables (Z) include population growth (POP) and inflation (INF). In particular, POP is measured by the annual population growth rate (Hayat, 2019; Okada & Samreth, 2014), while INF is determined through the annual growth of consumer price index (Doku et al., 2017; Mehic et al., 2013; Miao et al., 2021; Okwu et al., 2020).

The existing literature has proved the significant role of FDI and corruption control in EG. Additionally, there is a close relation between FDI and corruption control. Based on this, the research models the simultaneous relationship using the panel vector autoregressive (PVAR) approach developed by Abrigo and Love (2016). Rather than making a distinction between exogenous and endogenous variables, the PVAR approach considers all variables to be endogenous in common. Furthermore, every proxy in PVAR depends on all other variables and their historical data, proving that all variables are equal and consistent. This method proves to be suitable as it leverages the advantages of generalized method of moments (GMM) and allows the consideration of relationships among variables in the research model. This advantage is also the difference of this study compared to previous studies.

$$Y_{it} = \delta_0 + \sum_{k=1}^n \delta_{1k} Y_{it-k} + \sum_{k=1}^n \delta_{2k} FDI_{it-k} + \sum_{k=1}^n \delta_{3k} COR_{it-k} + \sum_{k=1}^n \delta_{4k} Z_{it-k} + \mu_{1i} + \varepsilon_{1it} \quad (1)$$

$$FDI_{it} = \alpha_0 + \sum_{k=1}^n \alpha_{1k} FDI_{it-k} + \sum_{k=1}^n \alpha_{2k} COR_{it-k} + \sum_{k=1}^n \alpha_{3k} Y_{it-k} + \sum_{k=1}^n \alpha_{4k} Z_{it-k} + \mu_{2i} + \varepsilon_{2it} \quad (2)$$

$$COR_{it} = \beta_0 + \sum_{k=1}^n \beta_{1k} COR_{it-k} + \sum_{k=1}^n \beta_{2k} FDI_{it-k} + \sum_{k=1}^n \beta_{3k} Y_{it-k} + \sum_{k=1}^n \beta_{4k} Z_{it-k} + \mu_{3i} + \varepsilon_{3it} \quad (3)$$

where, Eq. (1) focuses on analyzing the impact of FDI and COR on Y , while Eq. (2) and Eq. (3) examine the relationship between FDI and COR. Additionally, i represents each participating country, with $i = 1, 2, \dots, n$; t denotes the time of the study, with $t = 1, 2, \dots, T$; k represents the maximum lag chosen; μ represents a country-specific effect; and ε represents the error terms of the model.

Arellano and Bond (1991) suggest taking the first difference of Eq. (1), Eq. (2), and Eq. (3) to eliminate the correlation between country-specific effects (μ_{1i} , μ_{2i} , and μ_{3i}) and explanatory variables. Therefore, Eq. (1), Eq. (2), and Eq. (3) are transformed into Eq. (4), Eq. (5), and Eq. (6) as follows:

$$\Delta Y_{it} = \sum_{k=1}^n \delta_{1k} \Delta Y_{it-k} + \sum_{k=1}^n \delta_{2k} \Delta FDI_{it-k} + \sum_{k=1}^n \delta_{3k} \Delta COR_{it-k} + \sum_{k=1}^n \delta_{4k} \Delta Z_{it-k} + \Delta \varepsilon_{1it} \quad (4)$$

$$\Delta FDI_{it} = \sum_{k=1}^n \alpha_{1k} \Delta FDI_{it-k} + \sum_{k=1}^n \alpha_{2k} \Delta COR_{it-k} + \sum_{k=1}^n \alpha_{3k} \Delta Y_{it-k} + \sum_{k=1}^n \alpha_{4k} \Delta Z_{it-k} + \Delta \varepsilon_{2it} \quad (5)$$

$$\Delta COR_{it} = \sum_{k=1}^n \beta_{1k} \Delta COR_{it-k} + \sum_{k=1}^n \beta_{2k} \Delta FDI_{it-k} + \sum_{k=1}^n \beta_{3k} \Delta Y_{it-k} + \sum_{k=1}^n \beta_{4k} \Delta Z_{it-k} + \Delta \varepsilon_{3it} \quad (6)$$

Where Δ represents the first difference of the variables.

