CENTRALITY EFFECTS IN THE FINANCE-GROWTH NEXUS: PANEL DATA EVIDENCE FROM EASTERN AND SOUTHERN AFRICAN COUNTRIES

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ABSTRACT

This study examines the moderating effect of spatial centrality (in trade) on the relationship between Financial Sector Development (FSD) and Gross Domestic Product (GDP) growth in Southern and Eastern African countries based on panel Error Correction Models (ECM) and a Panel Smooth Transition Regression (PSTR) model where centrality is used as a regime-switching variable. Data covering 1980 to 2022 were obtained from the World Development Indicators (WDI) and Comité Européen d'Etudes des Polyphosphates (CEPII). The centrality regime switching effect is found to be statistically significant, with the finance-growth nexus being negative via both broad money and credit to the private sector in center countries and positive via credit to the private sector in the periphery, an observation that supports the Convergent Growth Hypothesis (CGH) that countries in the periphery are catching up to Centers in terms of GDP growth. This long-run behavior is strongly endorsed by gross fixed capital formation, which has a long-run effect on GDP growth but is rarely supported by openness and working population, whose effect is country-specific. This study adds Geography and FSD as key explanatory variables of the local CGH, where periphery countries tend to catch up to relatively developed center countries within their respective regions.

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1. BACKGROUND

The finance-growth causal effect is still debatable in most Sub-Saharan African (SSA) countries alongside four schools of thought, all supported by empirics (McHardy, 2022). The "demand following hypothesis" (DFH) suggests a positive causality generally running from growth to FSD (Bara and Mudzingiri, 2016; Zerbo, 2015). The DFH is supported by the fact that growth in most African countries has been driven by commodities and natural resources (AfDB, 2013). Similarly, The DFH is most likely where financial sectors have limited depth and efficiency and countries experiencing high levels of financial exclusion (Bara, Mugano, and Pierre, 2016). The "supply-leading hypothesis" (SLH), also called the "finance-led growth hypothesis", postulates that FSD drives economic growth. This view finds support in Odhiambo (2009), Akinlo and Egbetunde (2010), and Arayssi and Fakih (2017). The "bidirectional causality hypothesis" (BCH), also called the "feedback hypothesis" ascribes equal importance to both the FSD and growth since it assumes a positive two-way causal relationship between FSD and economic growth as supported in Odhiambo (2011), Arayssi and Fakih (2017), Waiyaki (2016) and Urgaia (2016). The "neutrality view", which ascribes no significant causal relationship between FSD and economic growth, is also well supported by empirics (Shan and Morris, 2002; Shan, Morris, and Sun, 2001; Graff, 1999; Lucas, 1988).

The idea that the geography of a country determines economic growth (the geography thesis) was initially propounded by Montesquieu (1748). It is based on areas in the world not being equally endowed in terms of geographic attributes such as soil quality, natural resources, topography, climate, and disease environment (Acemoglu, 2009; Escobal D 'Angelo and Torero Cullen, 2000). Geographical location may affect finance-growth nexuses by influencing goods flow and production factors. Geographic areas can be distinguished by physical localities (Operational distances) and functional spaces between any two localities, i.e., countries (Papi et al., 2017). Thus, the rise in the international flow of goods can be attributed to a decline in distance-weighted transportation costs (Bosker and Garretsen, 2021; Hummels, 2007). This geo-divide suggests that trading localities (firm within a country or across countries) may either be far away from their markets (centers) or their sources of raw materials (periphery).

The center-periphery divide can exist within a country in specific financial sectors such as banking (Papi et al., 2017) or across countries when comparing countries in specific geographic localities such as the European Union (Hinz, 2012; Boulhol and de Serres, 2008), ECOWAS (Sissoko, Sloboda, and Kone, 2018; Mahawiya, 2015) or EAC[1] and SADC[2] regions (Alananga and Mutasa, 2021; Bara, Mugano, and Le Roux, 2017). Transport cost problems, however, are well known to be more serious in periphery African countries than in Centers, mainly in Europe or the USA (Bloom et al., 1998). Redding and Venables (2004) relate wages and proximity to demand and supplier markets and explain a large part of the variation in GDP using geographic variables. Nearby countries, for example, tend to have stronger economies if the costs of doing business between them are eliminated (Bloom, Sachs, Collier, and Udry, 1998). Frankel and Romer (1999) find evidence of a positive relationship between per capita income and exogenous variation in the ratio of trade to GDP due to geographical variations.

Clark et al. (2004) provide additional evidence that developing countries have relatively higher intra-trade costs of 8% compared to their developed counterparts who potentially benefit from trading not only with closer partners but also relatively centrally located trading partners. In examining both foreign and real market potential as a measure of trade centrality, Head and Mayer (2011) observed a significant impact of market potential on income per capita. Similarly, Boulhol et al. (2008) suggest that the benefit of being a centrally located country is around 6-7% of GDP growth. Regarding market potential, Boulhol et al. (2008) estimate the effect of market access variable to be around 0.06-0.07. The variation identified this access effect, though Hinz (2012) notes that the market access explains between 27%-30% of the variation of GDP, and the result is dynamic since periphery countries with lower initial market access tend to improve relatively faster than those located closer to the Center. Similarly, the centrality of South Africa was observed to attract FSD in nearby SADC countries, and the effect of money was stronger than credit (Bara et al., 2017).

