



FDI INFLOWS AND FINANCIAL DEVELOPMENT IN ECOWAS: CAUSALITY ANALYSIS IN THE FREQUENCY DOMAIN



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ABSTRACT

Many studies have attempted to highlight the causal relationship between the inflows of Foreign Direct Investments (FDI) and the financial development with mitigated success in African countries, especially in ECOWAS member countries. For the most part, these studies have simply showed the importance of FDI and financial development in achieving GDP. To refocus the debate, this article analyzes in ECOWAS member countries the causal relationship between our variables of interest using recent causality techniques: time domain Granger (1969), Toda and Yamamoto (1995) and Breitung and Candelon (2006). Overall, country-by-country estimates revealed evidence of significant links between FDI inflows and financial sector development in terms of unidirectional as well as bidirectional causalities. Essentially, the findings imply that policymakers should not only address the causal direction between FDI inflows and financial development but also whether it is temporal or permanent and therefore authorities must define measures to be taken accordingly.

Contribution/ Originality: It is the first time the relationship between the inflows of FDI and the financial development in ECOWAS member countries has been analyzed by using the techniques mentioned above. These methods provide robust estimations. The findings suggest that the causality between financial development and FDI are mixed across different frequencies leading to varied policy designs.

1. INTRODUCTION

Over the last two decades, foreign investments has become an essential source of external capital complementary to domestic capital for Africa and especially in West African countries, which require substantial capital to sustain their development (Agosin & Machado, 2005; Seetanah, 2009). Several advantages of foreign direct investment (FDI) have been detected in the literature: for instance, fostering the technology diffusion process, acquisition of more developed management practices, poverty alleviation and productivity gain.

The literature indicates that the benefits mentioned above are contingent on the absorptive capacity of the host country. Among the important absorptive capacities considered in the literature, there are the quality of human capital (Borensztein et al., 1998) and the financial sector development (Adjasi et al., 2012; Durham, 2004; Hermes & Lensink, 2003). However, the direct relationship between FDI and financial development has received little attention. The idea that financial development matters in the relation between FDI and economic growth has been studied extensively (Alfaro et al., 2004, 2010; Bekaert et al., 2005; Hermes & Lensink, 2003; Levine et al., 2000;

Levine & Zervos, 1998)) with insufficient insight of the direct causal association between FDI flows and financial development, particularly in West African countries where the financial sector is in the development phase. Empirical studies in this field are interested in the role of the financial sector as a channel of FDI in the process of economic production (Alfaro et al., 2004; Hermes & Lensink, 2003).

Notwithstanding this deficit of contributions studying the direct causal relation between FDI flows and financial development, the literature offers some empirical papers that have explored FDI-financial sector development nexus (Al Nasser & Gomez, 2009; Bayar & Ozel, 2014; Desbordes & Wei, 2017; Enisan, 2017; Fauzel, 2016; Korgaonkar, 2012; Sahina & Egeb, 2015; Zakaria, 2007). Korgaonkar (2012) applied a data mining technique on 78 countries during the 1980 to 2009 period and found that financial development remained a prerequisite for attracting FDI inflows.

Agbloyor et al. (2013) studied links concerning financial markets and FDI in Africa using 2SLS method through a panel data and established significant bidirectional causality in FDI-financial markets relation. Desbordes & Wei (2017) examined the link amid FDI flows and financial development in source and destination countries during the period 2003-2006. The findings of the panel data regression pointed out those countries desiring to encourage firm's internationalization and attract foreign multinationals ought to promote actions to increase access on external financing. Focusing on a panel data of emerging markets. As for Soumaré & Tchana (2015), they explored the causality among FDI and financial market development and they argued that there is a two-way causal link between FDI and stock market proxies, but the link is unclear and inconclusive as regard the banking sector proxies. Gebrehiwot et al. (2016) studied causality on financial development-FDI nexus for eight African nations during 1991-2013 period and documented a bidirectional causality between variables. The contribution of Otchere et al. (2016) who has studied the direct causal linkage between FDI and financial markets in Africa, has demonstrated two-way causality and suggested a positive relationship between the variables. Yilmaz & Gavriletea (2018) assessed the connection between FDI inflows and financial development in CEEU countries from 1996 to 2015 by means of panel cointegration and causality approaches. They found no cointegration relation between FDI inflows, investments of foreign portfolio, and financial sectors, however they showed that unidirectional causality from financial development to FDI inflows exist as concern the short term. More recently, Njangang et al. (2019) analysed the long and short-term impacts of FDI inflows on financial development in forty-nine African economies from 1990 to 2016 and found that FDI stimulate financial sector development over the long term. This article contributes to the literature of FDI inflows and financial development by using the frequency domain causality test to assess short-, medium and long-term causality and seeks to show whether the direction of causality vary along the periods.