4. Empirical analysis

The descriptive statistics are detailed in Table 1 as follows:

Table 1
Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
Y	8.52	1.22	6.07	11.26
FDI	5.79	7.35	-0.99	32.69
COR	0.02	1.01	-1.14	2.30
POP	1.28	0.94	-4.17	5.32
INF	3.66	3.57	-1.14	23.12

Table 1 shows that the average value of Y is 8.52 (equivalent to 11,567.12 USD), with the lowest value (6.07, equivalent to 434.81 USD) belonging to Vietnam in 2002, and the highest value (11.26, equivalent to 77,710.07 USD) belonging to Singapore in 2021. The average value of FDI is 5.79%, with the lowest value belonging to Thailand in 2020 (-0.99%) and the highest value belonging to Singapore in 2021 (32.69%). For COR, the average value is 0.02, with the lowest value of -1.14 for Indonesia in 2002 and the highest value of 2.30 for Singapore in 2004.

Next, the study employs the Levin-Lin-Chu (LLC) and Im-Pesaran-Shin (IPS) tests, proposed by Levin et al. (2002) and Im et al. (2003) respectively, to determine the stationarity of the variables. Their results are presented in Table 2 as follows:

Table 2
Stationarity test result

Variable	LLC	IPS
Y	-5.35*** (0.00)	-2.29*** (0.01)
FDI	-3.80*** (0.00)	-3.30*** (0.00)
COR	-1.38* (0.08)	-1.09 (0.14)
POP	2.26 (0.99)	6.07 (1.00)
INF	-1.55* (0.06)	-3.69*** (0.00)
ΔY	-2.23*** (0.01)	-4.04*** (0.00)
ΔFDI	-6.68*** (0.00)	-5.78*** (0.00)
ΔCOR	-3.74*** (0.00)	-5.90*** (0.00)
ΔPOP	-1.72** (0.04)	-1.71** (0.04)
ΔINF	-7.76*** (0.00)	-6.77*** (0.00)

Note: *** $p \leq 0.01$; ** $p \leq 0.05$; * $p \leq 0.1$.

The result indicates that all the variables become stationary at first difference, or $I(1)$. Therefore, these variables are used to estimate the research model.

Table 3
Result of lag selection criteria

lag	CD	J	J pvalue	MBIC	MAIC	MQIC
1	-2.26	54.33	0.97	-277.98	-95.67	-168.96
2	0.64	29.00	0.99	-192.54	-71.00	-119.86

Based on the lag selection criteria proposed by Andrews and Lu (2001), the first-order PVAR is preferred because it has the lowest values of MBIC, MAIC, and MQIC (Table 3). Therefore, it is chosen to estimate the research model.

Table 4
PVAR estimation result

Variable	ΔY	ΔFDI	ΔCOR
	(4)	(5)	(6)
$\Delta Y(-1)$	-0.253*** (0.00)	-10.500*** (0.00)	-0.378*** (0.00)
$\Delta FDI(-1)$	0.003*** (0.00)	-0.188*** (0.00)	0.001*** (0.01)
$\Delta COR(-1)$	0.724*** (0.00)	-69.420*** (0.00)	-0.255*** (0.00)
$\Delta POP(-1)$	-0.007* (0.10)	-1.177*** (0.00)	0.20*** (0.00)
$\Delta INF(-1)$	-0.001 (0.78)	-0.586*** (0.00)	0.001 (0.24)

Note: *** $p \leq 0.01$; * $p \leq 0.1$.

