INDIAN JOURNAL OF GLOBAL ECONOMICS AND BUSINESS
Vol. 1, No. 2, 2022, pp. 53-69

ISSN: 2583-486X

GRANGER CAUSALITY BETWEEN FOREIGN DIRECT INVESTMENT AND FINANCIAL DEVELOPMENT IN SUB-SAHARAN AFRICAN COUNTRIES

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Article History

Received : 19 July 2022
Revised : 27 August 2022
Accepted : 11 September 2022
Published : 30 December 2022

To cite this article

Ebene Ndesse Axelle Maryline (2022). Granger Causality between Foreign Direct Investment and Financial Development in Sub-Saharan African Countries. *Indian Journal of Global Economics and Business*, Vol. 1, No. 2, pp. 53-69.

Abstract: This paper investigates the possibility of Granger causality between foreign direct investment and financial development in 48 sub-Saharan African countries from 1960 to 2020. For a technical reason, based on their wealth in 2020, the countries were classified as low-income, middle-income, and high-income countries. The three panels of twenty-three, twenty-four, and one countries, respectively, are examined collectively and then separately. Granger causality is tested with a panel data approach. The results indicate a single instance of two-way Granger causality between financial development indicators and FDI, both for the full sample and for the subsamples. In contrast, several cases of one-way causality are identified.

Keywords: Granger causality, foreign direct investment, financial development,

Jel Classification: C23, F23, F36.

1. INTRODUCTION

Sub-Saharan African countries, like most developing countries, actively seek to attract foreign direct investment due to insufficient internal resources. The growth-enhancing effects of foreign direct investment flows have motivated an in-depth study of the causal relationships these flows have with financial development.

The relationship between financial development and FDI has not been fully explored in the literature. The majority of previous studies on FDI have mainly focused on the relationship between FDI and economic growth between FDI and economic growth (see, for example, Alfaro et *al*., 2004, 2010; Hermes and Lensink, 2003).

Causality is the process by which an event or process (a cause) contributes to the production of another event, process (an effect), where the cause is partly

responsible for the effect, and the effect depends part of the cause. Causality is not necessarily one-sided; there may also be reverse causation.

Financial development is one of the important determinants of foreign direct investment (Desbordes and Wei, 2017; Cho and Kim, 2020). However, a limited number of studies have been undertaken to investigate the causal interaction between financial sector development and foreign direct investment inflows into Africa, although these two variables have the potential to influence each other in theory. Recent works include those of Agbloyor et *al*. (2013) which proposes to explore the causal links between financial markets and foreign direct investment in Africa. They use a two-step panel instrumental variable approach to avoid simultaneous causal biases and show that a more advanced banking system can lead to more FDI flows. Higher FDI flows can also lead to the development of the domestic banking system.

Asongu (2014) attempted to introduce financial components (efficiency, activity and size) that were previously missing in the assessment of the finance-investment nexus. It then uses vector autoregressive models from the perspective of vector error correction model and short-term Granger causality. These optimally specified econometric methods are distinguished from purely discretionary model specifications in the mainstream literature. Subsequently, Gebrehiwot, Esfahani, and Sayin (2016) investigated the long-term relationship between FDI and financial market development in the Sub-Saharan Africa region. Applying Granger's causality test to examine the causal relationship between the two variables and running the two-step panel regression model to ensure consistency of results, the authors find a relationship they believe to be inclusive between the IDE and the development of financial markets.

Soumaré and Tchana (2015) study the causal relationship between FDI and the development of financial markets using panel data from emerging markets. Most studies on the relationship between FDI and financial development have focused on the role of financial development in the link between FDI and economic growth, without a thorough understanding of the direct causality between FDI and financial development, particularly in emerging markets, where financial markets are developing. We document the two-way causality between FDI and stock market development indicators. For banking sector development indicators, the relationship is ambiguous and inconclusive. Caution should therefore be exercised when analyzing the relationship between financial development and FDI, as the results may depend on whether the financial development variables used to assess causality are stock market development indicators or banking sector.

