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The Association of Economic Growth, Foreign Aid, Foreign Direct Investment and Gross Capital Formation in Indonesia: Evidence from the Toda–Yamamoto Approach

Rosdiana Sijabat

Department of Business Administration, Atma Jaya Catholic University of Indonesia, Jakarta 12930, Indonesia; rosdiana.sijabat@atmajaya.ac.id

Abstract: This study examines the direction of causality between Gross Domestic Product, foreign aid, foreign direct investment, and gross capital formation in Indonesia from 1970 to 2019, using the augmented Toda–Yamamoto approach with the Granger causality test. Furthermore, this study achieved the unit root test for both variables using the ADF test, which confirmed that the variables studied were cointegrated and had a prolonged equilibrium relationship with GDP, ODA, FDI, and GCA. The Toda–Yamamoto causality test was used to investigate the direction of causality between variables. The results showed a positive one-way causality between ODA and GDP as well as between FDI and GDP. ODA has promoted the expansion of economic and development activities, thereby leading to GDP in Indonesia. However, despite having a long-run relationship, the study failed to prove a causal relationship between ODA and GCA in Indonesia. Therefore, there is a need for more optimal foreign aid management to attract foreign direct investment.

Keywords: economic growth; foreign aid; foreign direct investment; capital formation; causality

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1. Introduction

Studies on the relationship between economic growth (GDP), foreign aid, investment flows, and gross capital formation within a country have been previously conducted by Adebayo and Kalmaz (2020) as well as Pasara and Garidzirai (2020). For decades, foreign aid or Official Development Assistance (ODA), has become a topic of interesting discussion because it provides financing and financial support for growth in many developing countries (Adebayo and Kalmaz 2020; Mahembe and Odhiambo 2019). According to Younsi et al. (2019) and Moe (2008), some of the factors associated with the importance of ODA in developing countries are budget deficits, lack of domestic savings, and accumulated investment. Foreign aid is a global strategy applied in developing countries to alleviate poverty and improve the economy (Dutta et al. 2016; Adebayo and Kalmaz 2020).

Empirical studies carried out by Belloumi and Alshehry (2018), Krkoska (2001), and Anetor et al. (2020) found a relationship between FDI and economic growth. Furthermore, the positive impact of foreign direct investment on economic performance has also been relatively well established. The positive impact of foreign direct investment (FDI) on the transitional economy is also an essential source of financing to help cover the current account and fiscal deficit. It also adds to inadequate domestic resources and acts as a source of capital accumulation for a country (Ridzuan et al. 2017; Krkoska 2001). FDI also supports technology transfer and helps local companies expand into foreign markets (Olorogun et al. 2020). However, Belloumi and Alshehry (2018) found a negative effect between GDP growth and FDI. The study reinforces this finding carried out by Olorogun et al. (2020), which stated that FDI could affect Nigeria's GDP. This shows that there is no consensus on the relationship between FDI and economic growth in a country.

Furthermore, several studies have examined the causal relationship between capital formation and economic growth. For instance, research carried out by Turković (2017)

stated that GCA shows a high significance in technological improvement, with a significant impact on aggregate production activities in an economy. According to Habiyaremye and Ziesemer (2006), the level of GCA affects economic growth. Therefore, those with a lower initial capital stock can generate a higher marginal rate of return (productivity) with increased capital accumulation in the productive sector. Ghali and Ahmed (1999) found a two-way causality between fixed investment (capital formation) and economic growth in the G-7 economies. In a relatively recent study carried out by Topcu et al. (2020), the results of a causality test from 1980 to 2018 in 124 countries found a unidirectional causality between gross capital formation and GDP. However, studies examining the causality of GCA and economic growth have not been conducted in Indonesia. Moreover, the GCA and its contribution to output creation in Indonesia are not known due to the lack of capital stock estimation (Van der Eng 2008). Based on the discussion above, studies on the causality of FDI, ODA, and GCA with economic growth have been conducted. To date, there is a limited idea associated with the dynamics of causality between these variables due to Indonesian conditions, especially in using time series data.

This study makes two significant contributions to the empirical literature on GDP, ODA, FDI, and GCA. Firstly, it fills the causality with economic growth in Indonesia over an extended period of 50 years (1970–2019). This study aims to determine the Toda–Yamamoto causality framework through a robust empirical investigation. This approach helps allow augmented Granger causality testing between economic growth, ODA, FDI, and GCA by considering long-run information often overlooked in systems requiring differencing and before estimation. Muqorrobin (2015) carried out previous studies, and Budiharto et al. (2017) only relied on time series analysis. Previous studies ignore the possibility of non-stationarity or cointegration between series. Therefore, the TY approach is a better causality test than the Granger causality test because it combines data series regardless of the non-stationarity and cointegration possibility (Mishra 2014; Toda and Yamamoto 1995; Cervantes et al. 2020; Boţa-Avram et al. 2018). Through this approach, the risks associated with the possibility of incorrectly identifying the serial integration order or the presence of cointegration are minimized (Mehta et al. 2021; Eriksson and Lundmark 2020). Furthermore, this approach minimizes distortion and overcomes variable order integration issues (Bezić and Radić 2017; Eriksson and Lundmark 2020; Mehta et al. 2021).

Analysis of Trends In GDP, ODA, FDI and Gross capital formation in Indonesia.

From 1970 to 2019, Indonesia's GDP experienced a consistent upward trend as seen in Figure 1. The country had an average growth of 5.52 percent per year, with the lowest (negative) growth of −13.1 percent in 1998 and the highest in 1980 at 9.88 percent. In almost 50 years, Indonesia's GDP has increased by 1.258 percent or more than 12 times, from 88 billion rupiahs in 1970 to 1.2 trillion in 2019.

Generally, the Net Official Development Assistance (ODA) shows a downward trend from 1970 to 2019. However, as in the graph above, the development of ODA value is very volatile, with an average change per year of −73 million US dollars. The most significant decline of USD 1.4 billion (1.94 billion USD in 2003 to USD 228 million) occurred in 2004. Meanwhile, the steepest increase of US$2.4 billion occurred in 2005. The highest ODA value happened in 1971 at US$3.5 billion and the lowest in 2019 at US$-605 million. During this period, the average ODA was 1.52 billion US dollars (Figure 2).

According to Figure 3, Indonesia's FDI net inflows appear to have a relatively low change in the period before 1990. This was followed by an increasing trend and a decline from 1997 to 2000, known as the period of the monetary crisis in Indonesia (and Southeast Asia). In this period, the lowest FDI net inflow of −4.5 billion US dollars was recorded from 1970 to 2019. The increase in FDI was also experienced in the early 2000s, with a sharp rise from 2010 to 2014. Furthermore, the highest net inflow value of 25 billion US dollars from 1970 to 2019 was recorded in 2014. After that peak, FDI net inflows fell over the next two years by more than 80 percent from 2014 to 2016 (25 billion to 4 billion US dollars). A sharp increase (350 percent) occurred in 2017 after the fall. In 2019 the value of FDI net

inflow was USD 24.9 billion, which increased 171 times from 1970, which was only USD 145 million.

Figure 4 exhibits that Indonesia's GCA experienced relatively stable changes from 1970 to 1982 and 2007 to 2019, with high fluctuations between these two periods. There was a sharp increase from 1982 to 1985 by 15 times, from US$75 billion to US$1.2 trillion, which was also the highest rise in GCA value in the period 1970–2019. GCA then fluctuated until there was a drastic decline after 1995 with a negative value in 1998 and reached its lowest value of −949 billion US dollars in 2003.

