

Impact of Foreign Direct Investment on Agriculture, Forestry and Fisheries: Evidence from Eastern African Countries

Abdorahman Abdillahi Waberi

Department School of Management, Dalian Polytechnic University, Dalian, China Email: abdorahmanabdillahi@hotmail.com

How to cite this paper: Waberi, A. A. (2025). Impact of Foreign Direct Investment on Agriculture, Forestry and Fisheries: Evidence from Eastern African Countries. *Technology and Investment, 16,* 1-19. https://doi.org/10.4236/ti.2025.161001

Received: October 2, 2024 Accepted: January 24, 2025 Published: January 27, 2025

Copyright © 2025 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

http://creativecommons.org/licenses/by/4.0/

CO Open Access

Abstract

Agriculture, forestry, and fishing play a crucial role in strengthening the country's economic development, particularly in supporting industries, and have evolved in Africa in recent years. This study aims to analyze the impact of foreign direct investment on agriculture, forestry, and fisheries in 5 Eastern African countries (Djibouti, Ethiopia, Kenya, Rwanda, and Tanzania). Using the panel dataset on the 5 Eastern African countries selected for the period 2013 to 2022, we employ the panel data regression method, more specifically, the fixedeffect panel model. For the empirical analysis, correlation analysis and Granger Causality are also employed to analyze the relationship between the variables present in this study. Using the Granger Causality test result, the study highlights that there is a one-way relationship between foreign direct investment and agriculture, forestry, and fisheries. The results of the study reveal that foreign direct investment has a positive impact on agriculture, forestry, and fisheries. Furthermore, findings suggest that capital formation, export trade, and government spending have a positive impact on agriculture, forestry, and fisheries. Therefore, it is recommended that East African governments take the necessary steps to strengthen and attract foreign direct investment, which can improve the agriculture sector and achieve sustainable economic development.

Keywords

FDI, Eastern African Countries, Agriculture, Forestry and Fisheries, Variables Factors

1. Introduction

Foreign direct investment plays an essential role in African countries' sustainable

development and represents an engine that promotes the growth of different economic sectors. Africa has potential essential sectors such as ports, agriculture, and fisheries which attract strong investment and also contribute to the country's strong economic recovery. In recent years, foreign direct investment suffered a sharp decline at the global and regional levels caused by a sharp global economic slowdown in the wake of the outbreak of COVID-19. The governments of the African countries have taken necessary measures that have caused a sharp decline in the potential of foreign direct investment, which has affected global economic development. According to the report published on investment in the world in 2023, the flow of foreign direct investment to African countries collapsed in 2022, with a drop to \$45 billion from \$80 billion in 2021. In addition, FDI also plays an important role in strengthening and supporting global and regional economic development through job creation. Foreign direct investment (FDI) is a driving force for the development of the country's agricultural sector and has been increasing in Africa in recent years. According to the UNCTAD World Investment Report (2022), foreign direct investment reached a record \$83 billion in 2021 to African countries, and the flow of investment to East Africa is \$8.2 billion, an increase of 35% in 2021. Agriculture, forestry, and fisheries have played an indispensable role in recent years, not only in the development of essential sectors but also in the economic growth of the country. Additionally, investments in the agricultural sector serve as a backbone for the development of various sectors within the country, including the growth of the industrial sector. Most African governments spend less than 10 percent of their public budgets on agriculture (Cleaver, 2012).

However, foreign direct investment has the potential to stimulate the country's development through various economic sectors such as agriculture, forestry, and fisheries, all of which play an important role in the country's development. FDI in agriculture has received a considerable amount of attention in recent years (Deininger et al., 2011; Byamugisha, 2013). Hence, many studies have been done to find out how foreign direct investment (FDI) affects economic growth (e.g., Opoku et al., 2019). The results show that FDI has a positive effect on economic growth and a significant effect on the service and agricultural sectors. Foreign direct investment in agriculture plays a crucial role in reducing a country's poverty. As explained, some studies in African countries (e.g., Gohou & Soumaré, 2012) showed that FDI has a positive relationship with poverty reduction. Simultaneously, Walkenhorst (2000) in Central Europe and Kemeny (2010) both emphasized the positive influence of foreign direct investment on technological modernization.

The study on the role of foreign direct investment in agriculture, fisheries, and synergies (e.g., Nylwul & Koirala, 2022), and the impact on Nigeria's agricultural sector (e.g., Edeh et al., 2020) has argued that foreign direct investment improves and has a positive effect on the agricultural sector. Numerous research papers have also been conducted to determine the importance of foreign direct investment in the agricultural sector in various regions of the world, such as in Africa. The study carried out by Gunasekera et al. (2015) showed that FDI promotes Africa's share

in the agricultural production sector at the global level. In addition, the study conducted in Nigeria by Owutuamor and Arene (2018) also examined the impact of foreign direct investment on agricultural growth. Furthermore, some research has investigated the impact of FDI on food security (e.g., Aloui & Maktouf, 2023; Santangelo, 2018; Páral & Blížkovský, 2019) through various methods of analysis and showed that foreign direct investment has improved and positively influences food security. Similarly, the study done by Slimane et al. (2016) found that foreign direct investment improved food security through the agricultural sector. According to the study by Furtan and Holzman (2004), foreign direct investment has a positive effect on food and agriculture trade. To explain the importance of trade on agricultural exports, various literature studies have been carried out, such as Fan et al. (2023), which generally highlighted the importance of trade facilitation on the expansion of agricultural trade. On the other hand, the study by (e.g., Samdrup et al., 2023; Mihalache-O'Keef & Li, 2011) showed that FDI has a negative impact on food security.

In recent decades, the agriculture, synergy, and fisheries sectors have generally been identified as the engines of the country's economic development. At the same time, it is acknowledged that the government's expenditure on agriculture is ranked among the main sources of investment in agriculture (FAO, 2022). Furthermore, consumption expenditure in agriculture is critical to promoting agricultural production and development, as well as reducing poverty in countries. According to recent studies by researchers Ngobeni and Muchopa (2022) in South Africa and Bafadal et al. (2020), increased government expenditure promotes production in the agricultural sector. On the other hand, the study by Mo (2007) pointed out that government expenditure has negative effects on economic growth.