Some studies have attempted to highlight the causal relationship between foreign direct investment inflows and financial development with mixed success in African countries, particularly in ECOWAS member countries. For the most

part, these studies have simply shown the importance of FDI and financial development in achieving GDP. To refocus the debate, Pokou (2020) analyzes in ECOWAS member countries the causal relationship between our variables of interest using causality techniques. The author's country-by-country estimates found significant links between FDI inflows and financial sector development in terms of unidirectional and bidirectional causalities.

Odhiambo (2021) examines the causal relationship between financial development and FDI in Sub-Saharan African countries using three indicators of financial development, namely bank deposits, depository bank assets and liquid liabilities . Using a multivariate panel Granger causality model, his study found that the causal relationship between financial development and FDI depends on the variable used to measure the level of financial development. The relationship also varies over time. Overall, the study found that a causal flow from FDI to financial development prevails, at least in the short term.

Starting from the observation that previous contributions have recognized that FDI and financial development, respectively, play a vital role in enhancing economic growth across nations and that despite this, the causal relationship between FDI and financial development has not been sufficiently studied in developing countries and in particular in Africa, Mbratana, Fotié and Amba (2021) have recently sought to fill this by assessing the direct causality between FDI and financial development for 47 African countries. To achieve this, they used the Granger causality test to establish short-term (temporary) and long-term (permanent) causality. The main results attest to permanent and temporary causality in terms of bidirectional or unidirectional links, although there are several cases of lack of causality between FDI and financial development indicators.

This study aims to examine the causal relationship between FDI and financial development using new evidence from sub-Saharan Africa. The rest of the document is structured as follows: Section 2 provides an overview of the sample, data and variables. Section 3 discusses estimation techniques and empirical analysis. Section 4 presents the results, while Section 5 concludes the study.

2. SAMPLE, DATA AND VARIABLES

2.1. Sample

To observe a general pattern of the mutual relationship between financial development and foreign direct investment inflow performance, it is important to choose a sample of regions or countries on which the main information regarding the variables of interest is frequent and stable. To ensure the stability of the presence of such information between economies, the countries of sub-Saharan Africa were chosen. African financial sectors can play an important role in supporting a

sustainable, smart and inclusive economic recovery by helping to attract foreign investment and allocate domestic resources efficiently. A sample of 48 countries was therefore selected out of a total of 59 countries on the African continent, representing a coverage of over 80% (see Annex A for a complete list of countries). However, in order to take into account the disparities that exist between the different countries of the sub-Saharan region, a distinction has been made between low-income countries, middle-income countries and high-income countries.

Low-income countries include: Burkina Faso, Burundi, Democratic Republic of Congo, Gambia, Guinea, Guinea Bissau, Liberia, Madagascar, Malawi, Mali, Mozambique, Niger, Uganda, Rwanda, Central African Republic, Sierra Leone, Somalia, Sudan, South Sudan, Chad, Togo, Eritrea, Ethiopia; middle-income countries include South Africa, Angola, Botswana, Benin, Cabo Verde, Cameroon, Republic of Congo, Ivory Coast, Comoros, Eswatini, Gabon, Ghana, Equatorial Guinea, Kenya, Lesotho, Mauritius, Mauritania, Namibia , Nigeria, Sao Tome and Principe, Senegal, Tanzania, Zambia, Zimbabwe; high-income countries include Seychelles only.

2.2. Measurement of FDI

There are several sources of FDI data. An important source is the International Monetary Fund (2022) publication "International Financial Statistics" (IFS), which presents balance of payments statistics on FDI. Net FDI inflows, reported in the IFS, measure net investment inflows to acquire a sustainable management stake (10% or more of voting shares) in a company operating in an economy other than that of the investor. It is the sum of equity, reinvestment of earnings, other long-term capital, and short-term capital, as shown in the balance of payments. Gross FDI figures reflect the sum of the absolute value of inflows and outflows recorded in the financial accounts of the balance of payments. Our model focuses on entries into the economy; therefore, we prefer to use the net entry measure.