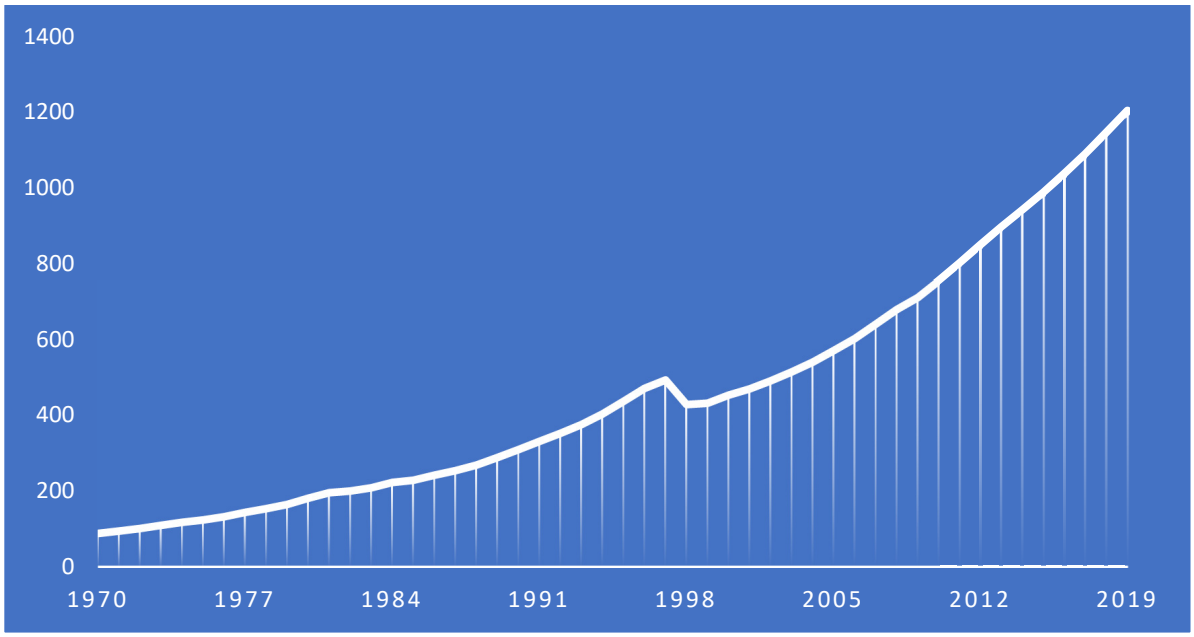

Figure 1. GDP, 1970–2019 (in billion Rupiah, constant).

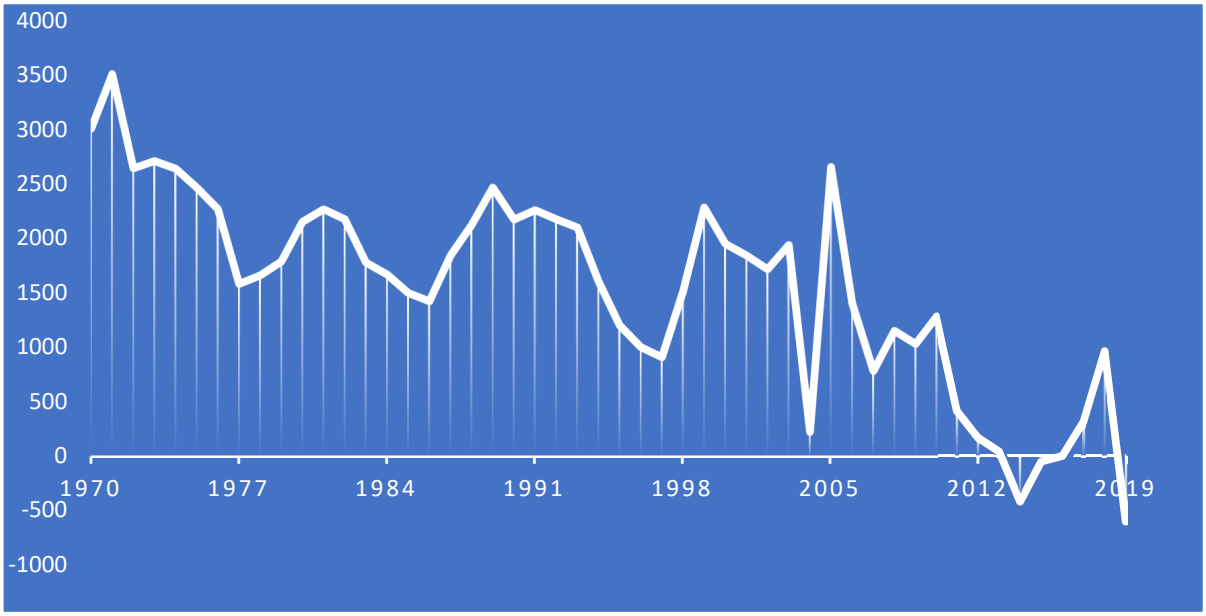

Figure 2. Official Development Assistance, 1970–2019 (in million, constant 2018 US$).

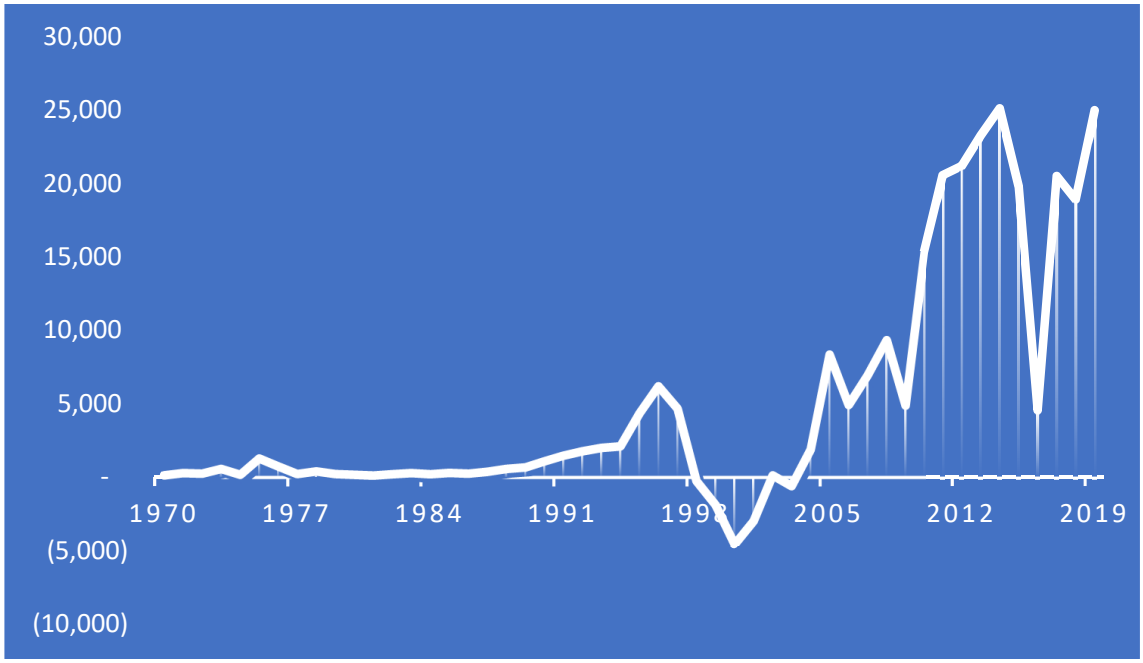

Figure 3. FDI Net inflows (BoP, in a million current US$).

From 1970 to 2019, GDP, ODA, FDI, and GCA showed different trends. GDP was consistently positive, while ODA declined significantly during this period. FDI had shown a positive trend since the late 1990s and early 2000s with large fluctuations. Subsequently, as seen in Figure 4, the GCA trend showed high fluctuations between 1982 and 2007 with low and positive changes outside this timeframe.

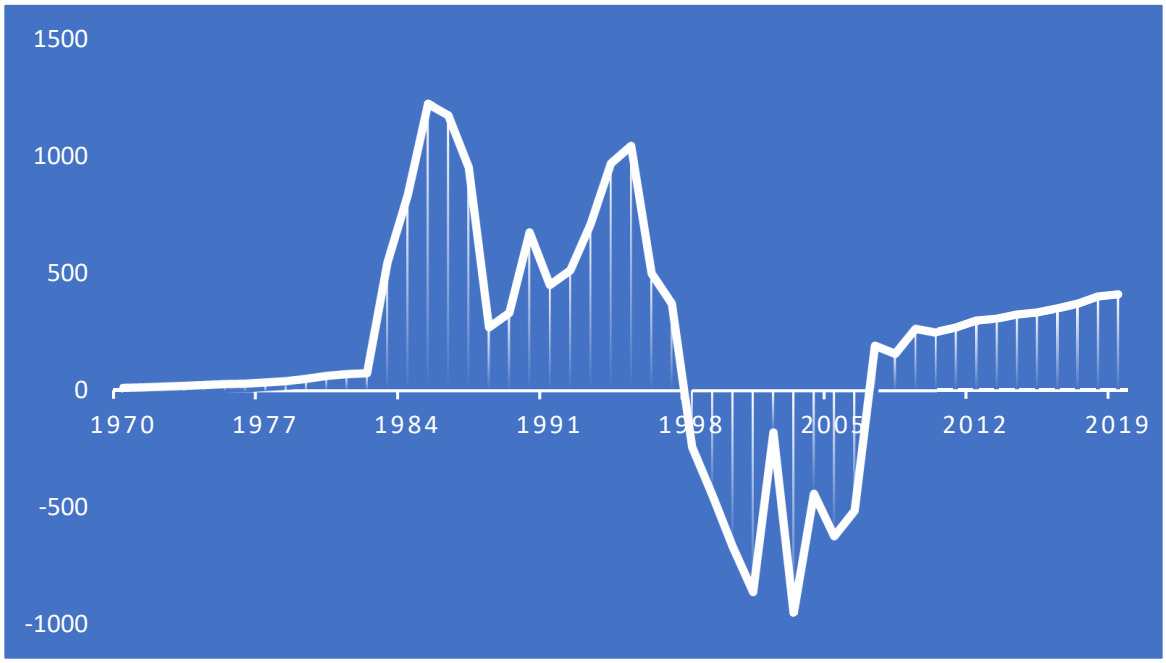

Figure 4. Gross Capital Accumulation (in billion constant 2010 US$).

