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Foreign direct investment and economic growth causal-nexus in economic community of West African States: Evidence from spectral causality

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Abstract: The paper examines the causal relationship between FDI and economic growth (GDP) in thirteen ECOWAS countries using both time domain and frequency domain testing procedures using annual data from 1970 to 2015. The results showed that time domain is not adequate in detecting causality. The time domain detected causality in only four out of thirteen countries whilst the frequency domain detected causality at different frequencies and cycles in nine out of thirteen countries. The findings of this study indicate the importance of frequency domain causality, that it decomposes causality at different frequencies and subsequently detects causality at certain cycles lengths. The general observation that economic growth leads FDI calls for ECOWAS leaders to rethink about painful sacrifices they make to attract FDI into the region.

JEL Classifications: E22, F21, F43

Keywords: Frequency domain, spectral causality, time domain, FDI, economic growth
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1. Introduction

The increase in global economic integration and internationalization over the past decades have resulted in growth in international trade and foreign investment flows, mostly direct investment albeit unevenly distributed in term of location and sectors. These have led to some countries and sectors become better integrated with the global economy, with rising volumes of both inward and outward Foreign Direct Investment (FDI) flows alongside growing cross-border transactions. Notwithstanding, some countries and sector are yet to see these ripple effects of the global integration. What drives FDI flow is central to a policy decision to deal with volumes of capital flow and its associated imbalances.

The contentious debate in literature is about the cost and benefits of FDI inflow. In spite of the belief that FDI could have a deteriorating effect on the balance of payment due to profit repatriation and negative impact on competition in the domestic market, there seems to be a consensus pointing to a positive association between FDI and growth. There are theoretical and empirical positions that emphasize the benefit of flow of FDI to the host economies. These benefits include the provision of capital, creations of jobs, transfer of technological development to local firms, which improves the productivity of host countries and stimulate economic growth. It should be noted that these benefits are releasable when the host country has reached a minimum level of development in education, technology, economic stability, liberalized markets and infrastructure (Bengoa & Sanchez-Robles, 2003; Hansen & Rand, 2006; Singh, 2016). For example, endogenous growth models by Romer (1986; 1987); Lucas (1988; 1990); Mankiw, Romer, & Weil (1992) suggest that FDI significantly influence human capital development in terms of

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managerial skills and research & development that ultimately enables long-term economic growth. However, the dependency theory, espoused by Stoneman (1975); Bornschier (1980) and O' Hearn (1990), argues that FDI inflows in the long-run negatively impact on growth due to exploitation by worthy nations through extraction of labour and resources from developing nations without adequate compensation. The Neo-classical Growth Model by Solow (1956); Ramirez (200); Ram & Zhang (2002) advocates compromising position between the Endogenous Growth Models and Dependency School Theory to posit that FDI flow has an insignificant effect on growth in the long-run. The empirical literature is as well inclusive on the FDI-Growth relation but the researchers continue to proffer the potential benefits of FDI flows to host countries (see Asiedu, 2012; Akinlo,2004); Hansen & Rand, 2006; Temiz & Gokmen, 2014; Flora & Agrawal, 2017;, Biørn, & Han, 2017)

The importance of FDI inflow to ECOWAS stems from the inadequate capital resource, poverty and quest to promote export (Alege & Ogundipe, 2013). Empirically, the relationship between FDI and growth in West Africa, either single country or group of countries, have been investigated (see Akinlo, 2004; Alege & Ogundipe, 2013; Adamu & Oriakhi, 2013; Ajide, Adeniyi, & Raheem, 2014; Adeleke, 2014; Ajide & Osode, 2017). The findings on FDI-economic growth nexus is mixed and inconclusive. While Adamu & Oriakhi (2013) and Adeleke (2014) observed that FDI inflow to West Africa affects growth, Alege & Ogundipe (2013) and Ajide & Osode (2017) found an insignificant relationship. These studies employed a static model which could subsume the structural stability of the relationships (Adam, Agyapong, & Gyamfi, 2010). This study employs a causality testing procedure in the frequency domain to analyse the relationship between FDI and economic growth in ECOWAS. This improves the time domain estimates which do not decompose causality at different horizon or frequencies. Such estimates cannot distinguish between short and long-run causalities (Aye, Gadinabokao, & Gupta, 2017). The uniqueness of the study hinges on the application of spectral causality to FDI-Economic Growth nexus in ECOWAS to reveal the dynamics of causality between FDI and economic growth.