The aim of this study is to investigate the impact of foreign direct investment on agriculture, forestry, and fisheries, as well as identify other significant variables. In this study, we use the panel dataset collected from 5 East African countries such as Djibouti, Ethiopia, Kenya, Rwanda, and Tanzania in the period covered from 2013 to 2022. To achieve the present objective, the study applies the panel regression analysis model, which includes the ordinary least squares (OL), random-effects panel. In addition, Granger causality, descriptive statistics, and correlation analysis are also performed to examine the impact between variables in the analysis of this study.

This study is based on panel data analysis from five Eastern African countries and comprises different parties that are organized in the following way. The first part provided an analysis of the existing literature for this study, and then we presented the data and methodology used in this research. Additionally, we present the result of the data analysis, followed by the discussion. Finally, the conclusion of this study is discussed, followed by the limit and suggestions for future research.

2. Literature Review

Recently, researchers have conducted several pertinent studies to determine the

effect of foreign direct investment (FDI) on agriculture, forestry, and fisheries, with a particular focus on its value. Some of the previous relevant studies investigated the role of foreign direct investment in the agriculture sector at the regional or developing country level. Nylwul and Koirala (2022) investigated the role of foreign direct investment (FDI) in agriculture, forestry, and fishing in 16 developing countries by applying a panel VAR model to data from twenty years. The study result showed that there is a bidirectional causality between FDI in agriculture, forestry, and fishing in 16 developing economies. The study found that, in the medium to long term, foreign direct investment has a positive impact on value added to agriculture, forestry, and fisheries. Owutuamor and Arene (2018) examined the impact of FDI on agricultural growth in Nigeria by using ordinary least squares regression, co-integration tests, Granger causality tests, and other analyses from 1979-2014. The study highlighted that foreign direct investment has a positive but not significant relationship with agricultural growth in Nigeria. Walkenhorst (2000) pointed out that foreign direct investment plays a crucial and indispensable role in the region by providing essential capital, as well as technological and managerial skills. The study also highlighted the importance of high investment in the growth of the agriculture sector and industries. Edeh et al. (2020) investigated the impact of foreign direct investment (FDI) on the agricultural sector in Nigeria using quarterly data covers in the period 1981-2017. The result of this study showed that FDI has a positive and significant impact on Nigeria's agricultural sector output. In particular, this study uses the ARDL model to estimate the regression model parameters and the result reveals that the impact of foreign direct investment is greater in the short term than in the long term. In Addition, FDI plays a key role in promoting the country's development and supporting economic growth. Some previous studies have also investigated the impact on economic growth, studies such as (e.g., Opoku et al., 2019), which examine FDI and the effects of different sectors, such as Agriculture, Services, and Manufacturing as well on economic growth. This study uses the generalized method of moment (GMM) and panel data from 38 African countries from 1960 to 2014, revealing that FDI positively contributes to growth. On the other hand, the study results indicate that FDI specifically has a significant impact on the agriculture and service sectors, while its impact on the manufacturing sector is negative and insignificant.

However, recent studies done by some authors (e.g., Aloui & Maktouf, 2023; Samdrup et al., 2023; Mihalache-O'keef & Li, 2011) studied the impact of foreign direct investment on food security. Aloui and Maktouf (2023) investigated the impact of foreign direct investment and political stability on food security in a sub-Saharan African country. They used the GMM method and the simultaneous equation model in the data from 1996 to 2020. The result of this study showed that foreign direct investment (FDI) has a positive and significant impact on food security in the sub-Saharan African country. Samdrup et al. (2023) investigated whether FDI in agriculture promotes food security in developing countries. The studies conducted subgroup analyses, revealing a negative impact of FDI on food security when viewed as a stock variable. Mihalache-O'keef & Li (2011) studied the effects of foreign direct investment on food security using data from 56 developing countries and transitions between 1981 and 2001. The study is carried out by determining the effect of different types of FDI, such as FDI manufacturers, primary FDI, and tertiary sector FDI, and by testing arguments based on data and food safety indicators. The study's findings showed strong evidence that manufacturing FDI contributes to food security development. The study also found that FDI in the primary sector reduces food security, while FDI in the services sector has an ambiguous effect, which can sometimes even vary in negative effect on food security.

In Addition, FDI also plays an important role in improving the agricultural sector through technological innovations and modernization of the production sector, which plays an important role in the country's development. Recently, many developing countries have attracted foreign direct investment with many advantages that can contribute to strong economic growth and strong technology to stimulate the agricultural sector's development. Furthermore, FDI is the most direct way to get access to these technologies (Yao & Wei, 2007; Kemeny, 2010). Numerous recent studies have found that foreign direct investment (FDI) can have varying effects in the essential sectors of developing countries, particularly on food security, as in the case (e.g., Slimane et al., 2016), who conducted studies in a panel framework covering the period from 1995 to 2009 on the impact of FDI on food security. The result of this study showed that FDI has a positive and improving effect on food security, while it has a negative effect on the tertiary sector in developing countries. Furthermore, recent studies, such as those conducted by Dhahri and Omri (2020), have demonstrated the significant impact of FDI on agricultural production in developing countries. On the other hand, Jana et al. (2019) showed that foreign direct investment inflows do not contribute to output growth in the agricultural sector. This study highlighted the existence of reverse causality in which agricultural production attracts more foreign direct investment into the sector. Some recent studies that also examine the importance of foreign direct investment for economic growth (e.g., Gohou & Soumaré, 2012; Bafadal et al., 2020) highlight the evidence that FDI has the potential to reduce poverty and contribute to the country's development. Gohou and Soumaré (2012) investigated the relationship between FDI and well-being in Africa. This research showed that the link between foreign direct investment (FDI) and reducing poverty was very different in different parts of Africa. It also confirmed that there is a strong and positive link between FDI net inflows and reducing poverty. At the same time, the study examines the factors that influence the agriculture sectors, such as studied conducted by Bafadal et al. (2020), who developed an econometric model using a system of simultaneous equations to examine the impact of government expenditure on agricultural output and poverty. The results of this study showed that a strong fiscal policy in direct expenditure contributes to an increase in agricultural GDP and decreases poverty. Some authors use panel data to conduct empirical analysis to determine whether there is a link between FDI and trade. For example,