1.1. Economic Growth, ODA, FDI and Capital Formation

Capital formation is defined as generating capital assets and not using all of its resources for domestic development. Meanwhile, foreign aid (ODA) is a global strategy for alleviating poverty and improving the economy (Adebayo and Kalmaz 2020; Zhao and Du 2009). ODA is a form of Official Development Assistance and provides financial aid to promote developing

countries' economic development and welfare (Minoiu and Reddy 2010; Lee et al. 2020). Several studies have examined the relationship between ODA, FDI, and GCA with economic growth using different perspectives. However, the relationship between these variables is mainly mixed in both developed and developing countries. Anetor et al. (2020) examined 29 Sub-Saharan African (SSA) countries to determine the effect of FDI, international trade, and international aid on poverty reduction. The study used annual data for variables HDI, FDI, foreign aid, trade openness, GDP growth per capita, gross domestic formation, annual population growth, and inflation from 1990 to 2017 with the Feasible Generalized Least Square (FGLS) approach. The results of their study showed that the FDI level needed to eradicate poverty had not been achieved, and Foreign Aid had not been appropriately channeled. However, the study results showed that trade has a positive and significant effect on poverty alleviation, especially in SSA.

Numerous studies have been carried out to determine the relationship between growth and foreign aid, especially in developed and developing countries (Farah et al. 2018). Younsi et al. (2019) examined the relationship between foreign aid and reductions in income inequality in 16 African countries. The study used an unbalanced panel annual dataset from 1990 to 2011 with a random effect model using robust OLS regression and system-GMM estimator. The results showed that foreign aid, foreign investment, trade openness, and corruption had a positive and statistically significant effect on reducing income inequality. Furthermore, government spending and inflation had a negative and statistically significant effect on reducing income inequality. Conversely, Dutta et al. (2016) explored the impact of foreign aid on government regulation regarding the business climate in 64 MENA (the Middle East and North America) and sub-Saharan Africa countries. The dependent variables tested were various measures capturing the regulatory climate of a country's business, such as ease of opening a business, building warehouses, owning property, paying taxes, enforcing contracts, and closing businesses. While the independent variable was the flow of foreign aid in net official development assistance (ODA) and official aid (% GDP). This study analyzed panel data from 2004 to 2009 using the GMM estimator system analysis technique and the instrumental variable approach. The authors concluded that aid worsens the business climate by increasing government restrictions. This was because foreign aid provides recipient governments and political elites with the right resources to strengthen their power and predatory policies harmful to the business climate.

Research carried out by Yiew and Lau (2018) in 95 developing countries found a U-shaped relationship between foreign aid and economic growth. Initially, foreign aid had a negative impact on the country's growth, and at a certain time, it positively contributed to its economy. Simultaneously, the study examines the impact of foreign aid (ODA) and FDI on economic growth (GDP) using Pooled OLS (POLS), Random Effects (RE), Fixed Effects (FE), and Fixed Effect Robust (FERB) regression models. Still from developing countries, Ali et al. (2019) stated that foreign aid has a significant adverse effect on the corruption level. Furthermore, it was also found that foreign aid lowered the corruption perception index, thereby leading to more corruption in the country. This study was carried out to analyze foreign aid (FA) on corruption in Pakistan, India, Sri Lanka, and Bangladesh. The variables analyzed are the corruption level, foreign aid, GDP per capita, democracy, the rule of law (public perception of applicable law), and political stability from 2000 to 2014. The analysis was carried out using dynamic ordinary least squares (PDOLS) and fully modified ordinary least squares (FMOLS) panels to estimate the coefficients of cointegrating vectors and the Granger causality test panel (Granger 2004; Matesanz and Fugarolas 2009).

Mahembe and Odhiambo (2019) also conducted a study in 82 developing countries to examine the causal relationship between foreign aid, poverty, and economic growth. Their study used annual dynamic panel data from 1981 to 2013 with a panel unit roots approach, cointegration, and a panel vector error-correction model (VECM) Granger causality test (Granger 2004). The results of a study by Mahembe and Odhiambo (2019) provide evidence that there is a two-way causal relationship between economic growth and poverty in the short term. In addition, a unidirectional causal relationship was also found between

economic growth and foreign aid. Their study also empirically found a unidirectional causality between poverty and aid abroad. In contrast to the results of the short-term analysis, in the long run, it was found that foreign aid tends to converge on its long-term equilibrium path in response to changes in economic growth and poverty. In addition, economic growth and poverty together lead to foreign aid.

A relatively recent study carried out by Adebayo and Kalmaz (2020) examined the relationship between economic growth, foreign aid, trade, gross fixed capital formation, and inflation rates in Nigeria. The time-series regression analysis for the 39 years (1980–2018) used the Bound cointegration test, ARDL, and the time-frequency domain wavelet coherence approach. Their study confirmed that there is a long-run relationship between the indicators considered. The study also revealed that economic growth is significantly affected by foreign aid, trade openness, gross fixed capital formation, and inflation rates in the long run. The results of the wavelet coherence technique provide evidence to support the long-run estimation of this study, and the wavelet coherence results are supported by the results of the Toda–Yamamoto causality test.

Jena and Sethi (2020) empirically tested the effectiveness of foreign aid by improving the prospects for economic growth in the sub-Saharan Africa (SSA) region from 1993 to 2017 from 45 SSA countries. This study is based on Pedroni and Kao's cointegration test, the Johansen–Fisher Panel cointegration test, FMOLS, and PDOLS. They found that long-run and short-run relationships exist between foreign aid, economic growth, investment, financial deepening, price stability, and trade openness of the SSA economy. Moreover, there is also a unidirectional causality running from foreign aid to economic growth. The implications of this finding emphasize that the government in the region needs to design appropriate policy measures aimed at removing barriers; hence aid flows can be used more wisely to lead to optimal utilization of available resources.

Mallik (2008) examined the effectiveness of foreign aid for economic growth in the six poorest and most aid-dependent countries in the Central African Republic using the Vector Error Correction Model approach. The study found a long-run relationship between real GDP per capita, aid and investment as its percentage, and openness. Furthermore, the long-run effect of aid on growth is negative for most of the countries studied. It seems that a large amount of aid to these countries meets humanitarian needs rather than increasing the economy's productive capacity.

1.2. Economic Growth, Foreign Aid, FDI and Capital Formation

Many developing and developed countries are trying to attract FDI (Anetor et al. 2020). Table 1 summarizes previous studies on the association between economic growth, foreign aid, FDI, and capital formation. Findings from previous studies reveal that FDI has a positive or negative impact on a country's economic growth. Similarly, a study carried out in Nigeria by Olorogun et al. (2020) found that FDI affects GDP. Furthermore, they also concluded a significant relationship between GDP and Financial Development of the banking sector, which is also corroborated by indirect causality from gross capital formation to the financial sector. Their study analyzes gross capital formation (GCF) and financial development of the financial sector (% GDP) from 1970 to 2018 using Pesaran's ARDL bounds test and Toda–Yamamoto Granger causality and generally reinforces economic growth as a result of inflows. FDI, in the long run, through the financial sector, confirms that finance is the most crucial sector in the Nigerian economy.

Table 1. Summary of Studies in the Relationship between GDP, ODA FDI, and GCA.