The main measure of foreign direct investment (FDI) is the net inflow of investment into a company operating in an economy other than that of the investor, normalized by GDP. This series shows the net inflows (net investment flows less divestments) of foreign investors into the economy.

This variable is sometimes lagged by one year to reduce any potential simultaneity bias. We could have adopted a logarithmic transformation to attenuate the influence of outliers, as in Desbordes and Wei (2017), but the presence of negative values got in the way. The same is also true for certain financial development data or other measures used for the additional data coded 0 and 1.

The alternative measure used is foreign direct investment in value (ide_v) which refers to direct investment flows into an economy. It is the sum of equity, reinvestment of earnings and other capital. Direct investment is a category of cross-

border investment associated with a resident of one economy having control or a significant degree of influence over the management of an enterprise resident in another economy.

2.3. Financial Development Measures

In this research, financial development is reflected by financial development indicators in all countries available over the period 1980 - 2020. As we established in Chapter 2, a large body of literature estimates the impact of financial development on economic growth, inequality and stability. A typical empirical study assesses financial development using one of two measures of financial depth – the ratio of private credit to GDP or stock market capitalization to GDP. However, these indicators do not take into account the complex multidimensional nature of financial development.

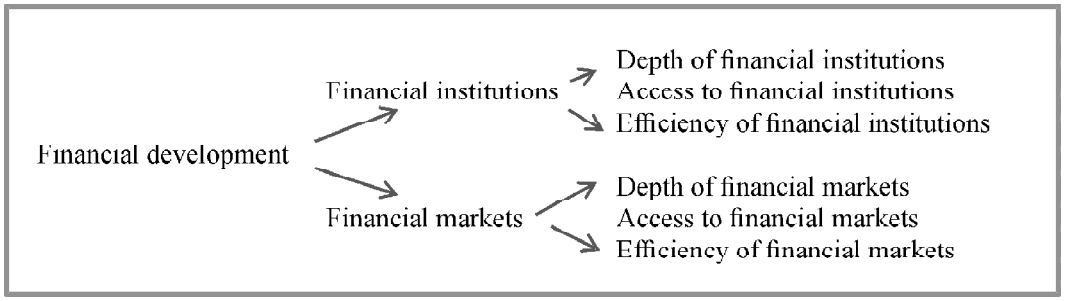
To correct this omission, the Financial Development Index was developed for the IMF staff discussion note "Rethinking Financial Deepening: Stability and Growth in Emerging Markets" (see for example, Sahay et al., 2015). It summarizes the level of development of financial institutions and financial markets in terms of depth (size and liquidity), access (ability of individuals and businesses to access financial services), and efficiency (ability of institutions to provide financial services at low cost and with sustainable incomes and the level of activity of the capital markets). The index database provides nine indices for more than 180 countries with annual frequency starting from 1980. The financial development indicator has the structure depicted in Figure 2.1.

The Financial Development Index is a data set that contains nine indices that summarize the level of development of financial institutions and financial markets in terms of depth, access and efficiency. These indices, which make it possible to assess the levels of financial systems in all countries, are aggregated into an overall index of financial development. We distinguish respectively: def: financial development; FI: financial institutions; FM: financial markets. The sub-indices named FID, FIA, FIE, FMD, FMA and FME, where I mean institutions and M mean markets, on the other side of depth, access and E for efficiency. The sub-indices are aggregated into two groups FI and FM, which feature financial institutions and financial markets. Finally, the FI and FM sub-indices are aggregated into the overall financial development index measure –def.

The depth of financial institutions (FID) is characterized by the following indicators: credit to the private sector (% of GDP), assets of pension funds (% of GDP), assets of mutual funds (% of GDP), premiums insurance, life and non-life (% of GDP).

Access to financial institutions (FIA) is characterized by the following indicators: branches (commercial banks) per 100,000 adults; ATMs for 100,000 adults.

Figure 2.1. Representation of the multidimensional aspects of financial development



Source: https://www.imf.org/external/pubs/ft/sdn/2015/sdn1508.pdf

The efficiency of financial institutions (FIE) is characterized by the following indicators: net interest margin; distribution of loan-deposits; non-interest income to total income; general expenses in relation to total assets; return on assets; return on equity.