The rest of the paper is structured as follows: the next section discusses the methodology, the third section presents the data, result and discussions, while the final section concludes.

2. Methodology

The frequency domain Granger Causality Test developed by Breitung & Candelon (2006) was employed. The test is presented in a bivariate Vector Autorepression (VAR) model of a time series $z_t = [x_t, y_t]'$ observed at time $t = 1,\ldots,T,$ with a vector representation of the form:

$$\Theta(L)z_t = \mu_t, \qquad t = 1, 2, \ldots, \tag{1}$$

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Where $\Theta(L) = \mathrm{I} - \Theta_1 L - ... - \Theta L^p$ is a $2 \mathrm{X} 2$ vector with L as the lag operator such that $L^q z_t = z_{t-q}$. The error vector u_t is assumed to be white noise with mean zero and covariance matrix $E(\mu_t \mu_t^{'}) = \Sigma$ defined positive. Given that the VAR process may include a constant, trend, or dummy variables, Σ is then decomposed as $G'G = \Sigma^{-1}$ with G being the inferior triangular matrix of the Cholesky decomposition. With the assumption that the system is stable, the moving average(MA) representation is

$$z_t = \Phi(L)\mu_t = \begin{pmatrix} \varphi_{11}(L) & \varphi_{12}(L) \\ \varphi_{21}(L) & \varphi_{22}(L) \end{pmatrix} \begin{pmatrix} \mu_{1t} \\ \mu_{2t} \end{pmatrix} = \begin{pmatrix} \psi_{11}(L) & \psi_{12}(L) \\ \psi_{21}(L) & \psi_{22}(L) \end{pmatrix} \begin{pmatrix} \eta_{1t} \\ \eta_{2t} \end{pmatrix} = \Psi(L)\eta_t \quad (2)$$

Where $\Psi(L) = \Phi(L)G^{-1}$. According to Wei (1994), the spectral density of X_t is given by

$$f_x(\omega) = \frac{1}{2\pi}\left[\left|\psi_{11}(e^{-i\omega})\right|^2 + \left|\psi_{12}(e^{-i\omega})\right|^2 \right] \quad (3)$$

where ω is the angular frequency.

The hypothesis that y_t does not cause x_t in the Granger sense at frequency ω can be proved by

$$M_{y \to x}(\omega) = \log\left[1 + \frac{\left|\psi_{12}(e^{-i\omega})\right|^2}{\left|\psi_{11}(e^{-i\omega})\right|^2} \right] \quad (4)$$

Equation (4) is zero if $\left|\psi_{12}(e^{-i\omega})\right|^2 = 0,$ which implies that y_t does not Granger cause x_t at frequency ω and $\left|\psi_{12}(e^{-i\omega})\right|^2$ is defined as per Geweke (1982) and Hosya (1991) as $2\pi f_x(\omega)$. We then write the null hypothesis that y_t does not Granger cause x_t at frequency ω as $M_{y \to x}(\omega) = 0$

The statistic is obtained by replacing $\left|\psi_{11}(e^{-i\omega})\right|$ and $\left|\psi_{12}(e^{-i\omega})\right|$ in equation (4) by the estimated values obtained from fitted VAR.

3. Data and empirical findings

Annual data on net FDI inflows (Million USD) and GDP (Million USD) covering the period from 1970-2015 are used. The sample countries for the analysis are 13 ECOWAS nations: Benin, Burkina Faso, Cote d'Ivoire, The Gambia, Ghana, Guinea, Guinea Bissau, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. Cape Verde and Liberia were

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excluded due to data availability. The data series on FDI inflow and GDP were compiled from World Development Indicators published by World Bank. We conducted two different unit root test to assess the stationarity properties prior to the investigation of causality between the two variables. The two unit roots test conducted are Augmented Dickey-Fuller test (ADF) and the Phillips Perron test (PP) for the case of intercept, and intercept and trend. The overall conclusion is that there is strong evidence for the presence of unit root at 5% significance level for all the level series of FDI and GDP for the 13 countries included in the study and that all the variable are I(1). The unit root test for ADF and PP for the case of intercept, and intercept and trend are available upon request.