Authors	Period	Countries	Econometric Techniques	Main Findings
Anetor et al. (2020)	1990–2017	29 Sub-Saharan Africa Countries	Feasible Generalized Least Square (FGLS).	FDI has not been able to alleviate poverty. Foreign aid has not been appropriately channeled, although trade can reduce poverty.
Adebayo and Kalmaz (2020)	1980–2018	Nigeria	Bound cointegration test; the Autoregressive distributed lag (ARDL); The time-frequency domain wavelet coherence approach.	Economic growth is affected by foreign aid, trade openness, gross fixed capital formation, and inflation in the long run.
Olorogun et al. (2020)	1970–2018	Nigeria	Unit root; Stationarity tests; Cointegration test; Pesaran's ARDL bounds test; Toda–Yamamoto Granger causality.	The development of FDI and the financial sector is a good predictor of a sustainable economy.
Pasara and Garidzirai (2020)	1980–2018	South Africa	Vector Autoregressive (VAR).	There is a long-run positive relationship between Gross Capital formation (GCF) and GDP and unemployment and GCF.
Jena and Sethi (2020)	1993–2017	45 Sub-Saharan Africa Countries	Pedroni and Kao's cointegration test; Johansen-Fisher Panel cointegration test; Fully modified ordinary least squares (FMOLS); Dynamic ordinary least squares (DOLS).	There is a long-run and a short-run relationship between foreign aid, economic growth, investment, financial deepening, price stability, and economic trade openness.
Mahembe and Odhiambo (2019)	1981–2013	82 developing countries	Vector Error Correction Models (VECM).	In the short run, there is unidirectional causality from poverty to foreign aid. In the long run, foreign aid tends to align with its long-run equilibrium path in response to economic growth and poverty changes.
Rani and Kumar (2019)	1966–2015	Brazil, Russia, India, China, and South Africa	ARDL; VECM.	Trade openness is a significant determinant of economic growth. Therefore, countries need to adopt policies toward trade liberalization for their sustenance.
Mowlaei (2018)	1992–2016	26 selected countries in Africa	Pooled Mean Group (PMG) Econometric Engineering	The three forms of foreign capital inflow (foreign direct investment (FDI), personal remittances (PR), and Official Development Assistant (ODA)) have a positive and significant effect on economic growth in the long and short run.

Table 1. *Cont.*

Authors	Period	Countries	Econometric Techniques	Main Findings
Meyer and Sanusi (2019)	1995Q1–2016Q4	South Africa	Johansen cointegration; VECM.	There is a long-run relationship between domestic investment, employment, and economic growth.
Younsi et al. (2019)	1990–2011	16 African countries	RE model with robust OLS regression and system-GMM estimator	An increase in foreign aid is associated with a rise in income inequality.
Dutta et al. (2016)	2004–2009	64 MENA and sub-Saharan Africa countries	System GMM estimator and instrumental variable approach	Aid can reduce the creation of domestic wealth, entrepreneurship, and foreign investment by reducing a country's business climate.
Yiew and Lau (2018)	2005–2013	95 developing countries	Panel data analysis.	A U-shape relationship exists between foreign aid and economic growth, although FDI and population are the more important determinants.
Belloumi and Alshehry (2018)	1970–2015	Arab Saudi	ARDL; FMOLS; DOLS; The canonical cointegrating regression (CCR).	FDI negatively affects domestic capital investment in the short run, while domestic capital investment negatively affects FDI in the long run
Turković (2017)	1974–2014	Iran	ARDL model.	Internal sources of capital drive economic growth gross fixed capital formation.
Moe (2008)	1990–2004	Cambodia, Indonesia, Malaysia, Myanmar, Thailand, Philippines, Laos, and Vietnam	OLS regression method.	Real GDP and FDI have a significant relationship with human development and education. At the aggregate level, ODA has a significant positive relationship only with human development.
Mallik (2008)	Around 1970–2005 (different by country)	Central African Republic, Malawi, Mali, Niger, Sierra Leone, and Togo	Johansen's cointegration tests; VECM.	The long-run effect of foreign aid on growth is negative for most of the countries studied.
Gani and Clemes (2003)	1991–1995	65 developing countries	Pooled cross-sectionally heteroskedastic and timewise (first-order) autoregressive procedure.	Aid for education and water is positively correlated with people's welfare in low-income countries, while aid for education and health is positively correlated with people's welfare in lower-middle-income countries.
Krkoska (2001)	1989–2000	25 transition countries	Zellner's Seemingly Unrelated Regression (SUR) method.	Capital formation is positively related to FDI.

Zellner's Seemingly Unrelated Regression (SUR) method was used to analyze the effect of capital formation and FDI in 25 transition countries from 1989 to 2000. Krkoska (2001) found that capital formation is positively related to FDI, a substitute for domestic credit, and complements foreign credit and privatized income. The study concludes that an improved investment climate capable of attracting higher FDI inflows is likely to lead to higher gross fixed capital formation and more significant economic growth. Belloumi and Alshehry (2018) investigated the causal relationship between domestic investment, foreign investment (FDI), and economic growth in Saudi Arabia using annual time-series data from 1970 to 2015. This study uses the Autoregressive distributed lag (ARDL) bounds testing technique, fully modified ordinary least squares (FMOLS), dynamic ordinary least squares (DOLS), and the canonical cointegrating regression (CCR). Their analysis showed that in the long run, there is a negative two-way causality between non-oil and gas GDP growth and FDI, a negative two-way causality between non-oil and gas GDP growth and domestic capital investment, and a two-way causality between FDI and domestic capital investment.

FDI supports the economic growth of a country in both the short and long run. The study carried out by Mowlaei (2018) analyzed the effect of various forms of FCI, namely, foreign direct investment (FDI), personal remittances (PR), and Official Development Assistance (ODA), on economic growth in 26 African countries. This study used time-series data from 1992 to 2016 with Pooled Mean Group (PMG) econometric techniques. Mowlaei found that the three forms of FCI (FDI, PR, and ODA) positively and significantly affect economic growth in the long and short run, with the PR exhibiting the most significant rate. Previous studies have shown that GCA promotes economic growth. Therefore, the fiscal authority in a country is strengthened by expansionary fiscal policies stimulating economic growth, investment, and employment (Pasara and Garidzirai 2020). Pasara and Garidzirai (2020) examined the relationship between economic growth, unemployment, and GCF from 1980 to 2018 using the Vector Autoregressive (VAR) approach in South Africa. The study empirically supports a positive long-run relationship between GCF gross capital formation and GDP economic growth. Moreover, they also found that unemployment does not affect economic growth (GDP) in the short run, with a significant and positive relationship between unemployment and GCF.

Gani and Clemes (2003) examined the role of foreign aid on welfare in 65 developing countries (low-income and lower-middle-income economies) using annual data (1991–1995). For analysis, the authors used a pooled cross-sectional heteroskedastic and timewise (first-order) autoregressive procedure. The study showed that aid in education and water positively correlate with people's welfare in low-income countries, while aid for education and health is positively correlated with their welfare in lower-middle-income countries. Moreover, output growth and gross domestic investment are positively associated with people's welfare in low- and lower-middle-income countries.

In low-income countries, it is also found that unproductive government spending, conflict, and rural population are negatively correlated with people's welfare. Rani and Kumar (2019) examined the long-run association and direction of causality between economic growth, trade openness, and gross capital formation for Brazil, Russia, India, China, and South Africa. This study analyzed time series data using the Applied Autoregressive Distributed Lag (ARDL) and vector error correction model. It showed that the unidirectional causality from trade openness to economic growth in India and Brazil supports the trade-led growth hypothesis. Meanwhile, bidirectional causality is found between trade openness and economic growth in China, supporting the feedback hypothesis. In South Africa, this study provides empirical evidence of a unidirectional causality moving from economic growth to trade openness, which validates the growth-driven trade hypothesis. Since trade openness is a significant determinant of economic growth in the BRICS (Brazil, Russia, India, China, and South Africa), member countries need to adopt policies toward trade liberalization to sustain economic growth.

In Iran, Turković (2017) investigated the relationship between capital formation and economic growth from 1974 to 2014. The variables analyzed are GDP per capita, exports

(goods and services), FDI, gross fixed capital formation, value-added production, value-added services, government consumption, and labor force using the ARDL model and AFD (Augmented Dickey–Fuller) approach. These approaches showed that an increase in exports of goods and services and net FDI significantly affect economic growth. Furthermore, domestic sources of capital were found to promote economic growth and gross fixed capital formation.

Moe (2008) studied Official Development Assistance (ODA) on human development and education in Southeast Asia countries, namely Cambodia, Indonesia, Malaysia, Myanmar, Thailand, Philippines, Laos, and Vietnam. The analysis was carried out from 1990 to 2004 using annual time series data and the OLS regression method. This study indicated that real GDP and FDI have a significant relationship with human development and education during the analyzed period. At the aggregate level, ODA has a significant positive relationship only with human development. This analysis also showed that ODA targeted to support socio-economic development has a significant relationship with human development.