The depth of financial markets (FMD) is characterized by the following indicators: market capitalization relative to GDP; stocks traded against GDP; international government debt securities (% of GDP); total debt securities of non-financial corporations (% of GDP); total debt securities of financial corporations (% of GDP).

Access to financial markets (FMA) is characterized by the following indicators: percentage of market capitalization outside the 10 largest companies; total number of debt issuers (domestic and external, non-financial corporations and financial corporations).

The efficiency of financial markets (FME) is characterized by the following indicator: stock market turnover rate (shares traded/capitalisation).

Each indicator is standardized from 0 to 1. The lowest value of the indicator for countries is zero, and all other values are measured against this minimum value. In order to avoid the pitfalls appearing following extreme data, the values of the variables of the 5th and 95th percentiles are defined as thresholds. The indicators are set in such a way that higher values indicate better financial development. Then, the indicators are grouped into six sub-indices in the lower part of the pyramid (see Figure 2.1 above). The aggregation is a weighted average of the base series, where the weights are the squares of the factor loadings of the principal components analysis, such that their sum includes 1. Finally, the sub-indices are aggregated in the same manner in higher indices using factor analysis according to the method of principal components; the index def is aggregated in the same way.

2.4. Data sources

Data on FDI as well as data on most of the control variables for this study were taken from the World Bank's World Development (WDI). They cover the period 1960-2020. The WDI Indicators are the world's most widely used international development dataset. These secondary data sources are credible and contain the data already converted into a common currency for all African countries included in the study. Additionally, secondary data sources are in the public domain, eliminating the risk of using biased and discordant data. All data values are in United States dollars at year-over-year exchange rates. This facilitates data comparability and analysis (Nnandi and Soobaroyen, 2015). Financial sector data come from the International Monetary Fund's Financial Development Index database.

3. METHODOLOGY: GRANGER CAUSALITY TEST

The Granger causality test itself has as its starting point the traditional Granger causality test, which is a methodology developed in a founding article (Granger, 1969), to analyze the causal relationships between two stationary time series. Since then, other approaches have been developed to analyze the existence of causal relationships between variables in the panels, namely by Dumitrescu and Hurlin (2012). As in Granger (1969), the existence of causality means that there are significant effects of past values of one variable on the present value of another variable. But this test surpasses traditional Granger causality tests by allowing the hypothesis of the existence of causality in at least one cross-section, against the non-existence of the homogeneous Granger-causality relationship.

According to Granger's concept of causation, correlation does not imply causation because the cause cannot come after its effect. More precisely, a variable, x, is said to cause another variable y, if the current value of this variable $y(t)$ depends significantly on the past values of variable , i.e. x_{t-1}, x_{t-2}, … (But not on its current value, x_t).

Since Granger causality is calculated by running bivariate regressions, there are a number of different approaches to testing Granger causality in a panel setting. In the case considered here, the starting point of the methodology is the estimation of a general linear panel Granger (1969) causality model with two equations. In general, bivariate regressions in a panel data setting take the form:

$$y_{it} = \alpha_1 + \Sigma_{k=1}^{K} \gamma_{1ik} y_{it-k} + \Sigma_{k=1}^{K} \beta_{1ik} x_{it-k} + \varepsilon_{1it} \tag{3.1}$$

$$x_{it} = \alpha_2 + \Sigma_{k=1}^{K} \gamma_{2ik} x_{it-k} + \Sigma_{k=1}^{K} \beta_{2ik} y_{it-k} + \varepsilon_{2it} \tag{3.2}$$

where i = 1, 2, ..., N designates the transverse dimension (these are the crossed units or units in sections); t = 1, 2, ..., T denotes the dimension of the time period of

the panel (these are the periods); $\alpha_{1,2}$ are the intercepts; $k = 1, 2, \ldots, K$ represents the shift or delays considered; $\varepsilon_{1,2}$ are the error terms (including not only the perturbation terms, but also the individual cross-unit specific effects).