Contrary to the geography thesis, empirics suggest that geographic variables and GDP have a narrow relationship, often changing with circumstances (Bhupatiraju and Verspagen, 2013). Nakajima et al., (2010) allude to the lack of significant evidence of the centrality effect over time. Hinlo and Arranguez (2017) note an insignificant relationship between economic growth and centrality. In

both the Philippines and Singapore, however, GDP growth and economic centrality cause each other over time, while a unidirectional connection between economic concentration and GDP was noted in the Philippines only. The conclusion from Hinlo and Arranguez (2017) suggests that diffusion of amenities, or a part of central functions or current innovations toward the periphery, may happen. Still, it rarely results in a total reduction of inequalities between center and periphery regions. Although centrality provides positive growth prospects, there are potential negative consequences for proximal countries with trading constraints, specifically those lacking free trade agreements with the Center (Gambuli, 2023; Alananga and Mutasa, 2022). It is against these contra observations that this study was backgrounded.

Following the introduction and background, we will present the theoretical underpinnings of centrality in section 2, followed by the conceptual framework in section 3, the methodology in section 4, the findings in section 5, and the conclusion in section 6.

2. THEORETICAL UNDERPINNINGS ON CENTRALITY

Recent studies on the finance-growth nexus are numerous (Odhiambo, 2023; Wen et al., 2021; Aluko and Ibrahim, 2020; An et al., 2020) but the moderation possibly provided through the Center-periphery divide is still understudied. The Heckscher-Ohlin trade theorem suggests that factor endowment is at the core of trade, leading to world factor price equalization under an open economy (Guo, 2015). Perroux's (1977) polarization theory suggests that geographic spaces are separated between Pole and Dominated regions. The basic notions arise in what is referred to as the pathological complexes or complexes related to the limitation imposed by limited space within a bordered area which in the traditional Heckscher-Ohlin trade theorem can be regarded in terms of factor endowments (Bilas and Bošnjak, 2015). The central place theory (CPT) suggests that space produced by human communities is oriented (anisotropic). Places selected as centers are associated with social, symbolic and economic value, thus making them attractive to flows of persons, energy, material, information, and finance from the periphery. The convergence of people and other resources toward the center is called polarization, and the property that centers have to offer several services to their periphery is called centrality. Based on the CPT, the further a region is located from the center of economic

activities, i.e., London and Brussels, the lower is its market access (Hinz, 2012).

Similarly, the traditional gravity equations model bilateral trade flows as a function of income and a vector of distance variables to capture geographical distances. The Krugeman-type economic geography models have also been implemented to explain the relationship between the factor income levels in a country (wages if labor is the only factor) and the weighted sum of expenditures of all countries in the world in what has been referred to as Market Access (MA) or Market Potential or Real Market Potential (RMP) (Head and Mayer, 2011). The weights are bilateral trade costs from one country to each destination country for its exports, which measures trade centrality.

3. CONCEPTUAL FRAMEWORK

Based on the foregoing, centrality in economic activities is shaped by at least three significant forces. The first is the "product market competition effect" whereby workers (working population) migrate from one region to another thus enhancing competition in the latter (Ascani et al.,2012). The second is the "home market effect" which implies that the region with the larger market (Center) for a specific product is a net exporter (Krugman, 1991). Lastly, the "price index effect" implies that a larger share of workers in one region determines lower prices for industrial products in the local market (Ascani et al., 2012). Figure 1 suggests that expanded FSD can cause GDP growth for countries in the Center because they engage themselves in skill-intensive manufacturing and will reverse in the periphery as they engage themselves in less skill intensive production. Given the higher developmental prospects of Center countries, a positive FSD-growth nexus is expected to be stronger in the Center than the periphery.

Empirical observations on the above postulates suggest that growth tends to be higher in center countries because first returns to physical and human capital tend to be higher in countries having better access to larger markets (Redding and Schott, 2003); Center countries have higher opportunity to concentrate finances in activities of comparative advantage which also encourages specialization of firms Boulhol et al.,2008); localized industries (Nakajima et al., 2010); and other transport saving advantages (Clark, Dollar, and Micco, 2004). These observations point to an

important role of market access for exports and it is hypothesized as follows.

H1:   Center countries have a significantly higher FSD-growth effect than periphery countries

FIGURE 1
Spatial Centrality in the Finance-Growth Nexus
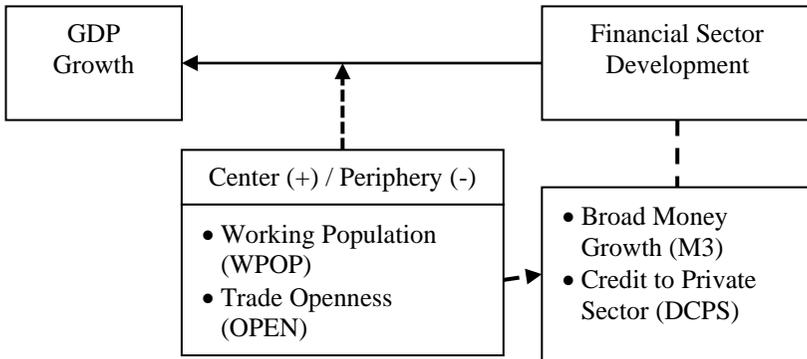
In terms of factor labor Boulhol et al. (2008), suggest that geographically periphery countries have a lower skill premium on manufactured goods than Center countries. The effect of labor or working population (WPOP) can also be understood in terms of the proportion of the WPOP among the educated workforce (Bilas and Bošnjak, 2015). Since many developing countries are also periphery countries, they produce less skill intensive products hence have a larger WPOP share per unit of output compared to Center countries. With a larger WPOP share per unit of output, periphery countries are likely to experience marginal effect of FSD and growth. As a result, much of the FSD effect end-up in lower-price goods ultimately reversing the finance-growth link. Similarly, Redding and Schott (2003) provide some evidence that the world's most peripheral countries have relatively low education levels (Boulhol et al.,2008) thus improving the workforce quality through higher education in these countries may have a larger marginal impact than in Center countries where it is already high. From these postulates it is hypothesized as follows.