The presence or otherwise of cointegration was investigated with Autoregressive Distributed Lag (ARDL) cointegration approach by Pesaran, Shin, & Smith, (2001). The choice of ARDL model is due to its ability to handle low-frequency data and small sample size. Results presented in Table 1identified cointegration between FDI and Economic Growth, that is, economic growth on FDI in Benin and Togo whereas FDI on economic growth in Guinea Bissau, Sierra Leone and Togo. These are an indication of the long-run relationship between FDI and Growth. Next, the causal relationship between economic growth and FDI investigated for all the thirteen countries included in the study. Toda-Yamamoto Granger non-causality test was employed to test causality in the time domain and the results presented in Table 1. Consistent with the cointegration tests, the results detected unidirectional causality for three countries (Benin, Guinea Bissau and Sierra Leone) and bidirectional for the case of Togo. The causalities run from economic growth to FDI in Benin whilst in Guinea Bissau and Sierra Leone, it runs from FDI to economic growth at 5% significance level.

TABLE 1. ARDL COINTEGRATION AND TIME DOMAIN CAUSALITY

		ARDL COINTEGRATION			TODA-YAMAMOTO GRANGER NO-CAUSALITY			
Country	Dependent Variable	ARDL Model	F-Stat	Cointegrated	Null Hypothesis	MWALD	P-Val.	Causality
Benin	$F_{FDI}(FDI\backslash GDP)$	(3,0)	6.329	Yes	$GDP \rightarrow FDI$	14.942	0.001	Yes
	$F_{GDP}(GDP\backslash FDI)$	(1,0)	2.765	No	$FDI \rightarrow GDP$	1.275	0.735	NO
Burkina Faso	$F_{FDI}(FDI\backslash GDP)$	(3,3)	1.035	NO	$GDP \rightarrow FDI$	0.671	0.412	NO
	$F_{GDP}(GDP\backslash FDI)$	(1,0)	2.202	NO	$FDI \rightarrow GDP$	0.616	0.803	NO
Cote d'Ivoire	$F_{FDI}(FDI\backslash GDP)$	(1,1)	3.433	No	$GDP \rightarrow FDI$	0.706	0.400	NO
	$F_{GDP}(GDP\backslash FDI)$	(2,0)	3.688	NO	$FDI \rightarrow GDP$	0.516	0.472	NO
Gambia	$F_{FDI}(FDI\backslash GDP)$	(3,3)	4.116	No	$GDP \rightarrow FDI$	1.393	0.235	NO
	$F_{GDP}(GDP\backslash FDI)$	(3,3)	3.904	NO	$FDI \rightarrow GDP$	1.094	0.206	NO
Guinea	$F_{FDI}(FDI\backslash GDP)$	(1,4)	1.579	No	$GDP \rightarrow FDI$	0.625	0.429	NO
Bissau	$F_{GDP}(GDP\backslash FDI)$	(4,1)	5.587	Yes	$FDI \rightarrow GDP$	8.266	0.004	Yes
Guinea	$F_{FDI}(FDI\backslash GDP)$	(4,1)	1.642	No	$GDP \rightarrow FDI$	0.254	0.614	NO
	$F_{GDP}(GDP\backslash FDI)$	(4,1)	1.952	No	$FDI \rightarrow GDP$	0.635	0.801	NO
Ghana	$F_{FDI}(FDI\backslash GDP)$	(1,0)	3.229	No	$GDP \rightarrow FDI$	0.007	0.935	NO
	$F_{GDP}(GDP\backslash FDI)$	(1,0)	1.968	No	$FDI \rightarrow GDP$	2.445	0.120	NO
Mali	$F_{FDI}(FDI\backslash GDP)$	(1,0)	1.185	No	$GDP \rightarrow FDI$	0.263	0.609	NO
	$F_{GDP}(GDP\backslash FDI)$	(3,0)	2.674	No	$FDI \rightarrow GDP$	0.000	0.997	NO
Niger	$F_{FDI}(FDI\backslash GDP)$	(1,0)	4.032	NO	$GDP \rightarrow FDI$	0.031	0.860	NO
	$F_{GDP}(GDP\backslash FDI)$	(2,1)	3.932	No	$FDI \rightarrow GDP$	1.049	0.306	NO
Nigeria	$F_{FDI}(FDI\backslash GDP)$	(2,0)	1.185	No	$GDP \rightarrow FDI$	2.264	0.324	NO
	$F_{GDP}(GDP\backslash FDI)$	(3,0)	1.378	No	$FDI \rightarrow GDP$	0.009	0.996	NO
Senegal	$F_{FDI}(FDI\backslash GDP)$	(2,0)	3.552	No	$GDP \rightarrow FDI$	0.214	0.643	NO
	$F_{GDP}(GDP\backslash FDI)$	(1,2)	2.695	No	$FDI \rightarrow GDP$	0.632	0.547	NO
Sierra Leone	$F_{FDI}(FDI\backslash GDP)$	(3,4)	2.217	No	$GDP \rightarrow FDI$	1.676	0.196	NO
	$F_{GDP}(GDP\backslash FDI)$	(3,1)	7.51	Yes	$FDI \rightarrow GDP$	5.465	0.019	Yes