Furtan and Holzman (2004) observed the effect of FDI on agriculture and food trade in an empirical analysis from 1987 to 2001. According to the study, FDI has a positive impact on agriculture and food trade. Fan et al. (2023) investigated the impact of trade facilitation indicators such as economic freedom, cross-border trade, and infrastructure quality on China's agricultural exports to ASEAN countries over a period from 2006 to 2020. The study applied empirical analysis to examine impact using a mixed regression model. The result revealed that these trade facilitation indicators have a significant positive impact on China's agricultural exports to the ASEAN market.

Besides, Gunasekera et al. (2015) investigated the effect of foreign direct investment in African agriculture by applying a dynamic Global Trade Analysis Project model. The study also examined the potential impact of improving land productivity in Africa and foreign direct investment. The results of this study reveal that growth in FDI contributes to agricultural production and exports. The results of this study showed that development assistance has a positive impact on agricultural growth. However, Nwer et al. (2021) identified the many major constraints and factors that have a negative effect on agricultural use and production in the country. The study showed that certain constraints such as dry and hot climatic conditions, soil types, and lack of vegetation cover, are the main factors limiting agricultural production in the country. Ngobeni and Chiedza (2022) examined the effects of government expenditure in agriculture over the period 1983-2019 and suggested that the South African government should prioritize increasing government expenditure in the agriculture sector.

3. Data and Methodologies

This section presents a description of the different data and the methodologies used in this study.

3.1. Data Description

This paper aims to investigate the impact of foreign direct investment on agriculture, synergies, and fisheries in evidence from selected Eastern African countries such as Djibouti, Kenya, Ethiopia, Rwanda, and Tanzania. The data used in this study will be selected over the period from 2013 to 2022. This research primarily draws from a variety of data sources to examine the relationship between the selected variables. The selected variables such as agriculture, forestry and fisheries, foreign direct investment, government expenditure, capital formation, and export trade are the most appropriate variables for the analysis of this study. In this study, agriculture, forestry, and fisheries, as previous research has done (e.g., Bounphone et al., 2023). Moreover, the FDI variable is measured by capital inflow, as used by some previous studies (e.g., Opoku et al., 2019; Esquivias et al., 2023; Sultanuzzaman et al., 2019; Bounphone et al., 2023). Some previous studies, such as Ngobeni and Chiedza (2022) and Opoku et al. (2019), have used the final consumption expenditure variable to measure government expenditure. Capital formation can be measured by the value of gross fixed capital formation, as used by Nylwul and Koirala (2022) and Opoku et al. (2019).

Therefore, the hypothesis proposed in this study is that foreign direct investment has a positive impact on agriculture, forestry, and fisheries in selected East African countries. We collected various data for the empirical analysis of this study from official World Bank data sources and websites like the World Development Indicators (WDI). **Table 1** presents the description of the variables selected in this study.

Table 1.	The	variables	selected	in	this	study	•
----------	-----	-----------	----------	----	------	-------	---

Variables	Variable Type	Description of the variable selected	Source
AFF	Dependent Variable	Agriculture, Forestry, and Fishing, value added (BOP, current US\$)	World Development Indicators (WDI)
GFC	Independent Variable	Gross Fix Capital Formation (per billion US\$)	World Bank data/WDI
GE	Independent Variable	Final consumption expenditure (per billion US\$).	World Bank data/WDI
ET	Independent Variable	Export goods and service (BOP, per billion US\$)	World Bank data/WDI
FDI	Independent Variable	Foreign direct investment, net inflows (BOP, per billion \$)	World Bank data/WDI

3.2. Methodology

This study uses the panel data regression to analyze the impact of direct investment on agriculture, forestry, and fisheries in 5 Eastern African countries such as Djibouti, Ethiopia, Kenya, Rwanda, and Tanzania over the period 2013-2022. In this study, we selected these 5 African countries based on the availability of reliable data for the period from 2013 to 2022. In addition, the study also used the Granger cause test to determine the causal link between these selected variables on agriculture, forestry, and fisheries in the panel data from 5 Eastern African countries. In this study, the set of models applied for this study is analyzed using Eviews econometric statistical software to analyze the empirical analysis of this research. We mainly use different appropriate methods to examine the effect of foreign direct investment on agriculture, forestry, and fisheries and determine the other significant variables. This study employs descriptive statistics, correlation analysis, and unit root tests to determine the stationarity of the selected data. We apply various tests to examine the impact of foreign direct investment on agriculture, forestry, and fisheries in 5 Eastern African countries, selected based on data availability. The study takes into account panel data over the period from 2013 to 2022 in these selected 5 Eastern African countries such as Djibouti, Ethiopia, Kenya, Rwanda, and Tanzania.

As previously mentioned, this study employs the panel data regression model for its empirical analysis. First, we primarily use the Hausman test to determine whether to apply the fixed-effect model panel or the random-effects model. The model is suitable and appropriate for this study, which means that the hypothesis is approved and will be applied. We will apply the null hypothesis where the Hausman test probability value is less than 0.05, and accept the alternative otherwise. The Hausman test model hypothesis is presented as follows:

H₀: Random Effect model is appropriate

H₁: Fixed Effect Model is appropriate

The regression model of this study panel data is as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \varepsilon_{it}$$

 $LNAFF_{it} = \beta_0 + \beta_1 LNFDI_{1it} + \beta_2 LNET_{2it} + \beta_3 LNGE_{3it} + \beta_4 LNGFC_{4it} + \epsilon_{it}$

where, β_0 represents the estimated intercept, and the variables β_1 , β_2 , β_3 , and β_4 are the estimated slope coefficients of this regression. In addition, (ϵ) represents the residual term, (i) indicates the individual country, and (t) denotes the period, respectively. In the equation above, Y is the dependent variable. X₁, X₂, X₃, and X₄ are the independent variables in this regression.