Meyer and Sanusi (2019) examined the causality between domestic capital formation and investment, employment, and economic growth in South Africa using quarterly data from 1995Q1 to 2016Q4. They found empirical evidence of a long-run relationship between domestic investment, employment, and economic growth. Besides, this study provides evidence that investment has a positive long-run impact on employment. The Johansen cointegration analysis and the Vector Error Correction Models (VECM) also showed bidirectional causality between employment and economic growth, while evidence of unidirectional causality from investment to employment is also found. Although there is a two-way causality between these two variables, economic growth does not mean an increase in employment in the long run, which confirms the existence of "jobless growth." The investment proved to be a positive driver of employment in the South African economy in the long run.

By considering the synthesis of the previous studies above, the following hypotheses are formulated and tested in this study:

Hypothesis 1 (H1). *Economic growth causes ODA.*

Hypothesis 2 (H2). *ODA causes economic growth.*

Hypothesis 3 (H3). *Economic growth causes FDI.*

Hypothesis 4 (H4). *FDI causes economic growth.*

Hypothesis 5 (H5). *Economic growth causes GCA.*

Hypothesis 6 (H6). *GCA causes economic growth.*

2. Methodology

The empirical analysis was carried out through four stages. Firstly, by testing the unit root using the Augmented Dicky–Fuller Test (ADF) and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) unit root test (Dickey and Fuller 1981; Salles et al. 2019). Secondly, by performing VAR lag order selection criteria and testing the number of cointegration vectors in the system using the Johansen cointegration test. Thirdly, by estimating and testing causality within the framework of a multi-variant vector error correction (VECM) or Vector Autoregressive (VAR) model (Mishra 2014; Jian et al. 2019; Zou 2018), suitable for detecting the direction of causality between economic growth, FDI, ODA, and GCA. Fourthly, by modifying the Wald test from Toda–Yamamoto to explore the causality direction of economic growth, FDI, IDA, and GCA.

2.1. Data and Model Specification

The regression model is based on the research carried out by Jena and Sethi (2020), Belloumi and Alshehry (2018), and Turković (2017), which investigated the relationship between ODA, FDI, and GCA. The basic regression model is as follows:

$$GDP = f\ (ODA + FDI + GCA) \quad (1)$$

which investigated the relationship between ODA, FDI, GCA and economic growth (GDP):

$$GDP\ t = \beta 0 + \beta 1 ODA\ t + \beta 2 FDI\ t + \beta 3 GCA\ t + \varepsilon\ t \quad (2)$$

where $\beta 0$ is the constant of the regression equation, $\beta 1$, $\beta 2$, and $\beta 3$ are the long-run elasticity of GDP related to all exogenous variables, and ε denotes the error term. GDP (Gross Domestic Product) measures economic performance, while ODA, FDI, and GCA denote the official foreign aid, foreign direct investment, and gross capital formation, respectively. All of the variables are standardized prior to empirical analysis. GDP is used because GDP is the most common measure of economic performance used to calculate a country's economic growth. GDP measures the monetary value of all finished goods and services produced in a country within a certain period. ODA plays a vital role in driving economic growth (Yoon 2018). Therefore, in this study, ODA was chosen as the independent variable because Indonesia, as a developing country, uses ODA for economic development. The following independent variable is FDI. Selected FDI has a role in increasing player growth in the recipient country. Many empirical studies have found the role of FDI in the economy. Through knowledge transfer, FDI creates positive benefits for recipient countries (Arif-Ur-Rahman and Inaba 2021; Zamani and Tayebi 2022). GCA was chosen as the independent variable because this variable is essential to encourage economic growth through capital accumulation (Pasara and Garidzirai 2020). Data on economic growth, FDI, ODA, and GCA in Indonesia utilize annual time series data from the World Bank's development indicators (www.data.worldbank.org; (accessed on 4 April 2021)) from 1970 to 2019. Table 2 provides a brief description of the variables and sources of data as follows:

Table 2. Description of variables and sources of data.

Variable	Definition	Sources
GDP (constant 2010 US$)	GDP at buyer prices is the sum of the gross value added by all resident producers in the economy plus product taxes and excluding subsidies not included in product value.	World Development Indicators, The World Bank website.
Net Official Development Assistance (ODA) (in US$)	It consists of loan disbursements made on concessional terms, such as after principal repayments and grants by official member agencies of the Development Assistance Committee (DAC), multilateral agencies, and non-DAC countries to promote economic development and prosperity.	World Development Indicators, The World Bank website.
Foreign Direct Investment (FDI) (US$)	Foreign direct investment, net inflows is the sum of equity capital, income reinvestment, and other capital. It is a category of cross-border investment that relates to residents with control or a significant degree of influence towards the company management that are residents of another economy.	World Development Indicators, The World Bank website.
Gross Capital Formation (constant 2010 US$)	Gross domestic investment consisted of spending on additional fixed assets of the economy plus net changes in inventory levels.	World Development Indicators, The World Bank website.

Note: variable definition is based on World Development Indicators. Source: https://data.worldbank.org/indicator; (accessed on 4 April 2021).

Table 3 shows a statistics summary of the five variables used in this time series model. The GDP, FDI, ODA, and GCA variables are displayed in US dollars to facilitate statistical presentation. The Jarque Bera (JB) normality test is used to ensure the normality of time series data (Jarque 2011; Alhodiry et al. 2021). The JB test is a normality test that estimates when the slope and kurtosis of the data differ significantly from the theoretical normal distribution (Abdellatif et al. 2018; Rana et al. 2021. According to Jarque (2011) and Mantalos (2010), time-series data need to have a normal distribution. Therefore, the regression results are not biased. The criteria for the JB Test are as follows when the value of the JB statistic is insignificant (less than 2), the time-series data is normally distributed. Meanwhile, when the probability is insignificant and greater than 5%, the data is normally distributed (Jarque 2011; Mantalos 2010; Abdellatif et al. 2018). Table 3 shows that the JB statistic value = 1.7500848, indicating that the time-series data is normally distributed and feasible for regression because the regression results are unlikely to be biased.

$$JB = n\left[\frac{S^2}{6} + \frac{(K-3)^2}{24}\right] \quad (3)$$

where:

n = Size of samples
S = Skewness of samples
K = Kurtosis of the samples

Table 3. Statistic Descriptive.

Variable	Unit	Mean	Maximum	Minimum	Std. dev.	Obs.
GDP	Million USD	459,011.5	1,204,480	88,635.22	311,350.5	50
ODA	Million USD	1556.242	3508.090	−605.9700	927.0632	50
FDI	Million USD	5034.080	25,120.73	−4550.355	8099.999	50
GCA	Million USD	201,528.1	1,223,951	−949,892.7	479,667.2	50
Jarque-Bera: 1.750848						
Probability: 0.416685						

Author's own calculations using EVIEWS.

Table 4 indicates the correlation coefficients between the five variables analyzed. The correlation coefficient between the five variables is shown in the table above. ODA was found to have a strong and negative correlation with GDP and FDI, while GDP was positively and strongly correlated with FDI. The correlation between GCA variables appears to be relatively lower with varying signs.

Table 4. Correlation Matrix for the Variables.

GDP	1.0000			
ODA	−0.8351	1.0000		
FDI	0.8367	−0.7619	1.0000	
GCA	0.0036	−0.2055	0.1752	1.0000

Author's own calculations using EVIEWS.

2.2. The Toda and Yamamoto Approach

Empirical research in analyzing causality between two variables generally uses the Granger test (1969), estimating the VAR model at levels (a VAR model in levels) and using the Wald test. However, Granger's test was not used to consider series properties such as stationarity and cointegration relations (Kirikkaleli and Darbaz 2021; Mishra 2014); hence this is a weakness of the Granger test. If the time series data is not stationary and integrated, then the t-statistics do not follow the chi-square distribution. In addition, the statistical Wald test does not follow an asymptotic chi-square distribution and consequently does not allow for a valid estimation of Granger causality. The TY approach can be used to

overcome the weakness of the Granger test. With the TY approach, hypothesis testing can be successfully carried out regardless of whether the variables involved are stationary or not and whether there is a cointegration relationship between them (Martinazzi et al. 2020; Masih and Masih 1998). In essence, the TY approach is used because the TY approach has advantages and is considered more robust to be used to test Granger causality. The more straightforward TY approach is carried out through a modified Wald test in an enlarged vector autoregressive (VAR) model. This TY approach provides a chi-square asymptotic zero distribution (χ^2) for the Wald Granger non-causality test statistic in the VAR model. When used to test Granger causality in the VAR framework, the TY approach is not needed to pretest variables for the properties of integration and cointegration to avoid pretest bias from the cointegration problem (Martinazzi et al. 2020; Zapata and Rambaldi 1997). This can be achieved as long as the maximal sequence of process integration does not exceed the actual lag length of the VAR model.