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TABLE 1. ARDL COINTEGRATION AND TIME DOMAIN CAUSALITY

	ARDL COINTEGRATION				TODA-YAMAMOTO GRANGER NO-CAUSALITY			
Togo	$F_{FDI}(FDI\backslash GDP)$	(2,1)	5.766	Yes	$GDP \rightarrow FDI$	6.775	0.009	Yes
	$F_{GDP}(GDP\backslash FDI)$	(2,4)	6.268	Yes	$FDI \rightarrow GDP$	4.475	0.034	Yes

TABLE 2. FREQUENCIES AND CYCLES OF YEARS CAUSALITY WERE DETECTED

COUNTRY	DEPENDENT VARIABLE	OMEGA	CYCLES OF T YEARS
Benin	$F_{FDI}(FDI\backslash GDP)$	0.96-1.64, 2.19-2.46	3.8-6.5,2.6-2.9
	$F_{GDP}(GDP\backslash FDI)$	<0.41, 0-1.09,102-1.28, 2.05-2.73	<15.3, 5.8-9.2,4.9-5.1, 2.3-3.1
Burkina Faso	$F_{FDI}(FDI\backslash GDP)$	-	-
	$F_{GDP}(GDP\backslash FDI)$	-	-
Cote d'Ivoire	$F_{FDI}(FDI\backslash GDP)$	-	-
	$F_{GDP}(GDP\backslash FDI)$	<0.38	Above 16.5
Gambia	$F_{FDI}(FDI\backslash GDP)$	-	-
	$F_{GDP}(GDP\backslash FDI)$	-	-
Guinea Bissau	$F_{FDI}(FDI\backslash GDP)$	-	-
	$F_{GDP}(GDP\backslash FDI)$	<0.92	Above 6.83
Guinea	$F_{FDI}(FDI\backslash GDP)$	0.44-0.58	10.83-14.28
	$F_{GDP}(GDP\backslash FDI)$	-	-
Ghana	$F_{FDI}(FDI\backslash GDP)$	0.68-0.71, 1.64-1.78, 2.04-2.65	8.9-9.2,3.5-3.8, 2.4-3.1
	$F_{GDP}(GDP\backslash FDI)$	-	-
Mali	$F_{FDI}(FDI\backslash GDP)$	>2.79	Below 2.2
	$F_{GDP}(GDP\backslash FDI)$	-	-
Niger	$F_{FDI}(FDI\backslash GDP)$	-	-
	$F_{GDP}(GDP\backslash FDI)$	-	-
Nigeria	$F_{FDI}(FDI\backslash GDP)$	1.12-1.68, >2.79	3.7-5.6, Below 2.3
	$F_{GDP}(GDP\backslash FDI)$	-	-
Senegal	$F_{FDI}(FDI\backslash GDP)$	-	-
	$F_{GDP}(GDP\backslash FDI)$	-	-
Sierra Leone	$F_{FDI}(FDI\backslash GDP)$	<0.68	Above 9.24
	$F_{GDP}(GDP\backslash FDI)$	All	All
Togo	$F_{FDI}(FDI\backslash GDP)$	<1.23, >1.37	Below 4.6 and Above 5.1
	$F_{GDP}(GDP\backslash FDI)$	1.09-1.78	3.5-5.8

Source: Author Estimates.

Note: Omega reports frequencies at which causalities were detected. Cycles of T year indicate frequencies of length at which causalities recorded.