H2:   Increased quality of the working population for a center country has a significantly lower FSD-growth effect than in a periphery

Additionally, Figure 1 suggests that centrality encourages firm specialization that can achieve efficient scale and more generally exploit increasing returns in specific fields of production Boulhol et al.,2008). Further evidence based on the Augmented gravity model, point to the effect that centrality both in terms of in-degree (importer openness) and out-degree (international competitiveness) have significant but varied effect on international trade flows for African countries (Kitila and Chen, 2021). For this end a third hypothesis is formulated as follows:

H3:   Increased openness in a center country has a significantly lower FSD-growth effect than in a periphery country

Centrality in trade has also been observed to affect profit distribution across countries, thus influencing power relations among nations (Iliopoulos et al., 2021). This suggest that firms in the Center country may accrue higher gross profit but at the marginal additional capital investment may have higher marginal returns alongside the law of diminishing marginal returns. As such, one would expect gross fixed capital formation to have a higher net impact in countries classified as periphery than those classified as Centers. Thus, a fourth hypothesis is formulated as follows:

H4:   Increased gross fixed capital formation for a Center country has a significantly lower FSD-growth effect than in a periphery country

4. METHODOLOGY AND DATA

4.1 MODEL SPECIFICATION AND ESTIMATION

In order to identify the role of FSD on growth, the basic Solow-Swan Model is augmented with the indicators of FSD. In the context of panel regression, data from 1980 – 2022 are used to estimate three models for Periphery, Center and combined countries. In the second, approach, a PSTR model which captures the effect of centrality in

the growth-finance nexus was implemented.   The general PSTR model for the purpose of this study is given in Equation 1.

(1) $\Delta y_{it} = \varepsilon_i + \alpha_0^1 x_{it} + \alpha_1^1 x_{it} G(\widetilde{c_{it}}, \gamma, \widetilde{c^*}) + \varepsilon_{it}$

Where, $i = 1,...,N$ is the number of individuals in the panel, $t = 1,...,T$. The variable Δy_{it} is the growth rate of real per capita GDP, the vector x_{it} includes the transformed spatial centrality indicator ($\widetilde{c_{it}}$) and the control variables, ε_{it} represents the individual fixed effects and ε_{it} are the errors. The transition function $G(\widetilde{c_{it}}, \gamma, \widetilde{c^*})$ is continuous in the observable transition variable, $\widetilde{c_{it}}$. It is a normalized function that takes values between 0 and 1, and its extreme values are in turn associated with the regression coefficients α_0^1 and α_1^1. More generally, the value of $\widetilde{c_{it}}$ determines the value of $G(\widetilde{c_{it}}, \gamma, \widetilde{c^*})$ and thus the effects of spatial centrality on growth, $\alpha_1^1 x_{it} G(\widetilde{c_{it}}, \gamma, \widetilde{c^*})$, for country i in period t. Following Mahawiya, (2015), G is a logistic function taking the form specified in Equation 2:

(2) $G(\widetilde{c_{it}}, \gamma, \widetilde{c^*}) = \dfrac{1}{1 + \exp(-\gamma(\widetilde{c_{it}} - \widetilde{c^*}))}$

Where the slope parameter of the logistic function, $\gamma > 0$; determines the speed of transition, and $\widetilde{c^*}$ is the spatial centrality threshold. For $\gamma \to \infty$, the logistic transition function approaches to an index function $I(\widetilde{c_{it}} > \widetilde{c^*})$ that takes the value of 1 if $\widetilde{c_{it}} > \widetilde{c^*}$. For $\to \infty$, the transition function approaches a constant and the model becomes homogenous or a linear panel regression model with fixed effects. The specific PSTR model that was estimated takes the form of Equation 3.

(3)

$$\Delta GDPGROW_{it} = \varepsilon_i +$$
$$\alpha_0^1 GDPGROW_{it-1} + \alpha_0^2 FSD_{it} +$$
$$\alpha_0^3 WPOP_{it} + \alpha_0^4 GFCFGDP_{it} +$$
$$\alpha_0^5 OPEN_{it} + \alpha_0^6 CENTRI_{it} +$$
$$\alpha_1^1 OPEN_{it} G(\widetilde{c_{it}}, \gamma, \tilde{c}^*) +$$
$$\alpha_1^2 WPOP\_gdp_{it} G(\widetilde{c_{it}}, \gamma, \tilde{c}^*) +$$
$$\alpha_1^3 GFCF_{it} G(\widetilde{c_{it}}, \gamma, \tilde{c}^*)$$

A two-regime PSTR model is implemented with an assumption that the finance-growth causal relationship is partly determined by country centrality. PSTR is a fixed effect model with exogenous repressors that caters for the heterogeneity problem in the model (Mahawiya, 2015). Three variables are tested for the regime transition effect that is OPEN, WPOP and GFCF assuming CENTRI as a regime switching variable i.e., $\widetilde{c_{it}}$. In addition, the model included two dummies for regional block (eco_bloc) and proximity effects (prox_dummy) as observed in Alananga and Mutasa (2022).