In reality, different forms of panel causality testing differ on the assumptions made about the homogeneity of coefficients across cross-sections. The Granger test or test of non-causality considers the null hypothesis according to which $\beta_i = 0, \forall i = 1, 2, \ldots, N$. If this null hypothesis H_0 is rejected, it is possible to conclude that causality exists. More precisely, the strength of the Granger causality relations in each estimated equation can be evaluated using Wald tests for each of the β_i which are obtained for the considered time lags (t–1, t–2, ...). If the Wald test indicates that H_0 is rejected, the causality from x to y (or from y to x) exists.

Software usually offers two of the simplest approaches to causality testing in panels. The first is to treat the panel data as a stacked data set and then perform the Granger causality test in the standard way. This method assumes that all coefficients are the same in all cross-sections, i.e.:

$$\beta_{0i} = \beta_{0j}, \beta_{1i} = \beta_{1j}, \ldots, \beta_{li} = \beta_{ij}, \forall i, j \tag{3.3}$$

$$\alpha_{1i} = \alpha_{1j}, \ldots, \alpha_{li} = \alpha_{lj}, \forall i, j$$

A second approach taken by Dumitrescu-Hurlin (2012), makes an opposite extreme assumption, allowing all the coefficients to be different from section to section:

$$\beta_{0i} \neq \beta_{0j}, \beta_{1i} \neq \beta_{1j}, \ldots, \beta_{li} \neq \beta_{lj}, \forall i, j \tag{3.4}$$

$$\alpha_{1i} \neq \alpha_{1j}, \ldots, \alpha_{li} \neq \alpha_{lj}, \forall i, j$$

This test is calculated by simply running standard Granger causality regressions for each cross-section individually. The nesting step is to take the average of the test statistics, called wbar statistics. They show that the standardized version of this statistic, correctly weighted in unbalanced panels, follows a standard normal distribution. This is called the zbar statistic.

4. RESULTS

Following the proposed methodology, we apply the panel non-causality test developed by Granger (1969) to study the relationships between the nine IMF financial development indices and foreign direct investment in relation to GDP.

4.1. Test based on the full sample

Tables 4.1 to 4.4 show the results of the Granger panel causality tests based on the full sample and the country ranking subgroups by income, low-income country,

Table 4.1: Granger causality for the overall sample

	A: Financial development does not cause FDI (null hypothesis)			*B: FDI does not cause Financial development (null hypothesis)*		
	(1)	*(2)*	*(3)*	*(1)*	*(2)*	*(3)*
DEF vs IDE	Acceptation	Acceptation	Acceptation	Rejection **	Rejection **	Rejection *
FI vs IDE	Rejection***	Rejection **	Acceptation	Rejection ***	Rejection **	Rejection *
FM vs IDE	Rejection ***	Rejection ***	Rejection ***	Acceptation	Rejection **	Rejection ***
FID vs IDE	Rejection ***	Rejection ***	Rejection **	Acceptation	Acceptation	Acceptation
FIA vs IDE	Acceptation	Acceptation	Acceptation	Rejection ***	Rejection ***	Rejection ***
FIE vs IDE	Rejection *	Acceptation	Acceptation	Rejection *	Acceptation	Acceptation
FMD vs IDE	Rejection ***	Rejection ***	Rejection ***	Rejection **	Rejection ***	Rejection ***
FMA vs IDE	Rejection ***	Rejection ***	Rejection **	Acceptation	Rejection **	Rejection **
FME vs IDE	Acceptation	Acceptation	Rejection ***	Rejection ***	Rejection ***	Acceptation

Source: Our estimates

*Legend:*** = 1%; ** = 5% and * = 10%.

middle-income country, and high-income country . In addition to the three income groups to which we will return below, the tables present the results of the analysis of financial infra-development indicators, namely financial institutions (FI), financial markets (FM), the depth of financial institutions (FID), access to financial institutions (FIA), efficiency of financial institutions (FIE), depth of financial markets (FMD), access to financial markets (FMA) and market efficiency financial (FME). Panel A of Table 4.1 shows the results for the absence of causality from financial development to FDI with lag lengths ranging from 1 to 3, while Panel B shows the results for the absence of causality in the opposite direction. , that is to say ranging from FDI to financial development. The length of the lag is not determined by any of the information criteria, but is obtained automatically by the software and does not change for any model specification chosen from a maximum of three lags or lags.