The Toda and Yamamoto (TY) causality method modifies the Wald statistic (MWALD), with the modified wald test technique used to provide restrictions on the measurement of Vector Auto Regression (VAR) (Mohanty et al. 2020; Rarnbaldi and Dora 1996). Cervantes et al. (2020) stated that this method is a better causality test than Granger because it combines data series regardless of possible non-stationarity and cointegration. Furthermore, the Toda–Yamamoto TY method does not limit the data stationarity level, meaning that it is independently cointegrated at I(0), I(1), or I(2) (Toda and Yamamoto 1995; Cervantes et al. 2020; Boţa-Avram et al. 2018; Bezić and Radić 2017). Another advantage of using the Toda–Yamamoto long-run causality approach is increasing the correct VAR order, K lag length, maximum integration order, Dmax, and ensuring that the usual test statistic for Granger non-causality has a standard asymptotic distribution (Boţa-Avram et al. 2018).

The TY method is carried out in two stages. The first determines the optimal lag length (k) and the maximum order of integration ($dmax$), which is obtained when the order of integration is different, then proceeds with making a VAR model at the series level. Furthermore, the VAR (k) model order of lag length was taken from LR, final prediction error (FPE), Aikaike's information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion (Niedzwiecki and Ciolek 2017; Cernat-Gruici 2009). Furthermore, it is tested to determine whether the VAR ($k + dmax$) (adjusted VAR model) has been correctly determined. The cointegration test is continued supposing the series has the same order of integration. The second step uses a modified Wald procedure to test the VAR (k) model for causality by determining whether the optimal lag length equals $p = [k + d\ (max)]$. Furthermore, a causality test was carried out using Wald statistics or a modified Wald test (MWald) for the significance of the parameters in the equation examined at the time lag number ($k + dmax$) (Mohanty et al. 2020; Dritsaki 2017).

The Toda–Yamamoto Granger Causality test was conducted to analyze the relationship between economic growth and ODA, FDI, and GCA (Toda and Yamamoto 1995). Toda and Yamamoto's method is based on the use of the VAR model at the level ($p = k + dmax$) with the correct VAR order k and d extra lag, where d represents the maximum order of time series integration (Kaur and Dhiman 2019). According to Rarnbaldi and Dora (1996), the Wald statistic tests causality between variables. Based on Equations (1) and (2), the modified Granger causality test, which shows the relationship between variables in the VAR system, is written as follows:

$$LPGDP_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 LPGDP_{t-i} + \sum_{i=k+1}^{d_{max}} \alpha_2 LPGDP_{t-i} + \sum_{i=1}^{k} \Phi_1 LPODA_{t-i} + \sum_{i=k+1}^{d_{max}} \Phi_2 LPODA_{t-i} + \lambda_{1t} \quad (4)$$

$$LPODA_t = \beta_0 + \sum_{i=1}^{k} \beta_1 LPODA_{t-i} + \sum_{i=k+1}^{d_{max}} \beta_2 LPODA_{t-i} + \sum_{i=1}^{k} \delta_1 LPGDP_{t-i} + \sum_{i=k+1}^{d_{max}} \delta_2 LPGDP_{t-i} + \lambda_{2t} \quad (5)$$

$$LPODA_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 LPODA_{t-i} + \sum_{i=k+1}^{d_{max}} \alpha_2 LPODA_{t-i} + \sum_{i=1}^{k} \Phi_1 LPGDP_{t-i} + \sum_{i=k+1}^{d_{max}} \Phi_2 LPGDP_{t-i} + \lambda_{1t} \quad (6)$$

$$LPGDP_t = \beta_0 + \sum_{i=1}^{k} \beta_1 LPGDP_{t-i} + \sum_{i=k+1}^{d_{max}} \beta_2 LPGDP_{t-i} + \sum_{i=1}^{k} \delta_1 LPODA_{t-i} + \sum_{i=k+1}^{d_{max}} \delta_2 LPODA_{t-i} + \lambda_{2t} \quad (7)$$

$$LPGDP_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 LPGDP_{t-i} + \sum_{i=k+1}^{d_{max}} \alpha_2 LPGDP_{t-i} + \sum_{i=1}^{k} \Phi_1 LPFDI_{t-i} + \sum_{i=k+1}^{d_{max}} \Phi_2 LPFDI_{t-i} + \lambda_{1t} \quad (8)$$

$$LPFDI_t = \beta_0 + \sum_{i=1}^{k} \beta_1 LPFDI_{t-i} + \sum_{i=k+1}^{d_{max}} \beta_2 LPFDI_{t-i} + \sum_{i=1}^{k} \delta_1 LPGDP_{t-i} + \sum_{i=k+1}^{d_{max}} \delta_2 LPGDP_{t-i} + \lambda_{2t} \quad (9)$$

$$LPFDI_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 LPFDI_{t-i} + \sum_{i=k+1}^{d_{max}} \alpha_2 LPFDI_{t-i} + \sum_{i=1}^{k} \Phi_1 LPGDP_{t-i} + \sum_{i=k+1}^{d_{max}} \Phi_2 LPGDP_{t-i} + \lambda_{1t} \quad (10)$$

$$LPGDP_t = \beta_0 + \sum_{i=1}^{k} \beta_1 LPGDP_{t-i} + \sum_{i=k+1}^{d_{max}} \beta_2 LPGDP_{t-i} + \sum_{i=1}^{k} \delta_1 LPFDI_{t-i} + \sum_{i=k+1}^{d_{max}} \delta_2 LPFDI_{t-i} + \lambda_{2t} \quad (11)$$

$$LPGDP_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 LPGDP_{t-i} + \sum_{i=k+1}^{d_{max}} \alpha_2 LPGDP_{t-i} + \sum_{i=1}^{k} \Phi_1 LPGCA_{t-i} + \sum_{i=k+1}^{d_{max}} \Phi_2 LPGCA_{t-i} + \lambda_{1t} \quad (12)$$

$$LPGCA_t = \beta_0 + \sum_{i=1}^{k} \beta_1 LPGCA_{t-i} + \sum_{i=k+1}^{d_{max}} \beta_2 LPGCA_{t-i} + \sum_{i=1}^{k} \delta_1 LPGDP_{t-i} + \sum_{i=k+1}^{d_{max}} \delta_2 LPGDP_{t-i} + \lambda_{2t} \quad (13)$$

$$LPGCA_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 LPGCA_{t-i} + \sum_{i=k+1}^{d_{max}} \alpha_2 LPGCA_{t-i} + \sum_{i=1}^{k} \Phi_1 LPGDP_{t-i} + \sum_{i=k+1}^{d_{max}} \Phi_2 LPGDP_{t-i} + \lambda_{1t} \quad (14)$$

$$LPGDP_t = \beta_0 + \sum_{i=1}^{k} \beta_1 LPGDP_{t-i} + \sum_{i=k+1}^{d_{max}} \beta_2 LPGDP_{t-i} + \sum_{i=1}^{k} \delta_1 LPGCA_{t-i} + \sum_{i=k+1}^{d_{max}} \delta_2 LPGCA_{t-i} + \lambda_{2t} \quad (15)$$

The hypotheses for the TY causality test were performed using the modified Wald Procedure. The MWALD test has an asymptotic chi-square with degrees of freedom p within the limits when a VAR $k = (p + dmax)$ is calculated. To test the causality of TY between two variables, the bivariate VAR(k) model is as follows:

$$X_t = \alpha_1 + \sum_{i=1}^{h+d} \beta_{1i} X_{t-i} + \sum_{j=1}^{l+d} \delta_{1j} Y_{t-j} + \varepsilon_{1t} \quad (16)$$

$$Y_t = \alpha_1 + \sum_{i=1}^{h+d} \beta_{2i} Y_{t-i} + \sum_{j=1}^{l+d} \delta_{2j} Y_{t-j} + \varepsilon_{2t} \quad (17)$$

where: d is the order of maximum integration and d is the optimal lag length, ε_{1t}, and ε_{2t} are the error terms assumed to be white noise. For the bivariate VAR Equation (16) above, the null hypothesis (H_0) and alternative hypothesis (H_1) are determined as follows:

$$H_0\text{: Y does not cause X} \quad (18)$$

$$H_1\text{: Y does cause X} \quad (19)$$

For the bivariate VAR Equation (17) above, H_0 and H_1 hypotheses are determined as follows:

$$H_0\text{: X does not cause Y} \quad (20)$$

$$H_1\text{: X does cause Y} \quad (21)$$

Based on the above equation, causality between two variables is described as unidirectional, bidirectional, or a cause-and-effect relationship (Pradhan and Sahoo 2021; Irandous 2021). Two variables have unidirectional causality when the null hypothesis of Equations (16) and (17) are rejected. However, when the null hypothesis of Equation (16) is rejected and accepted the null hypothesis of Equation (17), therefore, it is concluded

that a change in X_t causes the change in Y_t or when it fails to reject the null hypothesis of Equation (16) and rejects the null hypothesis of Equation (17), it is concluded that a change in Y_t causes the change in X_t. Meanwhile, when two variables with two-way causality exist, both null hypotheses from Equations (16) and (17) are rejected (Wang and Ngene 2018; Si et al. 2018; Koh et al. (2020). Furthermore, the two variables do not have causality when the null hypothesis of Equations (16) or (17) is rejected.