4.2 DATA AND VARIABLES

The annual time series data from the World Development Indicators (WDI) of the World Bank provides a first step in obtaining aggregate data for measures of real GDP per capita, FSD is based on private credit to the private sector (lnCPSGDP) and the ratio of M3 to GDP (M3GDP). Since it is imperative to control for other economic effects, trade openness (OPEN) and labor or working population (WPOP) and Gross Fixed Capital formation (GFCFGDP) across countries were included. The core variables in the relationship were centrality and proximity. Centrality (CENTRI) is measured in terms of aggregated bilateral trade volumes and was obtained from CEPII[3] The CENTRI is a gravity-based market potential index which was linearly interpolated for missing values. The estimated panel regression model also included the Foreign Market Potential (lnFMPRV) based on Redding and Venables (2004) as a control. A description of the variables is provided in Table 1.

TABLE 1
Description of Variables

Abbreviation	Variable Name	Measurement	Data Source
Dependent Variable			
GDPGROW	GDP growth at Constant (2015) prices	Values in %	WDI
Intervening Variables			
CENTRI	Trade centrality index	Number standardized using the G function Dummy as {1 if centrality index exceeds threshold (c^*), 0 otherwise} in the PSTR model	CEPII
Independent Variables			
M3GDP	Broad money as a share of GDP	Values in %	WDI
LNCPSGDP	Natural log of domestic credit to the private sector as a share of GDP	Values	WDI
GFCFGDP	Gross fixed capital formation as a share of GDP	Values in %	WDI
OPEN	Import plus export as a share of GDP	Values	WDI
WPOP	Working population as a share of the population aged 15 years or above	Values	WDI
LNRMPRV	Natural log of real market potential computed using Redding and Venables (2004)'s method	Values	CEEPII

TABLE 1 *(continued)*

Abbreviation	Variable Name	Measurement	Data Source
ECO_BLOC	Regional bloc	Dummy 01 if a country belongs to the SADC economic bloc and 0 if it belongs to the EAC	
PROX_DUMMY	Proximity to the identified Center countries measured in terms of sharing a border	Dummy =1 if sharing a border with a Center country, 0 otherwise	

Based on the centrality classification, Tanzania, Kenya and Uganda within EAC are classified as Center countries while Rwanda and Burundi are considered periphery. Within the SADC region, Botswana, Eswatini, South Africa and Zimbabwe are considered as Center countries while Madagascar, Malawi, Mauritius, Seychelles and Zambia are considered Periphery countries. Table 2 provides descriptive statistics which points to a reversed relationship for the two monetary policy variables (M3 and DCPS); while money growth could be important for Periphery countries DCPS growth is more prevalent in Center countries.

Descriptive statistics are provided in Table 2 where periphery and Center countries are compared. Overall Center countries experience higher GDP growth although on average difference is only around 0.1. Center countries also experience high M3GDP which is almost twice as much, a higher DCPSB which is more than three times, a higher GFCFGDP and a higher WPOP which is almost four times larger. The only variable for which periphery countries are slightly higher is FMP. In terms of stability of the series, growth, capital formation and quality of working population are the three variables that seem to be relatively unstable in the periphery. The FSD indicators are relatively varied in Centers than Periphery countries. The Center-periphery divide is almost having the same degree of variation for openness, centrality and market potential.

TABLE 2
Descriptive Statistics

Variable	Centre				Periphery			
	Mean	Std. Dev	Min	Max	Mean	Std. Dev	Min	Max
GDPGROW	3.6	4.2	-14.6	19.5	3.5	6.5	-50.3	35.2
M3GDP	51.9	23.5	12.1	122.6	25.7	15.3	7.3	151.6
DCPSB	36.3	21.7	6.2	104.9	11.7	12.1	-98.3	84.1
lnCPSGDP	36.2	21.7	6.2	104.9	11.9	12.2	-98.3	84.8
GFCFGDP	23.2	8.0	11.0	56.5	17.0	14.5	-59.3	46.6
OPEN	0.8	0.4	0.2	2.0	0.6	0.4	-0.2	1.8
WPOP	60.9	9.3	26.9	80.7	67.5	15.7	-4.9	92.6
LNFMPRV	13.4	1.1	11.8	15.9	13.5	1.0	11.5	16.1
CENTRI	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1
N	258				473			