Next, Breitung & Candelon (2006) procedure was followed to test causality between FDI and economic growth in the frequency domain. The procedure disintegrations the causality to allow the analysis at different frequencies. Figures 1 and 2 show the results of the frequency domain causality. The test statistics are represented by the solid line along with their 5% critical values in the form of a broken line for all frequencies in the interval (0,π). Following Aye, Gadinabokao, & Gupta (2016), the frequency, Omega (ω), is converted into a cycle or periodicity of T years as $T = \frac{2\pi}{\omega}$. The results from figures 1 and 2 show that there is causality between economic growth and FDI at different frequencies, ω, which correspond to different cycles of T years in nine out of thirteen countries. For example, time domain failed to reject null hypothesis of no-causality in either unidirectional or bidirectional causality between economic growth and FDI for Cote

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d'Ivoire, Guinea, Ghana, Mali and Nigeria, this contrasts with the causality in frequency domain at short and long cycle lengths (see Table 2 at appendix for frequencies and cycle at which causalities were detected). This finding explains the contradictory findings in the literature. A cursory look at figures 1 and 2 show that with the exception of Sierra Leone in which FDI Granger cause economic growth at all frequencies and cycle, the relationship between FDI and economic growth varied with frequency/cycles. The findings of this study reiterate the importance of frequency domain causality, that it decomposes causality at different frequencies and cycles.

On the causal link between economic growth and FDI, the findings indicate that in most case, the causality run from economic growth to FDI. A suggestion that economic growth in ECOWAS lead FDI. This collaborates Ajide & Raheem (2016) that FDI strives in a developed institution which is part component of economic growth. The findings, however, contradict conventional growth model of Solow (Solow, 1956) postulation that investment contributes to the economic growth and more especially recent study by Sothan (2017) which observed the stronger impact of FDI on economic growth for Cambodia. In West Africa, most FDI inflows go into extractive industries and as noted by Akinlo (2004), FDI to extractive industry do no enhance economic growth compared to the manufacturing sector. This brings to the fore the need to be cautious of the sacrifices made by ECOWAS leaders in lieu of FDI.

FIGURE 1. FREQUENCY DOMAIN CAUSALITY RUNNING FROM ECONOMIC GROWTH (GDP) TO FDI

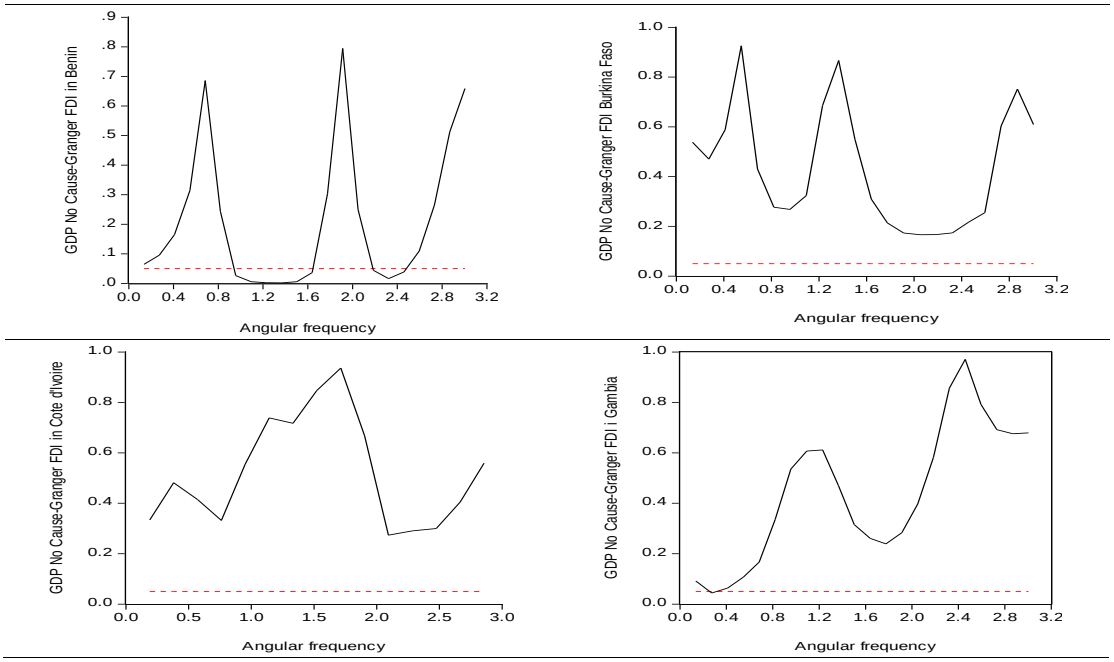

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FIGURE 1. FREQUENCY DOMAIN CAUSALITY RUNNING FROM ECONOMIC GROWTH (GDP) TO FDI