4. Result

This section provides a detailed analysis of the results obtained from various panel analyses. Descriptive statistics, unit root testing, and correlation analysis are described. It also presents various established tests, such as Granger causality, as well as the selection of appropriate panel data regression models in this study.

4.1. Descriptive Statistic of Research Variable

The set of variables used in this study are listed in the following table of descriptive statistics. **Table 2** presents descriptive statistical results, indicating that agriculture, forestry, and fisheries have a maximum of 47.72 and Std. Dev equal to 12.08634, with a Mean of 13.20140. Foreign direct investment (net inflows) has a maximum of 4.26, and a standard deviation of 1.15960, with a Mean of 1.0784. In addition, the export of goods and services (LNET) variable has a maximum of 13.85, Std. Dev to 3.557299. Final consumption expenditure (per billion US\$) has a maximum of 107.43, with the standard deviation equal to 32.77177. The LNGFC variable has a maximum of 33.82, Std. Dev has 11.58, with a mean equal to 14.15. As shown in the table below, the Jacque-Bera value in this variable (LNAFF, LNET, CFNGL, and LNGE) is all above a significant level of 0.05%, which may indicate that the data are normally distributed.

4.2. Unit Root Test

Table 3 shows the panel unit root test results at the level and the first difference using the Augment Dickey-Fuller (ADF) type on the variables selected in this study. To have better and more reliable estimations, testing the stationarity and the unit roots in the data has paramount importance in panel data (Naik & Padhi, 2015). We apply the panel unit root test, which is essential for examining the existence of unit roots for each variable presented in this model. The results pre-

sented in **Table 3** indicate that all variables are not stationary at the level with a p-value greater than 1% of a significant level and become stationary at the first difference, except LNFDI and LNET, which are not stationary.

Variables	LNAFF	LNFDI	LNET	LNGFC	LNGE
Observations	50	50	50	50	50
Mean	13.20140	1.0784	6.6752	14.15	39.0858
Median	13.27500	0.545	6.765	15.87	38.23
Maximum	47.72	4.26	13.85	33.82	107.43
Minimum	0.02	0.14	1.06	0.510	0.53
Std. Dev	12.08634	1.159601	3.557299	11.58	32.77177
Skewness	0.761568	1.482824	-0.025262	0.173	0.409994
Kurtosis	3.130527	4.199844	1.808532	1.610	1.930506
Jarque-Bera	4.868712	21.32227	2.962808	4.273	3.783742
Probability	0.087654	0.000023	0.227318	0.118	0.150789
Sum	660.07	53.92	333.76	707.5	1954.290
Sum Sq. Dev.	7157.9	65.88907	620.0644	6570	52625.44

Table 2. Descri	ptive statistics.
-----------------	-------------------

Source: Author's calculation.

Table 3. Panel unit root test.

	At Level At First Dif			Difference				
Variables	Intercept	p-value	Trend and Intercept	p-value	Intercept	p-value	Trend and Intercept	p-value
LNAFF	0.5104	0.9929	0.5717	0.3501	0.6440	0.0413**	0.8897	0.0919*
LNFDI	0.1764	0.1205	0.2584	0.4140	0.0420	0.0882*	0.1675	0.2733
LNGE	0.8943	0.9981	0.4001	0.9933	0.1066	0.8443	0.3187	0.9313
LNGFC	0.6491	0.9150	0.1718	0.2511	0.1099	0.0233**	0.3662	0.0654*
LNET	0.1683	0.9500	0.1418	0.1297	0.0199	0.1969	0.0411	0.5724

Source: Author's calculation. Notes: The variables LNAFF, LNFDI, LNGE, LNGFC, & LNET denote agriculture, forestry, and fishing, foreign direct investment, gross fixed capital formation, government expenditure measured by final consumption expenditure, & export of goods and services. Null hypothesis states the series is the existence of stationaries. In addition, *and **indicate the significant level at 0.1 and 0.05 respectively.

4.3. Correlation Analysis

Table 4 displays the test results of the correlation analyses between the different variables selected in this study. As can be seen, there is a strong and positive correlation between the agriculture, forestry, and fisheries variables and the other independent variables present in this analysis. Furthermore, this statistical correla-

tion method is appropriate to identify the correlation between these variables and determine the impact of FDI on agriculture, forestry, and fisheries. The FDI has a strong positive and significant relationship with agriculture, forestry, and fisheries, with a correlation coefficient of 0.809040, which is very close to 1, and a probability of 0.0000, which is less than 0.05 significance. The results presented in this table show that there is a strong relationship between LNFDI and LNAFF, indicating that agricultural sector growth is also attracting more FDI to these selected East African countries. **Table 4** reveals that the other selected independent variables, including fixed capital formation, export of goods and services, and final consumption expenditure, are positively and strongly correlated with agriculture, forestry, and fisheries (LNAFF). Additionally, this correlation is statistically significant, with a probability of less than 0.05. Therefore, it can be concluded that all these selected variables, such as LNFDI, LNGFC, LNGE, and LNET, have a strong positive correlation with the LNAFF.

Table 4. Test of correlation analysis.

Variable	LNAFF	LNFDI	LNGFC	LNGE	LNIET
LNAFF	1.000000				
LNFDI	0.809040*	1.000000			
LNGFC	0.923249*	0.775340*	1.000000		
LNGE	0.900424*	0.570283*	0.822757*	1.000000	
LNET	0.646607*	0.309418*	0.709907*	0.819210*	1.000000

Source: Author's calculation. Note: *p-value < 0.05.