FIGURE 2
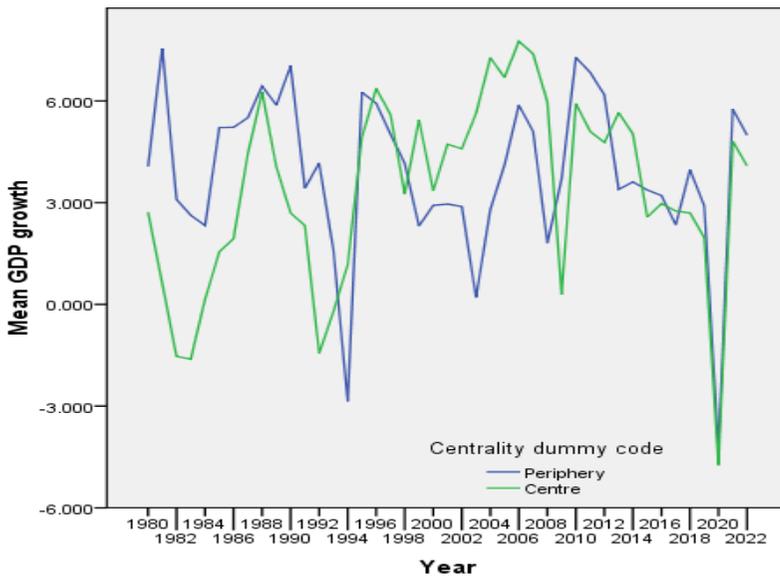Centrality Effect on the Trends of GDPGROW

Figure 2 suggests that for most of the period before 1995, GDP growth was higher in the periphery than the Center and between 1995 and 2008, GPD in Center countries dominated. Since then, however, there are ups and down for both Periphery and Center countries. Center and Periphery countries are however clearly differentiated in terms of M3 growth in Figure 3. Prior to 1990 and after 2018 Periphery countries have higher M3 growth than Center countries; otherwise, Center countries have dominated.

FIGURE 3
Centrality Effect on the Trends of M3GDP
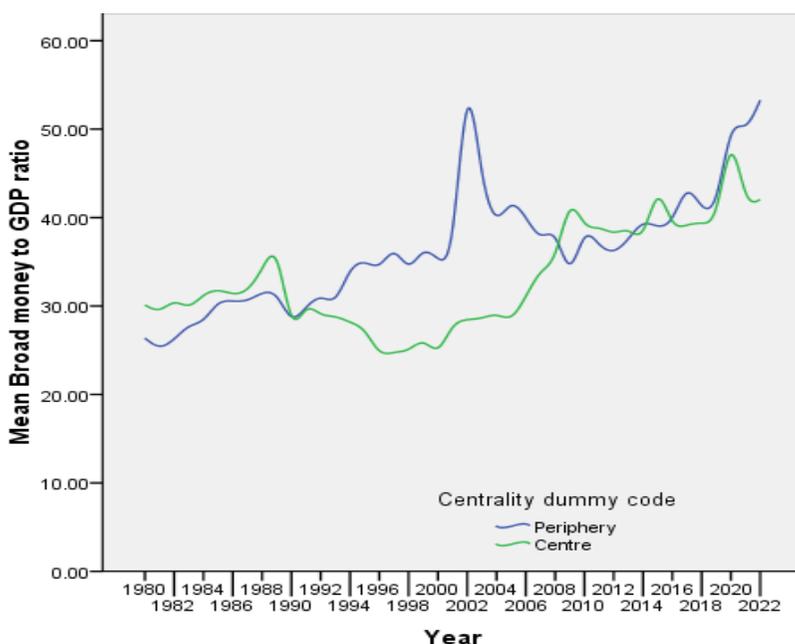
Figure 4 suggests that DCPS between Centre countries and Periphery one do experience periods of ups and downs with periphery countries dominating marginally in those years they lead but Centers dominate with larger magnitude in the years of their respective years of dominance. Figure 5 suggests that overall, the GDP is higher in Center and Periphery countries.

FIGURE 4
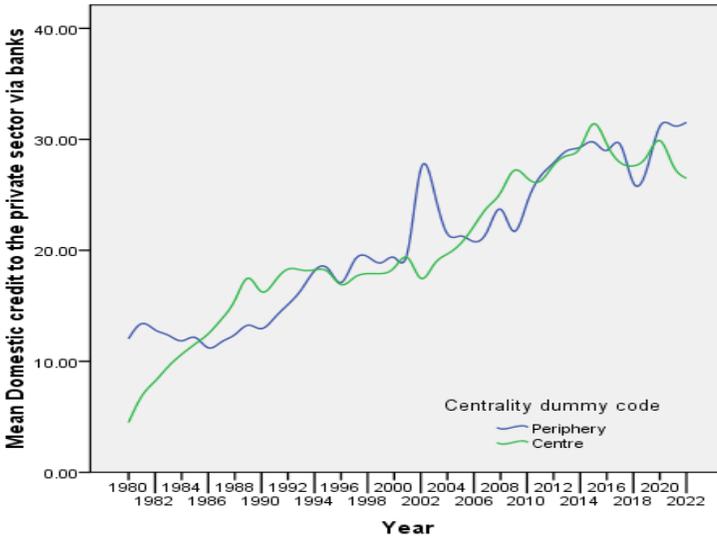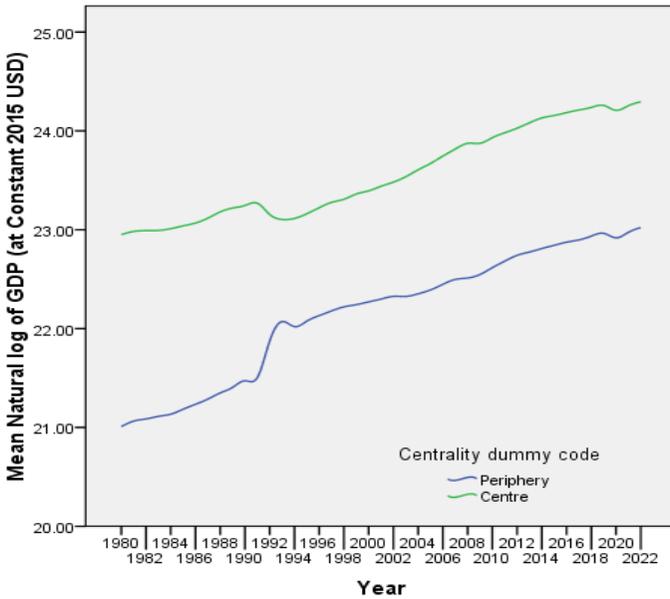Centrality Effect on the Trends of DCPSGDP