Among the studies consecrated exclusively on the relation between FDI inflows and financial development, this is the first evidence, which explores causal relation between these two notions in the frequency domain analysis in the case of West African countries. Investment is essential to fostering the West Africa economy. Despite the relatively robust economic growth in West Africa in recent years, the region accounts for only around 1% of global FDI. Our examination of the causality among FDI inflows and financial development concerns a sample of fourteen ECOWAS economies. The rest of the study is organised as follows: Section 2 focuses on data description, Section 3 presents econometric methodology with empirical results in Section 4, and Section 5 concludes with final remarks.

2. DATA DESCRIPTION

The study used yearly data for fourteen countries of ECOWAS. According to the empirical literature on this topic, two different indicators were adopted to measure financial development, namely, liquid liabilities (*LIAB*) represent measure of "financial depth" (King & Levine, 1993a; Shen & Lee, 2006)) and domestic credit issued from the banking sector to the private sector (*BANK*) indicate a measure of the size of the financial sector (King & Levine, 1993a, 1993b). FDI inflows had as a measure the net inflows of FDI. The period of the study was delimited

by the obtainability of data for each country. Our different variables were expressed in-percentage of GDP. Data were extracted from the Global Financial Development and World Development Indicators in the World Bank database. Table 1 proposes summary statistics of the series used and the countries in our sample.

Table-1. Descriptive statistic.

Country	Variable	Mean	SD	Min	Max	T
Benin	FDI	1.232	1.683	-0.9	6.08	38
	LIAB	26.157	6.87	13.379	42.856	37
	BANK	18.062	8.087	5.415	31.84	38
Burkina-Faso	FDI	0.726	1.045	-0.092	4.104	38
	LIAB	21.072	5.519	12.304	35.145	37
	BANK	15.059	5.976	6.649	31.257	38
Cabo Verde	FDI	4.884	3.86	-0.005	12.667	32
	LIAB	56.14	21.287	27.344	98.847	37
	BANK	29.65	23.385	1.664	65.278	38
Cote d'Ivoire	FDI	1.319	1.004	-2.07	3.543	38
	LIAB	27.691	4.404	21.209	36.625	37
	BANK	24.316	9.987	12.372	41.871	38
Gambia, The	FDI	3.009	3.368	-1.072	12.55	38
	LIAB	26.084	13.461	13.654	53.66	35
	BANK	11.449	6.428	3.507	24.885	38
Ghana	FDI	2.916	2.98	0.045	9.517	38
	LIAB	15.746	7.944	6.339	32.064	37
	BANK	8.948	5.092	1.542	15.827	38
Guinea	FDI	2.45	4.268	-0.84	18.809	32
	LIAB	13.004	6.935	5.647	25.257	26
	BANK	4.909	2.268	2.627	10.775	29
Guinea-Bissau	FDI	1.303	1.071	0.016	4.274	34
	LIAB	17.403	13.732	0.11	47.007	31
	BANK	6.894	4.524	0.403	18.501	28
Mali	FDI	1.586	1.757	-0.773	6.351	38
	LIAB	20.155	4.317	14.135	27.236	37
	BANK	15.954	4.717	7.341	27	38
Niger	FDI	2.933	4.549	-2.138	16.629	38
	LIAB	16.147	4.793	7.294	26.549	37
	BANK	11.074	4.825	3.3	17.39	38
Nigeria	FDI	1.717	1.325	-1.151	5.791	38
	LIAB	18.241	7.307	9.609	33.864	37
	BANK	9.608	4.312	4.948	22.267	38
Senegal	FDI	1.167	1.005	-0.988	2.976	38
	LIAB	28.052	7.907	19.958	46.133	37
	BANK	20.035	5.968	11.536	29.537	38
Sierra Leone	FDI	3.097	8.637	-28.624	32.301	38
	LIAB	12.575	4.743	6.024	23.322	37
	BANK	4.277	1.872	1.522	8.159	38
Togo	FDI	2.366	3.228	-1.384	18.818	38
	LIAB	34.993	9.097	20.918	52.472	37
	BANK	23.089	7.852	11.473	41.708	38

3. ECONOMETRIC METHODOLOGY

As stated above, the main purpose of the current research was to assess the Granger causal relation among FDI inflows and financial development indicators in ECOWAS over different frequencies, therefore, we performed the Breitung and Candelon (2006) test originally introduced by Geweke (1982) and got the results below:

Setting $z_t = [x_t, y_t]'$ a two-dimensional vector over the time $t = 1, \dots, T$. Vector z_t has a finite-order VAR formulation such as:

$$\Theta(L)z_t = \varepsilon_t \quad (1)$$

where $\Theta(L) = I - \Theta_1 L - \dots - \Theta_p L^p$; $\Theta(L)$ is a 2×2 lag polynomial with $L^k z_t = z_{t-k}$. The error vector ε_t is white noise with $E(\varepsilon_t) = 0$ and $E(\varepsilon_t \varepsilon_t') = \Sigma$ where Σ is positive definite. For ease of exposition, we neglect any deterministic terms in Equation 1.

Let $GG' = \Sigma^{-1}$ such that $E(\eta_t \eta_t') = I$ and $\eta_t = G\varepsilon_t$, G corresponds to the Cholesky decomposition of the lower triangular matrix. The Moving Average (MA) formulation of the system under the stationarity assumption is:

$$z_t = \Phi(L)\varepsilon_t = \begin{bmatrix} \Phi_{11}(L) & \Phi_{12}(L) \\ \Phi_{21}(L) & \Phi_{22}(L) \end{bmatrix} \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad (2)$$

$$= \Psi(L)\eta_t = \begin{bmatrix} \Psi_{11}(L) & \Psi_{12}(L) \\ \Psi_{21}(L) & \Psi_{22}(L) \end{bmatrix} \begin{bmatrix} \eta_{1t} \\ \eta_{2t} \end{bmatrix} \quad (3)$$

where $\Phi(L) = \Theta(L)^{-1}$ and $\Psi(L) = \Phi(L)G^{-1}$.

The spectral density of x_t is formulated as:

$$f_x(\omega) = \frac{1}{2\pi} \left\{ \left| \Psi_{11}(e^{-i\omega}) \right|^2 + \left| \Psi_{12}(e^{-i\omega}) \right|^2 \right\} \quad (4)$$

In light of Geweke (1982) the measure of causality is expressed as:

$$M_{y \rightarrow x}(\omega) = \log \left[\frac{2\pi f_x(\omega)}{\left| \Psi_{11}(e^{-i\omega}) \right|^2} \right] \quad (5)$$

$$= \log \left| 1 + \frac{\left| \Psi_{12}(e^{-i\omega}) \right|^2}{\left| \Psi_{11}(e^{-i\omega}) \right|^2} \right| \quad (6)$$

Equation 6 is zero if $\left| \Psi_{12}(e^{-i\omega}) \right|^2 = 0$ indicates that y does not cause Granger cause x at frequency ω .

Based on above equations, Breitung and Candelon (2006) reformulated the relationship between x and y in the VAR equation:

$$x_t = \alpha_1 x_{t-1} + \dots + \alpha_p x_{t-p} + \beta_1 y_t + \dots + \beta_p y_{t-p} + \varepsilon_t \quad (7)$$

The null hypothesis $M_{y \rightarrow x}(\omega) = 0$ corresponds to the linear restriction such that

$$H_0 : R(\omega)\beta = 0 \quad (8)$$

with $\beta = (\beta_1, \dots, \beta_p)'$ the vector of coefficients of y and

$$R(\omega) = \begin{bmatrix} \cos(\omega) \cos(2\omega) \dots \cos(p\omega) \\ \sin(\omega) \sin(2\omega) \dots \sin(p\omega) \end{bmatrix} \quad (9)$$

The Fisher statistic (F) for (8) is distributed as

$$\left\{ \begin{array}{l} F(2, T-2p) \text{ for } \omega \in (0, \pi) \\ \text{with:} \\ 2 \text{ the numbers of restriction} \\ T \text{ the number of observations in the VAR}(p) \end{array} \right.$$

On the other hand, the optimal lag order in VAR(p) Equation 1 is preferred for $p \geq 3$, because for $p = 1$ and $p = 2$, the F -statistic is constant for all frequencies x . This approach does not require to test unit root or cointegration among series. As claimed in Breitung and Candelon (2006) frequency domain causality test is robust to unit roots and cointegration properties for the VAR model augmented by $k (= 1)$ and the restrictions tested with a VAR($p+k$). Lemmens, Croux, and Dekimpe (2008) indicate that Bayesian Information Criterion (BIC) executes suitably in frequency domain causality test. Therefore, this study applies BIC for defining the optimal lag length p in the VAR model.