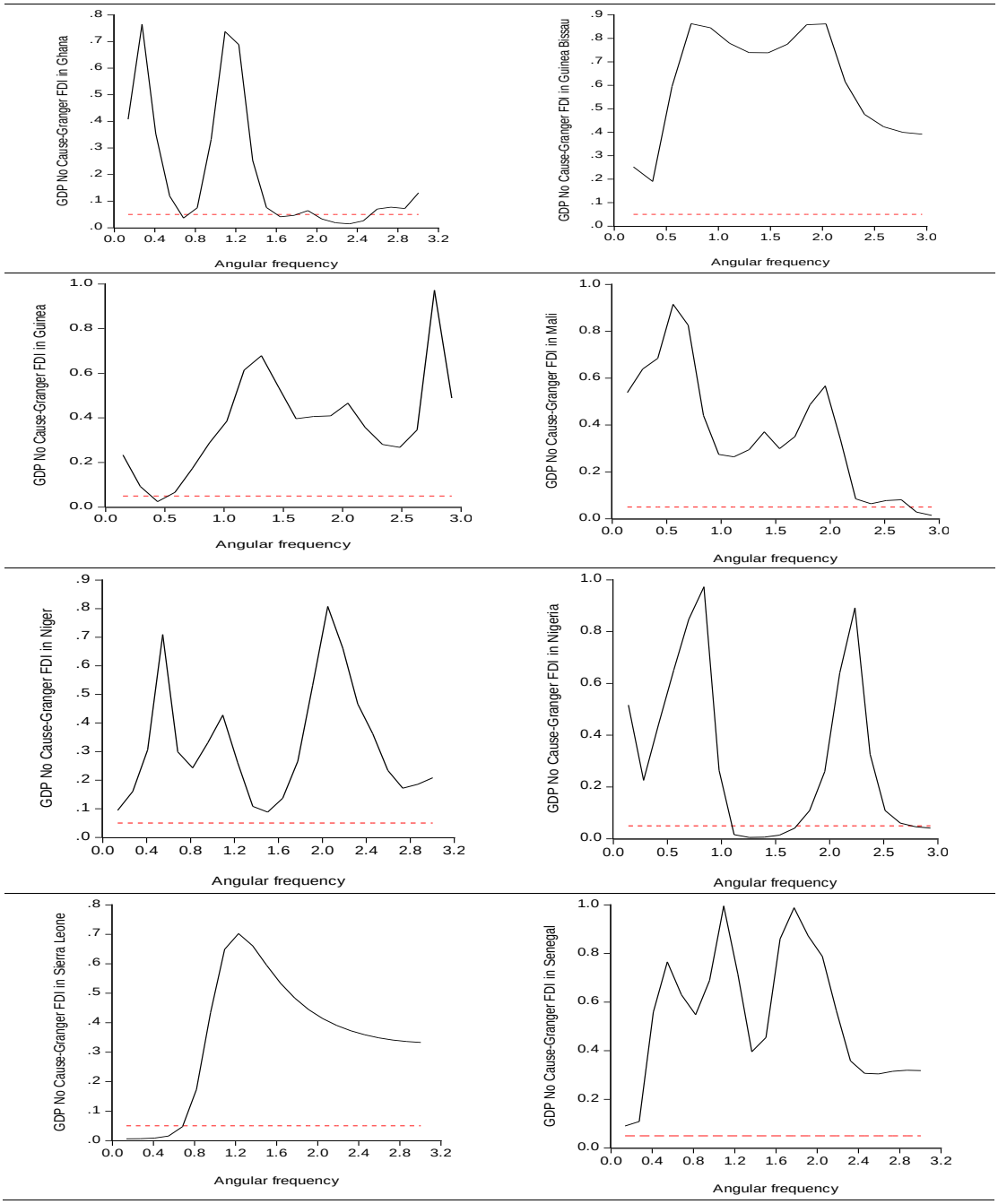

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FIGURE 1. FREQUENCY DOMAIN CAUSALITY RUNNING FROM ECONOMIC GROWTH (GDP) TO FDI