FIGURE 5
GDP for Centre and Periphery Countries

In terms of correlation among variables, Table 3 suggest that all the variables have a correlation of less than 80% suggesting that serial correlation is not a serious problem in the sample. In the Centers however, three cases of relatively high correlation exist, which are however reduced to only one case in the overall correlation analysis. The correlation coefficient is generally considered appropriate although DCPSB had to be dropped as FSD indicator for subsequent analyses.

4.3 PANEL UNIT ROOT TEST

Testing for weak cross-sectional dependence (CSD) in the panels the H0: weak cross-section dependence against the alternative H1: strong cross-section dependence was implemented and the results are presented in Table 4. All the series except three suggested for cross sectional dependence thus necessitating the adoption of second-generation unit root tests. The second generation Pesaran (2003), unit root test based on the assumption of a cross-sectional dependence, to identify the order of integration of the variables was adopted, while the Levin-Lin-Chu (LLC) unit-root test was used for independent series as shown in Table 5.

The LLC bias-adjusted test statistic $t * \delta = -3.2679$ is significantly less than zero ($p < 0.0005$) for GFCFGDP at level while for GDPWPOP bias-adjusted test statistic $t * \delta = -3.2727$ is significantly less than zero ($p < 0.0005$ when the trend is included), so we reject the null hypothesis of a unit-root [that is, that $\varphi = 0$ in (2)] in favor of the alternative that both GDPWPOP and GFCFGDP are stationary (that is, that $\varphi < 0$). OPEN seem to be integrated of higher order since even after including the trend it is still not stationary.

Following the detection of CSD in five out of the eight variables of interest, Panel Unit Root test (CIPS) results are presented as recommended by Pesaran (2012), in Table 6. All the variables except lnFMPRV are stationary at level while taking the trend into consideration makes all the CSD variables stationary. The null hypothesis of unit root is therefore rejected and the alternative that all series are stationary is accepted.

TABLE 3
Correlation Analysis Results for Periphery and Centre Countries

	GDPGROW	M3GDP	lnCPSGDP	GFCFGDP	OPEN	WPOP	LNFMPRV	CENTRI
				Center countries				
GDPGROW	1.00							
M3GDP	-0.13	1.00						
lnCPSGDP	-0.18	0.64	1.00					
GFCFGDP	0.13	0.25	-0.27	1.00				
OPEN	0.18	0.45	0.01	0.66	1.00			
WPOP	0.02	-0.12	-0.41	0.21	0.11	1.00		
LNFMPRV	-0.08	0.24	0.42	-0.08	0.06	0.11	1.00	
CENTRI	0.03	0.60	0.07	0.38	0.50	0.23	-0.18	1.00
				Periphery countries				
GDPGROW	1.00							
M3GDP	-0.15	1.00						
lnCPSGDP	0.22	0.48	1.00					
GFCFGDP	0.11	-0.06	0.02	1.00				
OPEN	0.05	0.25	0.22	0.35	1.00			
WPOP	-0.03	0.04	-0.09	-0.01	-0.22	1.00		
LNFMPRV	0.09	-0.01	0.28	0.28	0.39	0.02	1.00	
CENTRI	0.08	-0.13	0.12	0.04	-0.14	-0.13	0.20	1.00

TABLE 3 *(continued)*

	GDPGROW	M3GDP	lnCPSGDP	GFCFGDP	OPEN	WPOP	LNFMPRV	CENTRI
				Overall				
GDPGROW	1.00							
M3GDP	-0.10	1.00						
lnCPSGDP	0.05	0.71	1.00					
GFCFGDP	0.11	0.15	0.08	1.00				
OPEN	0.08	0.45	0.28	0.46	1.00			
WPOP	-0.03	-0.13	-0.27	-0.03	-0.20	1.00		
LNFMPRV	0.05	0.08	0.26	0.18	0.25	0.04	1.00	
CENTRI	0.05	0.42	0.22	0.19	0.26	-0.04	-0.01	1.00

TABLE 4
Cross Sectional Dependence Test Results

Variable	CD	SIG	CDW	SIG	CDW+	SIG	CD*	SIG	Decision
GDPGROW	12.09	***	-1.37		199.72	***	-1.59		Dependence
CENTR	-1.98	**	0.32		45.01	***	-3.11	**	Dependence
LNCPSGDP	0.00		0.00		0.00		-4.39	***	Dependence
LNFMPRV	77.45	***	4.95	***	963.01	***	-1.24		Dependence
WPOP	0.00		0.00		0.00		-0.45		Independent
GFCFGDP	0.00		0.00		0.00		-0.18		Independent
M3GDP	18.68	***	-2.45	**	476.08	***	1.09		Dependence
MS	24.81	***	-0.77		422.77	***	0.54		Dependence
OPEN	0.00		0.00		0.00		-1.29		Independent
WPOP	0.00		0.00		0.00		-3.15	**	Dependence