4. EMPIRICAL RESULTS

We determined empirically the causal direction between FDI and financial development via the frequency domain analysis at a high ($\omega=2,5$), a medium ($\omega=1,5$) and a low ($\omega=0,5$) frequency. These frequencies denote the permanent -, the intermediate-, and the temporary causality, respectively. For comparison, we also performed the time domain causality test in the spirit of Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996)¹.

Table 2 presents the frequency domain causality test results between FDI and LIAB as a proxy of financial development for each country. Following these results, it appears that there is both permanent and temporary bidirectional causality between FDI and LIAB for Burkina-Faso, Guinea and Nigeria. Additionally, there is permanent causality for Benin, Gambia and Mali, and temporary causality for Benin, Ghana and Guinea-Bissau from FDI to LIAB. The findings also suggested unidirectional causality from FDI to LIAB in the intermediate term for Benin, Ghana, Guinea, Mali and Nigeria. For the relationship going from LIAB to FDI, there was evidence of unidirectional permanent causality for Cabo Verde and Sierra Leone, and unidirectional causality in the medium term for Burkina-Faso, Cabo Verde, Guinea and Nigeria. In most of the cases, there was no link between these

¹ See Ciner (2011) for more details about this discussion.

variables. The time domain causality test estimates between *FDI* and *LIAB* in columns 3 and 4 of Table 2 corroborate² the findings in the frequency domain.

Table-2. Results of frequency domain Granger-causality test between *FDI* and financial development (with *LIAB* as indicator).

	Data range	Causality test results in the time domain		Causality test results in the frequency domain					
		FDI \rightarrow LIAB	LIAB \rightarrow FDI	FDI \rightarrow LIAB			LIAB \rightarrow FDI		
				Permanent $\omega=0,5$	Medium $\omega=0,5$	Temporary $\omega=2,5$	Permanent $\omega=0,5$	Medium $\omega=0,5$	Temporary $\omega=2,5$
Benin	1980-2016	7.3856*	2.5796	4.6884*	5.5912*	5.8649*	0.6899	1.3923	1.5243
Burkina-Faso	1980-2016	12.419***	20.559***	6.9925***	1.2664	4.9841*	11.2558***	11.6536**	9.2982***
Cabo Verde	1986-2016	1.9237	11.176**	1.3060	1.1004	0.7229	8.0628**	4.6032	3.8929
Côte d'Ivoire	1980-2016	2.5069	1.7862	1.7276	1.3633	0.7856	0.6147	0.3501	0.5579
Gambia	1980-2014	8.5966*	1.4691	6.2107**	0.3743	0.8194	0.8263	1.1346	1.1434
Ghana	1980-2016	9.3692**	11.091**	0.2507	7.4267*	6.4017**	2.6501	3.1184	3.7047
Guinea	1991-2016	7.6005*	34.742**	5.2179*	5.0030*	4.7071*	16.2514***	5.2195*	5.5670*
Guinea Bissau	1986-2016	8.6635**	2.2675	4.4680	0.8267	4.7127*	0.4268	0.9170	1.0684
Mali	1980-2016	11.311**	6.0278	8.9822**	3.1278	0.4699	3.8912	1.1789	1.5571
Niger	1980-2016	5.3299	0.54347	4.2006	0.7904	0.3446	0.3901	0.2676	0.2736
Nigeria	1980-2016	12.224**	11.545	8.2001**	4.6523*	6.5373**	5.7742*	6.5192**	4.8119*
Senegal	1980-2016	4.8191	5.1094	3.3344	2.7443	0.4671	4.0257	2.9338	2.7422
Sierra Leone	1980-2016	5.9245	6.7129*	3.5431	3.0893	4.3133	5.3306*	3.4700	3.0797
Togo	1980-2016	3.2275	1.5825	2.5068	1.2699	0.0521	1.0372	1.0827	0.9960

Notes: This table presents the Granger causality tests between *FDI* and *LIAB* variables. *** is for significance level of 1, ** for 5 and * for 10%.

Table 3 provides the causal nexus between *FDI* and *BANK* for each country. The findings provided evidence of a bidirectional causality at all frequencies in the case of Cote d'Ivoire and permanent bidirectional causality for Guinea. There was permanent causality for Cabo Verde, Guinea Bissau and Mali, and temporary as well as intermediate causality for Guinea for the relationship running from *FDI* to *BANK*. Our findings also suggested a one-way causal nexus from *FDI* inflows to *BANK* at all frequencies for Togo. On the other hand, there was no evidence in most cases³ of a causal link between *FDI* inflows and bank credit.

² There is existence of causal link in Ghana for the frequencies around 0.25.