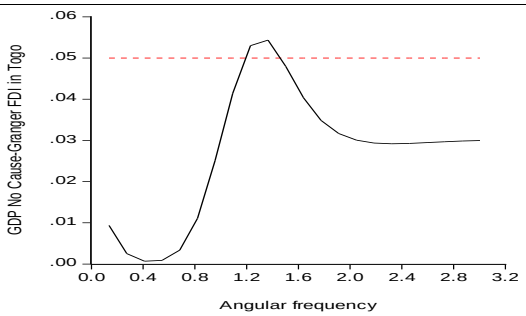
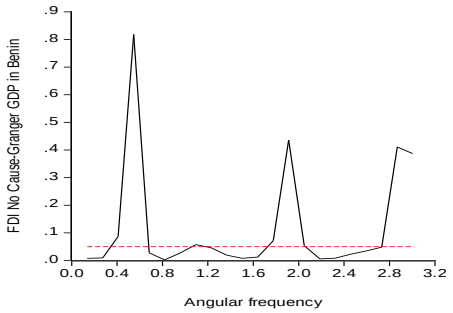
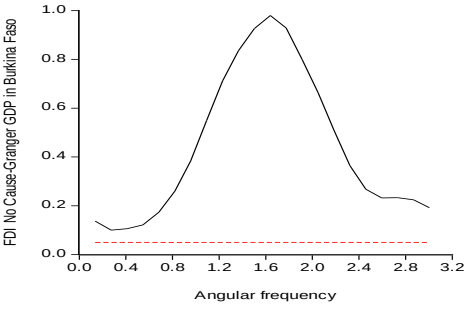
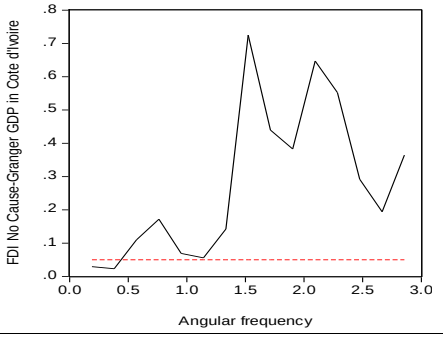
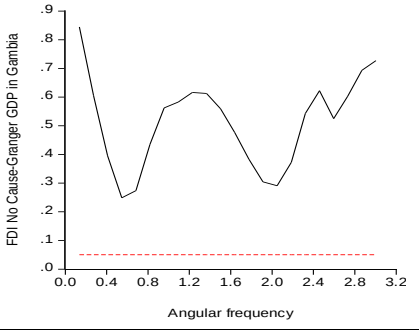


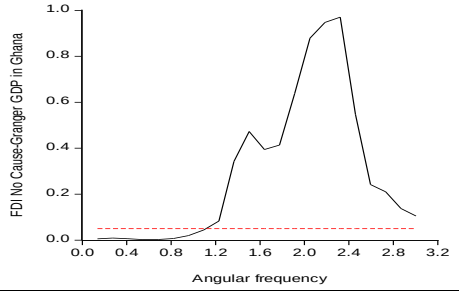
FIGURE 2. FREQUENCY DOMAIN CAUSALITY RUNNING FROM FDI TO ECONOMIC GROWTH (GDP)