TABLE 5
Levin-Lin-Chu Unit-Root Test

Variable	No trend			With Trend			Integration
	Unadjusted t	Adjusted t*	Sig	Unadjusted t	Adjusted t*	Sig	
GDPWPOP	-4.2	-0.8	0.2	-7.8	-3.3	0.0	-4.2
GFCFGDP	-5.9	-3.3	0.0	-8.3	-0.2	0.4	-5.9
OPEN	-2.1	1.7	1.0	-6.4	-1.1	0.1	-2.1

TABLE 6
Unit Root Tests Assuming Independent of the Series (A) and CSD (B)[5]

Variable	lags	(A) Maddala and Wu (1999) Panel Unit Root Test (MW)				(B) Pesaran (2007) Panel Unit Root Test (CIPS)				Integration Order
		No trend		With trend		No trend		With trend		
		chi_sq	Sig	chi_sq	Sig	Zt-bar	Sig	Zt-bar	Sig	
GDPGROW	0	419.39	***	367.19	***	-14.87	***	-13.86	***	I(1)
	1	229.74	***	191.26	***	-9.55	***	-8.76	***	
	2	135.21	***	99.79	***	-5.08	***	-3.65	***	
CENTR	0	86.40	***	72.63	***	8.81		8.71		I(0)
	1	46.66	*	37.10		9.74		9.83		
	2	33.03		22.72		10.18		10.58		
DCPSB	0	98.05	***	56.46	**	-1.22		1.09		I(0)
	1	46.92	*	42.98		-1.71	**	0.69		
	2	45.28	*	38.31		-1.20		1.49		
FMPRV	0	0.71		5.75		-2.95	**	-3.24	***	I(1)
	1	0.81		8.92		-2.90	**	-5.32	***	
	2	0.84		4.97		-0.75		-3.72	***	
M3GDP	0	52.41	**	37.29		-0.79		1.49		I(0)
	1	36.03		41.71		0.21		1.21		
	2	31.95		31.40		0.11		1.93		

TABLE 6 *(continued)*

Variable	lags	(A) Maddala and Wu (1999) Panel Unit Root Test (MW)				(B) Pesaran (2007) Panel Unit Root Test (CIPS)				Integration Order
		No trend		With trend		No trend		With trend		
		chi_sq	Sig	chi_sq	Sig	Zt-bar	Sig	Zt-bar	Sig	
GDPWPOP	0	70.14	***	37.69		-3.42	***	2.04		I(0)
	1	30.65		35.96		-2.48	**	0.71		
	2	34.11		25.64		-1.65	**	1.90		
LNCPSGDP	0	97.68	***	56.60	**	-1.14		1.16		I(0)
	1	46.90	*	41.64		-1.63	*	0.79		
	2	49.58	**	38.99		-1.27		1.44		

4.4 PANEL CO-INTEGRATION TESTS RESULTS

Since all the variables were found to be stationary, second-generation co-integration tests based on Westerlund (2007) were implemented for long-run relationship among variables. The error-correction based not only allows for various forms of heterogeneity, but also provides p-values which are robust against cross-sectional dependencies via bootstrapping. In short, it is tested whether the null of no error correction can be rejected (either for the whole panel or for a non-zero fraction of the cross units depending on whether a pooled or group-mean estimation is performed). If the null can be rejected, there is evidence in favor of cointegration. Table 7 displays the Westerlund test results. In the last column the bootstrapped p-values, which account for cross-sectional dependencies are also included. According to three of the four tests statistics we can reject the null of no significant error correction at the 5%-level.

TABLE 7
Panel Cointegration Test Results

Statistic	Value	Z-value	p-value	Robust p-value
Gt	-4.252	-6.947	0.000	0.000
Ga	-8.671	3.153	0.999	0.275
Pt	-12.608	-2.613	0.005	0.003
Pa	-11.145	0.084	0.533	0.037

Before carrying out a panel-based error correction model, two steps were further accomplished; the first is choice of the best estimator between Pooled Mean Group (PMG), Mean Group (MG) and Dynamic Fixed Effect (DFE). The results of the Hausman test between PMG and MG for all countries are presented in Table 8. It is evident that the PMG model is superior; since the probability is not statistically significant' we reject the null of no efficiency improvement from MG to PMG and adopt the alternative that the PMG is more efficient.

The Akaike Information Criterion (AIC) was used for optimal lag selection for counteracting variables in each country based on the ARDL model. As such the lags are allowed to vary per variable. The most recurring optimal lags across countries were then chosen as the best lags for the panel ARDL model implemented hereafter. The results in Table 9 suggest that only the dependent variable can be lagged in the overall model with possible lags for GFCF and WPOP. Since they do not dominate across countries,

however, the approach adopted here is to lag only the dependent variable i.e., GDPGROW.