The different rows of table 4.1 from the third show the results when measuring financial development using the nine indices that represent it in the context of our study. Their contents make it possible to examine Granger causality. In the three models represented by the columns numbered from (1) to (3), the point estimates can give rise to an acceptance or a rejection of the null hypothesis. In the case of rejection, significant estimates (with one, two or three stars) imply that financial development (FDI) does not cause FDI (financial development) in at least one country.

The results of the analysis reveal that there is a single case of bi-directional causality between financial development and FDI: FMD vs FDI with statistical significances of causality successively evaluated at a threshold of 1% in part A , 5% in part B for lag 1 and 1% for lags 2 and 3. Moreover, the statistical significance of causality is significantly stronger for part A than for part B. This result is supported by Bayar and Gavriletea (2018) in Asia, Bhattacharya, Inekwe and Paramati (2018) in Europe, who showed that financial development and FDI can have a feedback relationship.

We note a relative number of unidirectional causal effects identified: first DEF vs IDE, the statistical significances of causality of part A being respectively 5% when the lag is 1 and 2, and 10% for a lag of 3 Then FID vs IDE, for respective statistical significances of part A of 1% when the lag is 1 and 2, and 5% for a lag of 3. Finally FIA vs IDE which gives rise to statistical significances of the respective Part B by 1% regardless of the delay.

On the one hand, the previous analysis is in line with the research of Bayar and Gavriletea (2018), which reveals the existence of a one-way causality from financial development to FDI inflows in the CEECs. These results are consistent with the relevant literature (Sahin and Ege, 2015). For authors like Henri et al. (2019), FDI and DEF have no causal relationship in Africa. On the other hand, this

one-way causality is inconsistent with the results of Vojtoviè Klimaviciene and Pilinkiene (2019), which reveal that net Granger FDI inflows cause domestic credits to the private sector in the CEECs, but not the opposite effect. The results further support unidirectional causality running from a composite index of banking sector depth to FDI updated by Veselinoviæ and Despotoviæ (2021).

In the other five cases (FI vs IDE, FM vs IDE, FIE vs IDE, FMA vs IDE and FME vs IDE), the results reveal an ambiguous situation due to a drastic change in the test result when the delay is changed. For example, the FI vs FDI test results in part A as a rejection of the null hypothesis that financial development does not cause FDI at a threshold of 1% for a lag of 1.5% for a lag of 2 , and finally an acceptance of the null hypothesis for a lag of 3. In part B, we witness a systematic rejection of the null hypothesis (contrary) which states that FDI does not cause financial development. This ambiguity was notably raised by Gholizadeh et al. (2020) who found that the financial institutions index is not significant in the FDI equation at the 5% level.

4.2. Testing based on sub samples

In the continuation of the causal analyses, it was asked whether the results vary between countries with different levels of development. In this regard, Tables 4.2 provide an overview of the causal patterns for three subgroups, namely low- and high-income countries on the one hand and middle-income countries on the other. Granger causality for middle-income countries is performed in Table 4.2. There is a single case of bi-directional causality between financial development and FDI: FMD vs FDI with statistical significances of causality successively evaluated at a threshold of 1% in part A, 10% in part B for lag 1 and 1% for lags 2 and 3. Several cases of unidirectional causalities have arisen here, among which we find FID vs IDE and FIA vs IDE, the other two being FM vs IDE and FME vs IDE. For the FID vs IDE relationship, the statistical significances of part A are 1% when the lag is 1 and 2, and 10% for a lag of 3. For FIA vs IDE the statistical significances of part B are 1 % opposite lags of 1 and 2, and 5% for lag 3. Regarding FM vs IDE, the significance thresholds are 1% for all lags. Finally FME vs IDE gives significance thresholds of 1% in front of lags 1 and 2, and 5% for lag 3.