4.4. Granger Causality Test

As shown in **Table 5**, the Granger causality test is adopted using Eviews software to examine the causal effect between the different independent variables selected according to the availability of data and agriculture, synergy, and fisheries from 2013 to 2022.

Null Hypothesis	Observation	F-Statistic	Prob.	Decision
LNFDI does not Granger Cause LNAAF	40	0.39095	0.6793	Fail to reject H0
LNAFF does not Granger Cause LNFDI		4.82353	0.0141**	Reject H0
LNGE does not Granger Cause LNAFF	40	0.26896	0.7657	Fail to reject H0
LNAFF does not Granger Cause LNGE		3.50921	0.0408**	Reject H0
LNGFC does not Granger Cause LNAFF	40	2.92242	0.0670*	Reject H0
LNAFF does not Granger Cause LNGFC		4.17306	0.0237**	Reject H0
LNET does not Granger Cause LNAFF	40	0.68417	0.5111	Fail to reject H0
LNAFF does not Granger Causse LNET		2.06397	0.1421	Fail to reject H0

Notes: The symbols ** and * denote the rejection of the null hypothesis (H₀) at 0.05 and 0.10 significance levels, respectively. Source: Author's calculation based on data from the world bank/WDI.

As can be seen in the table above, the result of Granger's causal analyses is present to determine the existence of the causal relationship between the variables selected in this study. Foreign direct investment and public spending do not have a Granger effect cause on the value of agriculture, synergy, and fisheries. These LNFDI and LNGE variables have a probability of 0.6793 and 0.7657, respectively, above a 5% significant level. On the other hand, the table above shows that there is a unidirectional causal relationship between the value of agriculture, synergy, and fisheries (LNAFF) and foreign direct investment (LNFDI). Similarly, at a significance level of 5%, the table shows unidirectional causality between LNAFF and LNGE. It can demonstrate that the value of agriculture, forestry, and fisheries has a Granger cause of variable foreign direct investment and government expenditure. In addition, Table 5 indicates that exports of goods and services to 5 East African countries have no Granger cause value for agriculture, synergy, and fisheries. Furthermore, there is a bidirectional cause-and-effect relationship between LNGFC and LNAFF, which explains that gross fixed capital formation leads to a causal effect on the value of agriculture, synergy, and fishing at a significance level of 5% and 10%.

4.5. Selection Model of Panel Data Regression Analysis

In this panel data regression, different models are used to analyze data, namely random effects models, fixed-effect models, and common-effect models. In this study, we determine the most appropriate panel model from several analysis tests. We perform several tests in our research, including the Chow test and the Hausman test, to determine the most suitable panel regression model. The best model between random effects and fixed effects models was selected; the Hausman specification test is used for empirical analysis (Yao et al., 2020).

4.5.1. Chow Test

Table 6 shows the results of the Chow test in this study.

Table 6. Chow test.

Redundant Fixed Effects Tests							
Equation: Untitled							
Test cross-section fixed effects							
Effects Test	Statistic	d.f.	Prob.				
Cross-section F	33.893914	(4, 41)	0.0000				
Cross-section Chi-square	73.008868	4	0.0000				

Source: Author's calculation.

Based on the result of the table above, we can see that the probability values of F and Cross section Ch-squares are positive and highly significant at the significance level of 0.05. The p-value probability result is 0.0000, which is less than 0.05 of the significance level. Moreover, this shows that H0 is rejected and H1 is ac-

cepted, indicating that the adequate and correct model for this data regression is the Fixed Effect model.

4.5.2. Hausman Test

Table 7. Hausman test result.

Correlated Random Effects-Hausm	an Test		
Equation: Untitled			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	135.57565 7	4	0.0000

Source: Author's calculation.

According to **Table 7**, the Hausman test results show that the cross-section random probability of 0.0000 is less than 0.05, which is a significant level. The study accepts H1 and rejects H0, suggesting that the fixed effect model is the most suitable model for this panel regression. Based on the Chow test and the Hausman test, we conclude that the fixed-effect model is the appropriate model for this panel data regression.

4.5.3. Normality Test

In this study, **Figure 1** shows us the result of the normality test on the fixed-effect model. As we can see in the model result, the statistical value of Jarque-Bera and the probability of 0.838724 (0.657466), are greater than the 0.05 level of significance. This indicates that the H0 is accepted, which means that the panel data regression model selected in this study is normally distributed.



Source: Author's calculation.

Figure 1. Normality test results.

4.5.4. Fixed Effect Panel Model

Table 8 presents the results obtained using the fixed-effect regression model over a period from 2013 to 2022.

Table 8. Fixed-effect panel model results.

Dependent Variable: LNAFF Method: Panel Least Squares Date: 08/07/24 Time: 18:42 Sample: 2013 2022 Periods included: 10 Cross-sections included: 5 Total panel (balanced) observations: 50

Variable	Coefficient	Std. Error	t-Statistic	Prob.		
LNFDI	0.175686	0.371166	0.473335	0.6385		
LNGE	0.369221	0.022561	16.36574	0.0000		
LNGFC	0.007644	0.063499	0.120380	0.9048		
LNET	0.092584	0.221170	0.418610	0.6777		
С	-2.145542	1.156894	-1.854571	0.0709		
Effects Specification						
Cross-section fixed (dummy variables)						
R-squared	0.991608	Mean dep	endent var	13.20140		
Adjusted R-squared	0.989970	S.D. depe	ndent var	12.08634		
S.E. of regression	1.210438	Akaike inf	o criterion	3.381390		
Sum squared resid	60.07153	Schwarz	criterion	3.725554		
Log-likelihood	-75.53475	Hannan-Q	uinn criter.	3.512450		
F-statistic	605.5509	Durbin-W	atson stat	0.638798		
Prob (F-statistic)	0.000000					

Source: Author's calculation.