3. Results

3.1. Unit Root Test

The time-series variables are often non-stationary. When used in regression, it produces a spurious regression, thereby making the estimation results unreliable (Mohapatra and Giri 2021; McCallum 2010). To ensure the stationarity of the data, a unit root test was carried out using the Augmented Dicky–Fuller Test (ADF) and the Phillips-Perron (PP) Test (Dickey and Fuller 1981; Meyer and Sanusi 2019; Salles et al. 2019). The ADF test is for the time series unit root test, assuming that the error terms are correlated. The ADF and PP unit root tests were carried out using the following various regression model specifications (Marfatia 2016; Olorogun et al. 2020; Meyer and Sanusi 2019):

$$\Delta x_t = \alpha + \beta x_{t-1} + \lambda t + \sum_{s=1}^{n} \gamma_s \Delta x_{t-s} + \varepsilon_t \quad (22)$$

where X_t is the tested variable, εt is the error term, and t is the time trend. Assuming each variable contains the unit root in the level, excluding the first difference. Then, the analysis is used to continue determining the number of cointegration vectors between the variables in question. The ADF test from each series regression on lagged values and differences, as well as the number of lagged, followed by the Schwarz Information Criterion (SIC) (Kulaksizoglu 2015; Prins and Kingdom 2016; Greene 2018). In this ADF test, when the p-value > 5%, it is concluded that there is a unit root in the analyzed variable, and when the p-value is <5%, then there is no unit root. The results of the ADF are shown in Table 5, with GDP and GCA variables stationary at the first difference while ODA is stationary at the level. The table shows the results of the ADF test with a unit root for the FDI variable at the first difference levels.

Table 5. Results for the Augmented Dicky-Fuller (ADF) unit root test.

Variable	Test Form	ADF Value	5% Critical Value	10% Critical Value	Results
GDP	(C, T, 1)	1.1127	−3.5063	−3.1830	Unstable
ΔGDP	(C, N, 0)	−2.9480	−2.9237	−2.5999	Stable
FDI	(C, T, 0)	−4.4274	−3.5043	−3.1818	Stable
ΔFDI	(N, N, 0)	−10.3513	−1.9478	−1.6124	Stable
ODA	(C, T, 9)	−1.2384	−3.5266	−3.1946	Unstable
ΔODA	(C, T, 10)	−2.8956	−3.5331	−3.1983	Unstable
GCA	(C, T, 0)	−2.1089	−3.5043	−3.1818	Unstable
ΔGCA	(N, N, 0)	−7.6447	−1.9478	−1.6124	Stable

Notes: C, T, and K in the test form (C, T, K) separately represent the constant term, trend term, and lag order. Author's own calculations using EVIEWS 10.

Overcome the weaknesses of the ADF test in ensuring a signal for a structural break in the time series data. Furthermore, the ADF test uses the assumption of homogeneous and independent errors. The KPSS test incorporates automatic correction in the ADF test method, which allows autocorrelation of residual values (Dolado and Lütkepohl 1996). Therefore, the Kwiatkowski–Philips–Schmidt–Shin (KPSS) test was also carried out. Table 6 reports that FDI is stationary at the first difference level with a KPSS test value of 0.1734 (the 5% crisis value was 0.463). Furthermore, a cointegration test is conducted to determine a long-run equilibrium relationship between the variables.

Table 6. Results for the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) unit root test.

Variable	Test Form	LM-Stat	5% Critical Value	10% Critical Value	Results
GDP	(C, N, 5)	0.893074	0.463	0.347	Unstable
ΔGDP	(C, N, 5)	0.690263	0.463	0.347	Unstable
ODA	(C, N, 5)	0.783859	0.463	0.347	Unstable
ΔODA	(C, N, 6)	0.129896	0.463	0.347	Stable
FDI	(C, N, 5)	0.635624	0.463	0.347	Unstable
ΔFDI	(C, N, 3)	0.173475	0.463	0.347	Stable
GCA	(C, N, 5)	0.110032	0.463	0.347	Stable
ΔGCA	(C, N, 2)	0.065069	0.463	0.347	Stable

Notes: C, T, and K in the test form (C, T, K) separately represent the constant term, trend term, and bandwidth (Newey-West automatic) using Bartlett kernel. Author's own calculations using EVIEWS.

3.2. VAR Lag Order Check and Cointegration Test

A cointegration test is conducted to determine the possibility of a long-run relationship between GDP, ODA, FDI, and GCA. Furthermore, the order lag needs to be checked by constructing the VAR model. Determination related to the optimal number of lags refers to the Akaike Information Criterion (AIC), Final Prediction Error (FPE), the Schwarz Information Criterion (SC), and Hannan–Quinn Criterion (HQ) with the smallest value, as well as LR with the highest value (Bhat et al. 2021; Niedzwiecki and Ciolek 2017). Table 7 shows the lag order of VAR in five criteria and concludes that the optimal lag model is 3.

Table 7. VAR lag order selection criteria.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−4756.668	NA	6.86×10^{81}	202.6242	202.8210	202.6982
1	−4552.716	355.8309	3.40×10^{78}	195.0092	196.1901 *	195.4536 *
2	−4530.694	33.73579	4.01×10^{78}	195.1359	197.3010	195.9507
3	−4495.197	46.82581 *	2.83×10^{78} *	194.6892 *	197.8384	195.8743

Notes: * indicates lag order selected by the criterion. LR: sequential modified LR test statistic (each test at 5% level). FPE: Final prediction error. AIC: Akaike information criterion. SC: Schwarz information criterion. HQ: Hannan-Quinn information criterion. Author's own calculations using EVIEWS.

These results show that GDP, ODA, FDI, and GCA are related to each other in the current period and interrelated from the previous three periods. Therefore, based on the VAR Lag Order, the most appropriate lag used to perform cointegration, VAR, and Causality tests are lag 3 (Alhodiry et al. 2021; Bhat et al. 2021). The decision on the selection of lag three is proven by the LR statistic value of 46.82581 and the final prediction criterion (FPE) value of 2.83 × 1078, as shown in Table 7. Lag 3 selection decisions are also based on statistical SIC and HQ values statistically significant at the 5% level.

Johansen's cointegration test is used to examine the long-run relationship between variables (Bhat et al. 2021; Menegaki 2019). This test is carried out by analyzing the degree/rank of the matrix through the eigenvalues of the p matrix. P is defined as the product of two matrices: where the matrix β is a cointegration vector, a is the sum of each cointegration vector, and this denotes the VECM equation. The null hypothesis in the trace test is the number of cointegration vectors $\leq r$. A separate test is carried out on the individual eigenvalues with the null hypothesis to determine the maximum eigenvalue. The number of cointegration vectors is r, towards alternative $(r + 1)$. This method is also used to determine the direction of causality, and its relationship between the variables studied (Bhat et al. 2021).

The hypothesis of the Johansen approach cointegration test is written as follows:

$$\lambda_{Trace}(r) = -T \sum_{i=r+1}^{g} in(1 - \hat{\lambda}_i) \quad (23)$$

$$\lambda_{Max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (24)$$

$$H_0: r = r^* < k$$

$$H_1: r = k$$

The null hypothesis is accepted when the critical value at 1%, 5%, or 10% is greater than the value of the Trace and Max–Eigen Statistics and vice versa. When the Null hypothesis is rejected, it means that the equation tested has a cointegration relationship (Greene 2018). Table 8 presents the Johansen cointegration test results. It shows that the trace statistic and maximum eigenvalue are greater than the critical value with a significance level of 5%. This means that the null hypothesis states that no cointegration can be rejected while the alternative is accepted. This means that GDP, ODA, FDI, and GCA have cointegration at a significance level of 5%, and it is concluded that these variables have a long-run equilibrium.