In the four other remaining cases (FI vs IDE, DEF vs IDE, FIE vs IDE, and FMA vs IDE), the results reveal an ambiguous situation as already noted during the study of causality in a global sample situation. Here again, for the FI vs FDI test, we have a test which results in part A in a rejection of the null hypothesis that financial development does not cause FDI at a threshold of 1% for lag 1 and 5 % for delay 2; and finally in part B, a rejection of the null hypothesis at the 5% threshold for lag 1.

In Table 4.3, the case of low-income countries is considered. If we maintain the presentation scheme as the one that was developed in the global case, we still

Table 4.2: Granger causality for middle-income countries

	A: Financial development does not cause FDI (null hypothesis)			*B: FDI does not cause Financial development (null hypothesis)*		
	(1)	*(2)*	*(3)*	*(1)*	*(2)*	*(3)*
DEF vs IDE	Acceptation	Rejection *	Acceptation	Rejection ***	Rejection ***	Rejection ***
FI vs IDE	Rejection ***	Rejection **	Acceptation	Rejection **	Acceptation	Acceptation
FM vs IDE	Rejection ***	Rejection ***	Rejection ***	Acceptation	Acceptation	Acceptation
FID vs IDE	Rejection ***	Rejection ***	Rejection *	Acceptation	Acceptation	Acceptation
FIA vs IDE	Acceptation	Acceptation	Acceptation	Rejection ***	Rejection ***	Rejection **
FIE vs IDE	Rejection *	Acceptation	Acceptation	Rejection *	Acceptation	Acceptation
FMD vs IDE	Rejection ***	Rejection ***	Rejection ***	Rejection *	Rejection ***	Rejection ***
FMA vs IDE	Acceptation	Acceptation	Acceptation	Acceptation	Rejection ***	Rejection *
FME vs IDE	Rejection ***	Rejection ***	Rejection **	Acceptation	Acceptation	Acceptation

Source: Our estimates

*Legend:*** = 1%; ** = 5% and * = 10%.

Table 4.3: Granger causality for low-income countries

	A: Financial development does not cause FDI (null hypothesis)			*B: FDI does not cause Financial development (null hypothesis)*		
	(1)	*(2)*	*(3)*	*(1)*	*(2)*	*(3)*
DEF vs IDE	Rejection ***	Rejection *	Acceptation	Rejection ***	Rejection ***	Rejection ***
FI vs IDE	Rejection ***	Rejection **	Acceptation	Rejection **	Acceptation	Acceptation
FM vs IDE	Rejection ***	Rejection ***	Rejection ***	Acceptation	Acceptation	Acceptation
FID vs IDE	Rejection ***	Rejection ***	Rejection *	Acceptation	Acceptation	Acceptation
FIA vs IDE	Acceptation	Acceptation	Acceptation	Rejection ***	Rejection ***	Rejection ***
FIE vs IDE	Rejection *	Acceptation	Acceptation	Rejection *	Acceptation	Acceptation
FMD vs IDE	Rejection ***	Rejection ***	Rejection ***	Rejection **	Rejection ***	Rejection ***
FMA vs IDE	Acceptation	Acceptation	Acceptation	Acceptation	Rejection ***	Rejection *
FME vs IDE	Rejection ***	Rejection ***	Rejection **	Acceptation	Acceptation	Acceptation

Source: Our estimates

*Legend:*** = 1%; ** = 5% and * = 10%.

observe that the FMD vs FDI relationship is the only case of bi-directional causality identified between financial development and FDI. Similarly, the statistical thresholds observed previously are revealed here, namely a threshold of 1% in part A, 5% in part B for delay 1 and 1% for delays 2 and 3.