The result table of the fixed-effects panel model above shows that the R-squares is 0.991608, indicating that this model is accepted, and suggesting that the explanatory variables may explain about 99% of the variation in LNAFF for the five selected East African countries. As shown in the table above, the probability value of this model F-statistics is 0.0000, which is less than a 5% significance level and indicates that the model is fit. Moreover, the regression equation of this model is as follows:

$$\begin{split} LNAFF_{it} &= -2.145542 + 0.175686LNFDI_{1it} + 0.092584LNET_{2it} \\ &\quad + 0.369221LNGE_{3it} + 0.007644LNGFC_{4it} + \epsilon_{it} \end{split}$$

In this model, we can demonstrate that all the selected explanatory variables have a positive effect on agriculture, forestry, and fisheries, and they have strongly positive regression coefficients. The fixed-effect model shows that net foreign direct investment (LNFDI) has a positive impact on agriculture, forestry, and fisheries, with a regression coefficient of 0.175686. However, the variable is not statistically significant, with a p-value of 0.6385, which is higher than the significance level of 0.05. Furthermore, this result explains that if LNFDI increases by 1 unit, this means that agriculture, forestry, and fishing in 5 Eastern African countries has increased by 0.175686 units of value. Additionally, the table above shows that variables such as export of goods and services (LNET), and gross fixed capital formation (LNGFC) have a strongly positive impact on agriculture, forestry, and fisheries, with regression coefficients of 0.092584 and 0.007644, but both are not statistically significant with a probability of 0.6777 and 0.9048, which is greater than the 5% level of significance. In addition, the variable of consumption expenditure also has a positive impact on agriculture, forestry, and fisheries in the 5 East African countries, with a positive regression coefficient of 0.369221, but also highly significant at a significance level of 5%. This indicates that if LNGE increases by 1 unit, it leads to an increase of 0.369221 in agriculture, forestry, and fisheries in the 5 Eastern African countries.

5. Discussion

In this study, we present panel data analysis results spanning from 2013 to 2022. In Table 3 and Table 4, we have presented the unit root test and test of variable set correlation analyses selected in this study. We find that some selected variables are stationary at the first difference at the 5% to 10% significance level. Using test correlation analysis, we find that foreign direct investment has a strong correlation with agriculture, forestry, and fisheries. Indeed, there is a strong correlation between the selected variables and agriculture, forestry, and fisheries. The findings indicate that there is a significant relationship between the variables in this study. In **Table 5**, we present the Granger Cause Panel Test to determine the causality that exists between these dependent and independent variables. We find that there is a unidirectional causality between foreign direct investment and agriculture, forestry, and fisheries. In addition, the results show that foreign direct investment does not Granger cause agriculture, forestry, and fishing. This may indicate the existence of a one-way causal relationship between IDF and agriculture, forestry, and fisheries in 5 Eastern African countries. There is a relationship in which we can subject our data to a more appropriate econometric based on a panel data regression. The result also suggests that there is a one-way or unidirectional causality between government expenditure (LNGE) and agriculture, forestry, and fisheries (LNAFF). Furthermore, the results indicate that government expenditure does not Granger cause agriculture, forestry, and fisheries. The finding is supported by some studies carried out in South Africa by Ngobeni and Muchopa (2022), in India by Singh et al. (2021), and others, which demonstrate that government expenditure does not Granger cause the agriculture, forestry, and fisheries. We can also confirm that export goods and services do not cause LNAFF. This indicates the null hypothesis that LNFDI, LNGE, and LNET do not Granger cause LNAFF is accepted. In addition, findings provide that there is a bidirectional or two-way causality between Gross Fixed Capital Formation (LNGFC) and LNAFF. This indicates the null hypothesis that LNGFC does not Granger cause LNAFF is rejected at a significance level of 5%.

In this study, we apply several tests to analyze the effect by presenting results based on data regression using a fixed-effect panel model. The result confirms that FDI has a positive effect on agriculture, forestry, and fisheries, which is consistent with the result of the study by Nylwul and Koirala (2022), who showed that FDI has positive effects on agriculture, forestry, and fisheries. The findings also illustrate the relevant result obtained by Edeh et al. (2020), who argued that foreign direct investment has a positive impact on agricultural sector output. We find that FDI plays an important role in the agricultural sector in the 5 Eastern African countries selected in this study. The result shows that foreign direct investment contributes an important role to the country's development potential by offering significant advantages, especially in the agricultural sector, as reported by Gunasekera et al. (2015), FDI could play a significant role in the coming decades. Similarly, the finding indicates that Gross Fixed Capital Formation and Export of Goods and Services also have a positive effect on the growth of agriculture, forestry, and fisheries in the 5 Eastern African countries. We find that government spending has a positive effect on agriculture, forestry, and fisheries, with statistical significance at the 1% significance level. The result shows that government expenditure plays a key role in the development of the agriculture, and forestry fisheries, as argued by Ngobeni and Muchopa (2022), government expenditure contributes to the growth in the value of agricultural production.

6. Conclusion

In conclusion, this study aims to analyze the impact of foreign direct investment on agriculture, forestry, and fisheries in 5 East African countries (Djibouti, Kenya, Ethiopia, Rwanda, and Tanzania). The study applies a panel data regression using panel data over a period from 2013 to 2022. Using one of the most appropriate Dicky Fuller Augment tests (ADF), the unit root test is investigated to check the stationarity of all the selected variables. In this study, different tests are adapted such as the Chow test and the Hausman specification test, which justified that the fixed-effect panel model of the panel data regression analysis is considered the most appropriate model in this study.