Table 8. Johansen cointegration test.

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CEs	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob. **
None *	0.425056	78.47188	69.81889	0.0087
At most 1 *	0.395372	52.45822	47.85613	0.0174
At most 2	0.248137	28.81057	29.79707	0.0646
At most 3	0.210625	15.40610	15.49471	0.0516
At most 4 *	0.087233	4.289924	3.841466	0.0383
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CEs	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob. **
None	0.425056	36.01366	33.87687	0.3199
At most 1	0.395372	23.64765	27.58434	0.1475
At most 2	0.248137	13.40448	21.13162	0.4157
At most 3	0.210625	11.11617	14.26460	0.1485
At most 4 *	0.087233	4.289924	3.841466	0.0383

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level. * Denotes rejection of the hypothesis at the 0.05 level. ** MacKinnon et al. (1999) *p*-values. Author's own calculations using EVIEWS.

3.3. Toda–Yamamoto Causality

Cointegration test results demonstrate initial evidence of a long-run equilibrium relationship between the observed variables, indicating a causal relationship. Therefore, the Toda–Yamamoto causality test was conducted. The optimal lag for VAR with economic growth and ODA is 1, while FDI and economic growth with GCA are 2. The maximum integrated order for each variable is 1. The Granger Toda–Yamamoto augmented causality test results are reported in Table 9, which shows a summary related to the causality direction between the variables and the statistic χ^2 and the probability value. At the 5% significance level, the TY causality test on the null hypothesis, which states that economic growth does not cause ODA, is not rejected. In other words, economic growth does not cause ODA. Conversely, ODA is found to cause economic growth. The causality is one-way from ODA; therefore, the null hypothesis that ODA does not cause economic growth is rejected. The causality between ODA and economic growth is unidirectional causality, which is also found in FDI, where it has a one-way causality at a 5 percent significant level. The causality test results between economic growth and GCA show that the null hypothesis cannot be rejected. This means that at a 5% significance level, economic growth does not cause GCA, and vice versa.

Table 9. Toda–Yamamoto augmented Granger causality test.

Null Hypothesis	Chi-Square	d.f	Probability	Causality Direction	Decision
Economic growth does not cause ODA	1.367542	2	0.5047	No causality	Accept
ODA does not cause Economic growth	7.120353 *	2	0.0284	Unidirectional (ODA → GDP)	Reject
Economic growth does not cause FDI	0.189431	1	0.6634	No causality	Accept
FDI does not cause Economic growth	4.177285 *	1	0.0410	Unidirectional (FDI → GDP)	Reject
Economic growth does not cause GCA	0.421109	1	0.5164	No causality	Accept
GCA does not cause Economic growth	1.653800	1	0.1984	No causality	Accept

Source: * Indicates significance at 5 percent. Author's own calculations using EVIEWS.

4. Discussion

This study examines the causal relationship between ODA, FDI, GCA, and Indonesia's economic growth from 1970 to 2019. The objectives are achieved in two steps. First, by carrying out a unit root test and cointegration to ensure that economic growth, ODA, FDI, and GCA integrated from the first order are related in the long run. This relationship is significant due to integrating two variables in the first order (I(1)). However, these variables are not related to each other unless they are cointegrated. The stationarity of the time series data used was checked using the ADF and KPPS tests. Based on the ADF test results, it is concluded that GDP and GCA are stationary at the first difference, while ODA is stationary at the level.

Furthermore, there is a unit root in the FDI variable at the level and first difference through the KPPS test. The ADF was continued with the degree of integration on the second difference, indicating that all variables were stationary. Therefore, time-series data analysis was continued with the formation of the VAR model. A cointegration test was performed using the Johansen to ensure the use of VAR or VECM. The results obtained indicate a stable long-run equilibrium relationship between the observed variables. The second step is to apply the causality TY framework developed by Toda and Yamamoto (1995) to determine the direction of causality between economic growth, ODA, FDI, and GCA.

The Granger Causality results based on TY estimation with the MWALD test showed that the null hypothesis, which stated economic growth does not cause ODA, and its meaning could not be rejected. On the other hand, it is found that ODA has causality to GDP, which also indicates that foreign aid plays a role in driving economic growth. Possible arguments include the effective allocation and use of foreign aid, where the return rate is higher than the investment level in Indonesia (Adebayo and Kalmaz 2020). The explanation for the role of ODA in promoting GDP in this study is because the data analyzed is long-run time series with ODA in the proper form of assistance for a country's economic growth. This is because it is transformed into development assistance supporting investments in physical infrastructure, organizational development, and human capabilities that produce long-run results (Minoiu and Reddy 2010). Furthermore, ODA positively impacts the economy in countries with fiscal and monetary policies (Burnside and Dollar 2000).

The null hypothesis stated that economic growth does not cause FDI and cannot be rejected. On the contrary, the hypothesis that stated that FDI does not cause economic growth can be rejected. Therefore, it is concluded that FDI has a positive role in economic growth and promotes GDP expansion with a positive causality rate in Indonesia. Studies carried out by Olorogun et al. (2020), and Bird and Choi (2020) stated that many factors make FDI directly impact GDP creation. These factors include promoting policies to support increased investment, creating a favorable economic environment to accelerate growth (Meyer and Sanusi 2019). This is in contrast to the research undertaken by Pasara and Garidzirai (2020), Rani and Kumar (2019), Turković (2017), and Meyer and Sanusi (2019), which found the effect of domestic capital formation on GDP. The causality test results showed that is no causality in one or both directions between GDP and GCA. The underlying explanation is as follows. Capital formation does not guarantee economic growth in a country. Supposing capital accumulation is not followed by efficient resource allocation from less productive sectors to more productive with possible occurrence in the Indonesian context (Blomstrom et al. 1994).

5. Conclusions, Recommendations and Limitations

The Official Development Assistance (ODA), FDI, and capital accumulation are elements used to ensure economic growth, including in Indonesia. Therefore, it is very interesting to examine the nexus between foreign aid, FDI, and capital accumulation on economic growth. Limited studies with long-time series data have been carried out to examine the relationship between these variables. Furthermore, the causality between foreign aid, FDI, and capital accumulation with economic growth using a causality approach and Toda–Yamamoto was not found. Therefore, this study uses a time series data span of 50 years (1970–2019), which was analyzed using Toda–Yamamoto Causality analysis to provide an adequate empirical contribution. The results reveal a one-way causality between ODA and GDP, as well as between FDI and GDP. This evidence also means that ODA and FDI are significant predictors of economic growth in Indonesia. Furthermore, the unidirectional causality relationship between ODA and GDP shows that foreign aid in the form of ODA leads to economic growth. Meanwhile, there was no causal relationship, either one-way or two-way, between economic growth and ODA, as well as FDI and the formation of capital accumulation are not statistically significant.

The findings in this paper also show that Indonesia's economic growth is influenced by foreign aid and foreign direct investment. The policy implication of this finding is that foreign aid management needs to be optimized due to its ability to promote economic growth. Furthermore, special attention needs to be paid to attracting foreign direct investment, which has also been found to promote economic growth. One of the efforts is to create a macroeconomic and microeconomic environment capable of attracting FDI and government bureaucracies that can allocate ODA efficiently and appropriately to sectors that promote economic growth. To allocate ODA effectively, the government improves economic and institutional policies and encourages corruption eradication (Jena and Sethi 2020; Adebayo and Kalmaz 2020). Furthermore, to optimize foreign aid, monetary policy fiscal policy needs to be more credible from the perspective of foreign countries. Therefore, there is a possibility that foreign aid will not succeed in achieving the goal of promoting economic growth, supposing the Indonesian government is unable to create economic instability and combat corruption, as often found in developing countries (Adebayo and Kalmaz 2020).

The study has limitations because it only focuses empirically on examining the causality of ODA, FDI, and GCA with Indonesia's economic growth. These are economic variables, and when the analysis is added by including demographic variables, bureaucratic management, and environmental aspects, it is likely to produce more comprehensive findings by analyzing factors and variables associated with a country's economic growth. Furthermore, since FDI was found to promote GDP, the Indonesian government needs to encourage improvements in the political and economic framework because the sustainability of FDI depends on the environmental quality of the recipient country (Olorogun et al. 2020). Therefore, FDI needs to be supported by policies to allocate more productive projects that promote economic growth for FDI to remain a stimulator of GDP creation (Belloumi and Alshehry 2018; Krkoska 2001). In addition, this study also does not include monetary economic variables in the regression model. Future research needs to include such variables as predictors of economic growth.

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