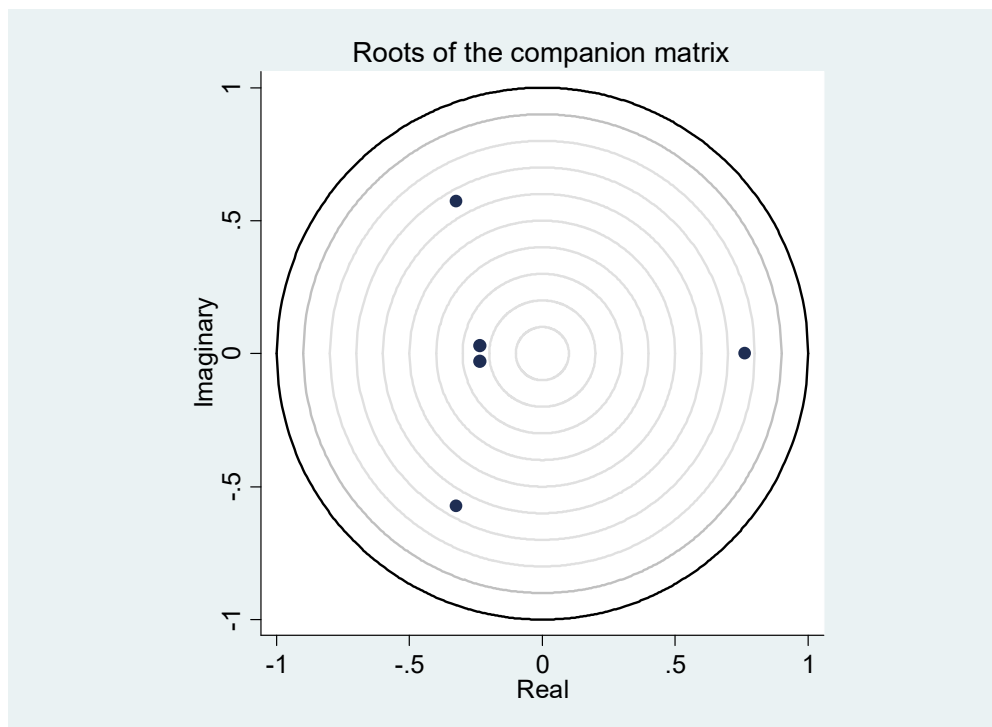


Fig. 1. Stability test result

Fig. 1 shows the estimation result using the first-order PVAR, which is stable and appropriate. In specific, EG is positively influenced by FDI and control of corruption at a lag of 1. Additionally, FDI and control of corruption have a close relationship. Specifically, control of corruption has a negative impact on FDI while FDI has a positive impact on control of corruption (Table 4). The result is also consistent with the Granger causality test result in Table 5. Furthermore, Table 4 also shows that FDI is negatively affected by population growth and inflation while population growth has a positive impact on control of corruption.

Table 5

Granger causality test result

Inferences of causality		Results
FDI → Y	16.01*** (0.00)	Yes
COR → Y	267.89*** (0.00)	Yes
COR → FDI	449.02*** (0.00)	Yes
FDI → COR	6.36*** (0.01)	Yes

Note: *** $p \leq 0.01$.

The impact of FDI on EG: The estimation results show that EG is positively affected by FDI at the lag of 1. In addition, Figure 2 also shows that EG is positively influenced by FDI with an approximate lag of 3. Therefore, the H_1 is accepted. This is in line with the previous findings of Aizenman et al. (2013), Mehic et al. (2013), Gui-Diby (2014), Okada and Samreth (2014), Doku et al. (2017), Hayat (2019), Okwu et al. (2020), and Appiah-Otoo et al. (2023). Moreover, the result affirms the compatibility of the neoclassical growth and endogenous growth theories in the ASEAN-6 countries. Accordingly, FDI significantly contributes to the increase of financial resources in the ASEAN-6 countries and also helps them improve technology and advance EG.

The impact of corruption control on EG: The estimation results indicate that control of corruption has a positive impact on EG with a lag of 1 (Table 4). This positive impact is also significant at a lag of 3 (Fig. 2). Therefore, the H_2 is accepted. This suggests that control of corruption can provide reassurance to foreign investors, making them feel confident about their investment returns, thereby encouraging new investments. It can also improve the efficient allocation of resources in the economy, providing the impetus to promote EG in the ASEAN-6 countries. This finding is consistent with the previous findings of Blackburn et al. (2006), Hayat (2019), Miao et al. (2021), and Dokas et al. (2023).

The correlation between FDI and control of corruption: The findings show that FDI and control of corruption have a close relationship (Table 5). In other words, the H_3 is accepted. According to the results, control of corruption has a negative impact on FDI with a lag of 1, but this impact turns positive at a lag of 2 (Figure 2). This suggests that control of corruption is important in enhancing the positive impact of FDI on EG, which is particularly evident at a lag of 2. This is an interesting finding of this study. Conversely, FDI has a positive impact on control of corruption with a lag of 1. Therefore, FDI can be an important driver for the ASEAN-6 countries to improve their level of corruption control and create a favorable environment to promote EG. This is a novelty of this study compared to the previous research. Thus, FDI and control of corruption have a close relationship, which can modify how each of them affects EG. Based on this finding, it is crucial for the ASEAN-6 countries to determine appropriate policies for managing FDI and controlling corruption in order to maximize their EG potential.