We find that foreign direct investment and the other selected variables have a strongly positive correlation with agriculture, forestry, and fisheries in the 5 Eastern African countries, with statistically significant at a 5% significance level. Specifically, we first estimate the Granger causality test using panel data regression analysis by demonstrating causality exists between the variables in this study. According to the results of the Granger cause tests, foreign direct investment and government expenditure have a one-way relationship with agriculture, forestry,

and fisheries. This study also demonstrates that capital formation has a Granger cause in agriculture, forestry, and fisheries. In addition, foreign direct investment is an essential pillar for the country's economic development and contributes greatly to the development and improvement of the agriculture, forestry, and fisheries sectors in the country. The result of the fixed-effect panel model, based on panel data regression, indicates that foreign direct investment, capital formation, and export trade in goods and services have a positive impact on agriculture, forestry, and fisheries in five Eastern African countries. Thus, the result also reveals that government expenditure has a strongly positive impact on agriculture, forestry, and fisheries, with statistical significance at a 5% level of significance.

Our findings indicate that foreign direct investment is a critical factor in promoting the agricultural sector's development in the five Eastern African countries. The increase in foreign direct investment can contribute greatly to the development of the industrial sector but also ensure that the agriculture, forestry, and fishing sectors grow adequately. Moreover, foreign direct investment strongly stimulates the growth of the agricultural, forestry, and fisheries sectors. Similarly, this study highlights that the growth of export trade, capital formation, and government expenditure promotes the country's dynamic growth and has a significant impact on agriculture, forestry, and fisheries in the five Eastern African countries. Therefore, the governments of East African countries should prioritize improving the conditions to attract more foreign direct investment in the long term, as this will contribute to a stable economy and sufficient and optimal growth in the agriculture, forestry, and fisheries. These countries can strengthen and increase their foreign direct investment in the agricultural sector through fiscal support and by improving political stability.

7. Limitations and Suggestions for Future Research

This study has a limitation of the short period covered by the data for these variables selected due to the unavailability of data in a larger period. The study focuses primarily on several East African countries but not all East African countries. Therefore, it may be better to study for a long period (e.g., 2000-2022) and add more countries in East Africa, and the results could be different and highly effective. The literature on these variables has recently been very limited to agricultural sectors. In addition, it may be that this study did not select all the variables affecting agriculture, forestry, and fisheries due to the availability of data and the very limited literature. Future research can focus on studying other factors and variables that could influence these sectors, such as political reforms, infrastructure, technology and climate change. Future research can also focus on determining the role of agriculture, forestry, and fisheries in the economic development of these East African countries selected in this study.

Availability of Data and Materials

Data generated and additional material used during the current study are available

from the corresponding author upon reasonable request.

Acknowledgements

The author would like to express his sincere gratitude to all those who provided useful suggestions, reading, and helpful comments for improvement, which was the essential pillar during the writing of the article.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

- Aloui, Z., & Maktouf, S. (2023). The Impact of Foreign Direct Investment and Political Stability on Food Security: Evidence from Sub-Saharan African Countries. *Comparative Economic Studies, 66*, 289-328. <u>https://doi.org/10.1057/s41294-023-00222-w</u>
- Bafadal, A., Tinaprilla, N., Arsyad, M., Padangaran, A. M. et al. (2020). Impact of Government Expenditure on Agricultural Output and Poverty. *International Journal of Advanced Science and Technology, 29,* 1640-1649.
- Bounphone, K., Keothephar, K., Srithilat, V., & Kidoikhammuan, S. (2023). The Dynamic Impact of Economic Growth, Foreign Direct Investment and Infrastructure in Laos. *Scholars Journal of Economics, Business and Management, 10*, 198-208. <u>https://doi.org/10.36347/sjebm.2023.v10i09.001</u>
- Byamugisha, F. F. K. (2013). Securing Africa's Land for Shared Prosperity: A Program to Scale up Reforms and Investments. Africa Development Forum Series. World Bank.
- Cleaver, K. (2012). *Scaling Up in Agriculture, Rural Development, and Nutrition: Investing in Agriculture to Reduce Poverty and Hunger, 2020 Vision Briefs 19.* International Food Policy Research Institute (IFPRI).
- Deininger, K., Byerlee, D., Lindsay, J., Norton, A., Selod, H., & Stickler, M. (2011). *Rising Global Interest in Farmland: Can It Yield Sustainable and Equitable Benefits?* Agriculture and Rural Development, World Bank Books, 2263.
- Dhahri, S., & Omri, A. (2020). Does Foreign Capital Really Matter for the Host Country Agricultural Production? Evidence from Developing Countries. *Review of World Economics*, 156, 153-181. <u>https://doi.org/10.1007/s10290-019-00361-2</u>
- Edeh, C. E., Eze, C. G., & Ugwuanyi, S. O. (2020). Impact of Foreign Direct Investment on the Agricultural Sector in Nigeria (1981-2017). *African Development Review*, *32*, 551-564. <u>https://doi.org/10.1111/1467-8268.12460</u>
- Esquivias, M. A., Jayadi, A., Shafiai, S., Abd Rashid, I. M., Borhanordin, A. H., Agusti, K. S. et al. (2023). The Nexus between Food Security and Investment, Exports, Infrastructure, and Human Capital Development. *Journal of Human, Earth, and Future, 4*, 221-240. https://doi.org/10.28991/hef-2023-04-02-07
- Fan, H., Trinh Thi, V. H., Zhang, W., & Li, S. (2023). The Influence of Trade Facilitation on Agricultural Product Exports of China: Empirical Evidence from ASEAN Countries. *Economic Research-Ekonomska Istraživanja, 36*, Article ID: 2143845. <u>https://doi.org/10.1080/1331677x.2022.2143845</u>
- FAO (2022). Government Expenditures in Agriculture 2001-2020. Global and Regional Trends. FAOSTAT Analytical Briefs, No. 35.
- Furtan, W. H., & Holzman, J. J. (2004). The Effect of FDI on Agriculture and Food Trade:

An Empirical Analysis 1987-2001. Agriculture and Rural Working Paper Series 28037, Statistics Canada.