³ There is existence of causal link in Ghana for the frequencies around 0.25.

Table-3. Results of frequency domain granger-causality test between FDI and financial development (with BANK as indicator).

	Data range	Causality test results in the time domain		Causality test results in the frequency domain					
		FDI \rightarrow BANK	BANK \rightarrow FDI	FDI \rightarrow BANK			BANK \rightarrow FDI		
				Permanent $\omega=0,5$	Medium $\omega=0,5$	Temporary $\omega=2,5$	Permanent $\omega=0,5$	Medium $\omega=0,5$	Temporary $\omega=2,5$
Benin	1980-2017	3.2171	3.5233	1.5520	0.1991	1.1687	1.1862	1.0597	1.3317
Burkina-Faso	1980-2017	5.5387	0.33256	4.5181	0.3687	0.1514	0.2580	0.0532	0.0213
Cabo Verde	1986-2017	8.8285*	1.625	5.8526*	2.7997	4.2439	0.7774	0.2716	0.3110
Côte d'Ivoire	1980-2017	20.185***	40.272***	16.3828***	9.4538***	9.8112***	23.6606***	7.3487**	7.0944**
Gambia	1980-2017	1.6003	2.0264	0.9116	0.0465	0.3102	1.4704	0.1384	0.1117
Ghana	1980-2017	2.4507	7.8804	0.2173	1.9938	1.8245	4.2361	1.8279	2.6324
Guinea	1989-2017	27.192***	6.6846*	17.2103***	17.2285***	12.6009***	4.8834*	3.4161	3.4818
Guinea Bissau	1990-2017	10.366**	1.4778	6.7872**	0.5178	3.2229	1.0449	0.9149	0.8597
Mali	1980-2017	15.805***	3.1363	12.0385***	2.0223	0.9463	0.6126	2.4828	2.2268
Niger	1980-2017	4.4114	3.032	3.5668	0.5906	0.2195	2.4733	1.3662	1.2277
Nigeria	1980-2017	2.162	4.4268	0.2506	1.6894	1.5739	2.4016	1.5416	1.9805
Senegal	1980-2017	3.4375	1.6787	2.7370	0.5002	0.1816	1.3686	0.7764	0.7042
Sierra Leone	1980-2017	4.0556	1.9454	3.2921	1.0208	0.5875	1.4823	1.5012	1.5410
Togo	1980-2017	33.823***	1.6052	26.4481***	15.3442***	7.8590**	0.2975	0.4354	0.7688

Notes: This table presents the Granger causality tests between FDI and BANK variables.

*** is for significance level of 1, ** for 5 and * for 10%.

According to the results provided in Table 2 and Table 3, it appears that the causal link between financial development and FDI is sensitive to different proxies employed as indicator of financial development and then findings concerning causality can differ if one modify the proxy of the financial development.

To summarize, our empirical findings supported earlier work on the causal nexus FDI-financial development. The unidirectional causal results from FDI to financial development were consistent with Abzari, Zarei, and Esfahani (2011) and Agbloyor et al. (2013) but the causality running from financial development to FDI were consistent with Desbordes and Wei (2017) and Yilmaz and Gavriletea (2018). Our bidirectional causality findings were also consistent with Gebrehiwot et al. (2016); Fauzel (2016) and Otchere et al. (2016).

5. FINAL REMARKS

This paper studied the causality between FDI inflows and financial development in a country-by-country time-series framework for ECOWAS. The frequency domain test developed by Breitung and Candelon (2006) assesses the direction of causality at a given frequency. Frequency domain method allows decomposing in time-periods and shows the causality in different time frequencies.

Two different variables were chosen as indicators of financial development and the empirical findings indicated that the causality results may change depending on the measure of financial development employed. The findings suggested that the causality between financial development and FDI was mixed across different frequencies (i.e. in terms of permanent, medium or temporary causality).

Overall, country-by-country estimates revealed evidence of (i) unidirectional causality, (ii) bidirectional causality and (iii) absence of causality between variables. These empirical findings lead to varied policy designs.

First, for the causality from FDI to finance, we suggest implementing more FDI-attracting policies to enhance financial development. Second, for the causality from financial development to FDI, we suggest implementing strategies that improve the level of the financial sector which will be beneficial for FDI flows to West Africa. Thirdly, for the two-way causality, the joint policies of financial reforms and investment-promoting policies for FDI can have a significant effect on the economic development of ECOWAS countries. In addition, policymakers should not only address the causal direction between FDI inflows and financial development but also whether it is temporal or permanent and therefore authorities must define measures to be taken accordingly.

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