The number of one-way causal effects is higher and now stands at four, namely, FM vs IDE, FID vs IDE, FIA vs IDE and FME vs IDE. However, among these, we find the relationship FID vs IDE, with the statistical significance of part A, 1% when the delay is 1 and 2, and 10% this time for a delay of 3. For the other three case, we have FM vs IDE whose statistical significances of part A maintained at 1% for all delays, FIA vs IDE with for part B the percentage at 1% the same, and FME vs IDE with statistical significances in the part B which are at 1% for delays 1 and 2, and 1% for delay 3. The relationships DEF vs IDE, FI vs IDE, FIE vs IDE and FMA vs IDE resulted in ambiguous results.

Table 4.4, reserved for the sample of high-income countries, also highlights the unique case of bidirectional causality with acceptance of the null hypothesis on both sides. In addition, a unique case of no results is identified: FMA vs IDE. Three one-way causal effects are identified: first FM vs IDE, where the statistical significances of causality in Part B are 1% for a lag of 1, and 5% when the lag is 2 and 3, respectively. Next, FID vs IDE, for respective Part A statistical significances of 5% when the lag is 1 and 2, and 10% for a lag of 3. Finally FMD vs IDE which results in respective Part B statistical significances of 1% for lag 1 and 5% when the lag is 2 and 3. In the other four cases (DEF vs IDE, FI vs IDE, FIA vs IDE and FIE vs IDE), the results reveal an ambiguous situation.

With regard to the consideration of classification by income level, the results suggest a trend close to the overall situation which has just been analysed, which suggests that the presence of causality or the absence of causality ranging from financial development towards FDI inflows is not influenced by the income level of the countries considered. If sub-income groups are tested, a range of patterns are observed: the original causal relationship is not maintained for any of the variables. Low-income countries show the most significant results for all causalities.

5. CONCLUSION

This article applied the Granger causality approach to the panel data model with in order to determine the relationship between FDI and financial development. Overall, the results of the causality test do not show the existence of very strong two-way causality for our sample of Sub-Saharan African countries. Based on the overall sample, there is only one case of bidirectional causality between FMD and IDE. The same is true for the group of middle-income countries and low-income countries. For high-income countries, the only case of two-way causality is for FME and FDI. In addition, several cases of unidirectional causality were identified

Table 4.4: Granger causality for high-income countries

	A: Financial development does not cause FDI (null hypothesis)			*B: FDI does not cause Financial development (null hypothesis)*		
	(1)	*(2)*	*(3)*	*(1)*	*(2)*	*(3)*
DEF vs IDE	Rejection **	Acceptation	Acceptation	Acceptation	Acceptation	Acceptation
FI vs IDE	Rejection **	Acceptation	Acceptation	Acceptation	Acceptation	Acceptation
FM vs IDE	Acceptation	Acceptation	Acceptation	Rejection ***	Rejection **	Rejection **
FID vs IDE	Rejection **	Rejection **	Rejection *	Acceptation	Acceptation	Acceptation
FIA vs IDE	Rejection **	Acceptation	Acceptation	Rejection **	Rejection *	Acceptation
FIE vs IDE	Rejection *	Acceptation	Acceptation	Acceptation	Acceptation	Acceptation
FMD vs IDE	Acceptation	Acceptation	Acceptation	Rejection ***	Rejection **	Rejection **
FMA vs IDE	-	-	-	-	-	-
FME vs IDE	Acceptation	Acceptation	Acceptation	Acceptation	Acceptation	Acceptation

Source: Our estimates

*Legend:*** = 1%; ** = 5% and * = 10%.

both in the overall sample and in the sub-samples. In the overall sample, these are respectively DEF and IDE, FID and IDE, and FIA and IDE. In the sub-sample of middle-income countries, we noted FID and IDE, FIA and IDE, FM and IDE, and FME and IDE. In the low-income country subsample, there are FM and IDE, FID and IDE, FIA and IDE, and FME and IDE. In the high-income country sub-sample: FM and IDE, FID and IDE, and finally FMD and IDE. Overall, the contribution of this study to the literature was to show strong evidence of unidirectional causality (Granger) between FDI and many indicators of financial development. One perspective for this type of study is to repeat the tests proposed here with longer time series and more refined econometric tools.

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