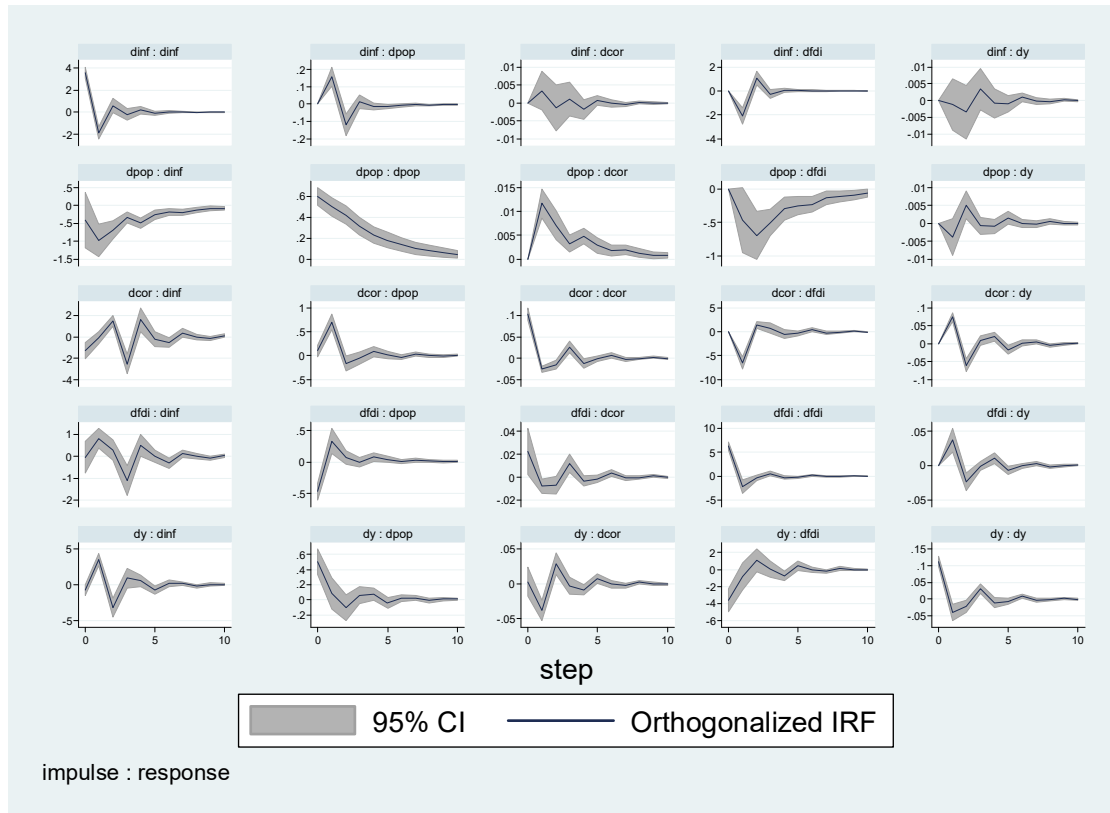


Fig. 2. Impulse response analysis result

5. Conclusion

The objective of this research is to examine the role of FDI and corruption control in EG in the ASEAN-6 countries during the period 2002-2021. To address it, the study utilizes the PVAR method developed by Love and Abrigo (2015) to estimate the research model. The estimation results show that FDI and corruption control have a positive impact on EG in the ASEAN-6 countries. Furthermore, FDI and corruption control have a close relationship with each other, indicating that EG is not only directly influenced by FDI and corruption control but also indirectly affected by each of these factors. This finding is a novel contribution of this research compared to previous studies. Therefore, it is crucial for these countries to identify appropriate policies to manage FDI and corruption control in order to maximize the level of EG. These countries should focus on several key issues, including:

For FDI, they need to enhance their ability to attract and effectively utilize FDI. This is because FDI does not have a direct impact on EG but also serves as a catalyst for improving corruption control and advancing EG. The attraction of FDI should be focused on high-tech industries and sectors that leverage the host country's strengths. Additionally, they should implement preferential policies and protect the rights of foreign investors to instill confidence and create a conducive environment for attracting FDI.

For corruption control, it is necessary for them to raise their control of corruption, ensuring that anti-corruption efforts are maintained steadily in the long term. Only then can the clear effectiveness of corruption control be achieved. This effectiveness does not only create a favorable investment environment but also enhances the capacity to absorb FDI, which is a significant driver of EG. To achieve this, they should enact and update regulations that are more appropriate to reality and establish strict

monitoring mechanisms to detect and prevent corruption-related incidents timely. Additionally, they should expand channels of information to allow citizens to easily express their opinions and report corruption cases.

Furthermore, they also need to improve the macroeconomic environment to attract FDI, control inflation at an appropriate level, and, most importantly, stimulate EG. Also, the quality of the labor force should be paid more attention as a crucial factor to enhance the ability to attract FDI and create a favorable environment for EG.

The research has achieved its aimed objective, but there are still certain limitations. For instance, due to limited data availability, it is unable to analyze each country individually. Or the selection of control variables in the model is based on previous research findings, so there may be additional control variables that were not included in previous studies but could play a significant role in reality. These limitations open up interesting avenues for future studies.

Acknowledgment

This research is funded by the Industrial University of Ho Chi Minh City (IUH), Vietnam (grant number: 22/1TCNH01).

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