- Gohou, G., & Soumaré, I. (2012). Does Foreign Direct Investment Reduce Poverty in Africa and Are There Regional Differences? *World Development, 40*, 75-95. <u>https://doi.org/10.1016/i.worlddev.2011.05.014</u>
- Gunasekera, D., Cai, Y., & Newth, D. (2015). Effects of Foreign Direct Investment in African Agriculture. *China Agricultural Economic Review*, *7*, 167-184. https://doi.org/10.1108/caer-08-2014-0080
- Jana, S. S., Sahu, T. N., & Pandey, K. D. (2019). Foreign Direct Investment and Economic Growth in India: A Sector-Specific Analysis. Asia-Pacific Journal of Management Research and Innovation, 15, 53-67. <u>https://doi.org/10.1177/2319510x19849731</u>
- Kemeny, T. (2010). Does Foreign Direct Investment Drive Technological Upgrading? World Development, 38, 1543-1554. <u>https://doi.org/10.1016/j.worlddev.2010.03.001</u>
- Mihalache-O'keef, A., & Li, Q. (2011). Modernization vs. Dependency Revisited: Effects of Foreign Direct Investment on Food Security in Less Developed Countries. *International Studies Quarterly, 55,* 71-93. <u>https://doi.org/10.1111/j.1468-2478.2010.00636.x</u>
- Mo, P. H. (2007). Government Expenditures and Economic Growth: The Supply and Demand Sides. *Fiscal Studies, 28,* 497-522. https://doi.org/10.1111/j.1475-5890.2007.00065.x
- Naik, P. K., & Padhi, P. (2015). On the Linkage between Stock Market Development and Economic Growth in Emerging Market Economies: Dynamic Panel Evidence. *Review of Accounting and Finance*, *14*, 363-381. <u>https://doi.org/10.1108/raf-09-2014-0105</u>
- Ngobeni, E., & Muchopa, C. L. (2022). The Impact of Government Expenditure in Agriculture and Other Selected Variables on the Value of Agricultural Production in South Africa (1983-2019): Vector Autoregressive Approach. *Economies, 10,* Article 205. https://doi.org/10.3390/economies10090205
- Nwer, B. A., Ben Mahmoud, K. R., Zurqani, H. A., & Elaalem, M. M. (2021). Major Limiting Factors Affecting Agricultural Use and Production. In H. A. Zurqani (Ed.), *The Soils of Libya* (pp. 65-75). Springer International Publishing. https://doi.org/10.1007/978-3-030-66368-1_5
- Nyiwul, L., & Koirala, N. P. (2022). Role of Foreign Direct Investments in Agriculture, Forestry and Fishing in Developing Countries. *Future Business Journal, 8,* Article No. 50. https://doi.org/10.1186/s43093-022-00164-2
- Opoku, E. E. O., Ibrahim, M., & Sare, Y. A. (2019). Foreign Direct Investment, Sectoral Effects and Economic Growth in Africa. *International Economic Journal, 33*, 473-492. https://doi.org/10.1080/10168737.2019.1613440
- Owutuamor, Z. B., & Arene, C. J. (2018). The Impact of Foreign Direct Investment (FDI) on Agricultural Growth in Nigeria (1979-2014). *Review of Agricultural and Applied Economics, 21*, 40-54. <u>https://doi.org/10.15414/raae.2018.21.01.40-54</u>
- Páral, M., & Blížkovský, P. (2019). Globalisation and Food Sovereignty: Impact of Foreign Direct Investments and Government Expenditure in Ghana in 2001-2010. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 67, 325-331. https://doi.org/10.11118/actaun201967010325
- Samdrup, T., Fogarty, J., Pandit, R., Iftekhar, M. S., & Dorjee, K. (2023). Does FDI in Agriculture in Developing Countries Promote Food Security? Evidence from Meta-Regression Analysis. *Economic Analysis and Policy*, *80*, 1255-1272. https://doi.org/10.1016/j.eap.2023.10.012

Santangelo, G. D. (2018). The Impact of FDI in Land in Agriculture in Developing Coun-

tries on Host Country Food Security. *Journal of World Business, 53*, 75-84. https://doi.org/10.1016/j.jwb.2017.07.006

- Singh, O. K., Priscilla, L., & Vatta, K. (2021). The Impact of Public Expenditure on Agricultural Growth: Empirical Evidence from Punjab, India. *Agricultural Economics Re*search Review, 34, 157-164. <u>https://doi.org/10.5958/0974-0279.2021.00023.9</u>
- Slimane, M. B., Huchet-Bourdon, M., & Zitouna, H. (2016). The Role of Sectoral FDI in Promoting Agricultural Production and Improving Food Security. *International Economics*, 145, 50-65. <u>https://doi.org/10.1016/j.inteco.2015.06.001</u>
- Sultanuzzaman, M. R., Fan, H., Mohamued, E. A., Hossain, M. I., & Islam, M. A. (2019). Effects of Export and Technology on Economic Growth: Selected Emerging Asian Economies. *Economic Research-Ekonomska Istraživanja, 32*, 2515-2531. <u>https://doi.org/10.1080/1331677x.2019.1650656</u>
- Walkenhorst, P. (2000). Foreign Direct Investment, Technological Spillovers and the Agricultural Transition in Central Europe. *Post-Communist Economies*, *12*, 61-75. https://doi.org/10.1080/14631370050002675
- World Investment Report (2022). *International Tax Reforms and Sustainable Investment*. UNCTAD. <u>https://unctad.org/publication/world-investment-report-2022</u>
- Yao, H., Alhussam, M. I., Abu Risha, O., & Memon, B. A. (2020). Analyzing the Relationship between Agricultural FDI and Food Security: Evidence from Belt and Road Countries. *Sustainability*, *12*, Article 2906. <u>https://doi.org/10.3390/su12072906</u>
- Yao, S., & Wei, K. (2007). Economic Growth in the Presence of FDI: The Perspective of Newly Industrialising Economies. *Journal of Comparative Economics*, 35, 211-234. <u>https://doi.org/10.1016/j.jce.2006.10.007</u>