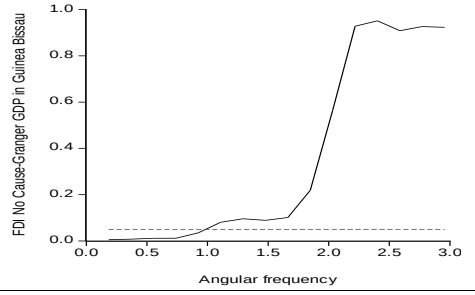


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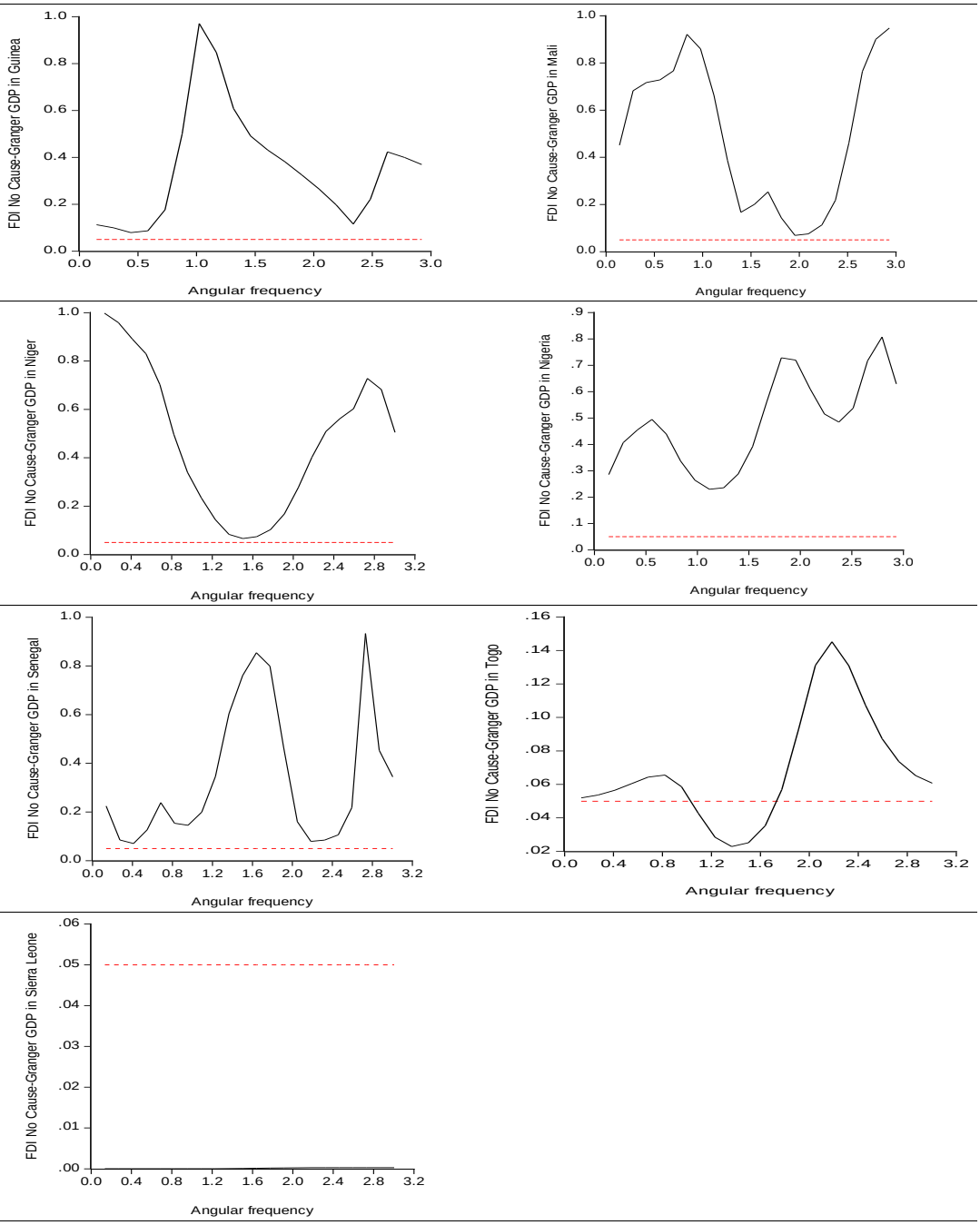
FIGURE 2. FREQUENCY DOMAIN CAUSALITY RUNNING FROM FDI TO ECONOMIC GROWTH (GDP)



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4. Conclusion

This paper investigates the causal relationship between FDI and economic growth in thirteen developing economies: Benin, Burkina Faso, Cote d'Ivoire, The Gambia, Ghana, Guinea, Guinea Bissau, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. Cape Verde and Liberia were excluded due to data availability. The time domain tests, ARDL and Toda-Yamamoto Granger no-causality fail to reject the null hypothesis of no-causality for all except unidirectional causality for three countries (Benin, Guinea Bissau and Sierra Leone) and bidirectional for the case of Togo.

The results for the frequency domain causality test found causality in either unidirectional or bidirectional causality between economic growth and FDI for Cote d'Ivoire, Guinea, Ghana, Mali and Nigeria in the frequency domain at short and long cycle lengths. The findings of this study indicate the importance of frequency domain causality, that it decomposes causality at different frequencies and subsequently detect causality at certain cycles lengths. The general observation that economic growth leads FDI call for ECOWAS leaders to rethink about painful sacrifices they make to attract FDI into the region such as the giving up of sovereignty and tax incentives.

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