TABLE 8
The Hausman Test Results[6]

Variable	Coefficients			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	mg	pmg	Difference	SE
M3GDP	0.04	-0.01	0.04	0.13
lnCPSGDP	3.27	-0.45	3.72	3.72
GFCFGDP	2.64E+06	0.06	0.20	0.12
OPEN	1.91	0.09	1.82	9.20
WPOP	-0.22	0.06	-0.28	0.31
LNFMPRV	-0.77	-0.86	0.09	1.26
CENTR	0.10	0.33	-0.23	0.77
Test: Ho: difference in coefficients not systematic	chi2(8) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 9.78		Prob>chi2 = 0.2809	

TABLE 9
ARDL Results for Optimal Lag Estimation[7]

	GDP GROW	M3 GDP	DCPSB	Ln CPSGDP	GFCF GDP	OPEN	WPOP	Ln FMPRV
Lag (id-=1)	1	0	0	0	0	0	0	0
Lag (id= 2)	1	0	0	0	0	0	0	0
Lag (id= 3)	1	0	0	0	0	0	1	0
Lag (id= 4)	1	0	0	0	1	0	0	0
Lag (i-=5)	1	0	0	0	0	0	0	0
Lag (id= 6)	1	0	0	0	0	0	0	0
Lag (id= 7)	1	0	0	0	0	0	0	0
Lag (id-= 8)	1	0	0	0	0	0	0	0
Lag (id-= 9)	1	0	0	0	0	0	0	0
Lag (id-= 10)	1	0	0	0	0	0	0	0
Lag (id-= 11)	1	0	0	0	1	0	0	0
Lag (id-= 12)	1	0	0	0	0	0	0	0
Lag (id-= 13)	1	0	0	0	1	0	0	0

TABLE 9 *(continued)*

	GDP GROW	M3 GDP	DCPSB	Ln CPSGDP	GFCF GDP	OPEN	WPOP	Ln FMPRV
Lag (id-= 14)	1	0	0	0	1	0	0	0
Lag (id-= 15)	1	0	0	0	0	0	0	0
Lag (id-= 16)	1	0	0	0	0	0	0	0
Lag (id-= 16)	1	0	0	0	0	0	0	0
Lags	1	0	0	0	1	0	1	0

5. FINDINGS AND DISCUSSION

5.1 CENTRALITY EFFECT IN THE PSTR MODEL

Based on the linearity (homogeneity) tests of the PSTR model, it was observed that the linear model (LM) of the data exhibits significant linearity among the explanatory variables. This linearity was however eliminated once a Heteroskedastic robust model (HAC) is used. The linear part of the PSTR model results in Table 10 suggest that countries with a centrality value less than one are in the first regime where only the centrality indicator significantly reduces GDP growth. GDP growth in these countries declines by around 9.7% for each unit increase in the centrality indicator. Thus, being a trade Center seems to be detrimental to GDP growth or rather countries embarking seriously on enhancing international trade within the SADC and EAC tend to lose in terms of GDP growth.

It was further noted that in the second regime GDP growth significantly declines with DCPSGDP. This observation suggests that countries considered highly dependent on trade, are seriously and negatively affected by their respective growth in the share of DCPSGDP. Potentially such DCPS may be directed toward non-tradable sectors or are more consumptive than productive in nature. Similarly, a unit increase in WPOP growth of Center countries reduces GDP growth in Center countries while it is positive though not statistically significant in periphery countries.

It is also notable in the second regime that both lagged GDP growth and M3 growth reduce GDP growth at the 10% significance level. This provides some evidence that in relatively higher centrality economies, GDP growth may decline over time as well as

in response to M3 growth. This effect is however not relevant for periphery countries. The variable GFCFGDP tends to be positive in trade Center countries while it was negative in Periphery countries. This suggests that capital investment rather than financial investment is what matters to achieve higher GDP growth in Center countries while the reverse could be true in the periphery. The effect of the variable OPEN is flat regardless of the degree of centrality owing possibly to much of its effect being captured in the centrality indicator which is positive on GDP growth in the Center countries.

In the nonlinear part of the model, Table 6 suggests that a unit increase in the lagged value of GDP growth reduces GDP growth by more than 37% thus confirming the behavior of the second centrality regime. Similarly, a percent increase in M3 reduces GDP growth by 8% which also confirms the behavior of the second regime. Figure 6 (a) illustrates the reversal of the money growth effect on the response variable. It is clear that although M3 growth contributes positively toward GDP growth, a high-level centrality index (beyond around 0.5) reverses that effect. This observation suggests that the effect of M3 on GDP growth is determined to some extent by the respective degree of centrality achieved by a country.

TABLE 10
PSTR Model Estimation Results[8]

Variable	EST	SIG.	EST	IG.
Parameter Estimates in the Linear Part				
	First extreme regime		Second extreme regime	
ECO_BLOCK	2.55			
	(1.38)			
PROX_DUMMY	0.81			
	(0.84)			
GDPGROW	25.93		-11.9	*
	(9.96)		(7.46)	
DCPSGDP	20.51		-388.2	***
	(120.70)		(143.60)	
M3_GROWTH	4.1		-3.85	*
	(2.26)		(2.46)	
CENTRI	-9.78	***	0.16	
	(3.79)		(0.46)	
OPEN	119.8		139.1	
	(70.51)		(74.75)	

TABLE 10 *(continued)*

Variable	EST	SIG.	EST	IG.
Parameter Estimates in the Linear Part				
	First extreme regime		Second extreme regime	
WPOP	286.9		-100.3	***
	(122.00)		(34.63)	
GFCFGDP	-2.78		0.58	
	(3.26)		(1.75)	
Parameter Estimates in the Non-Linear Part				
GDPGROW	-37.84	***		
	(12.92)			
DCPSGDP	-408.7	**		
	(210.20)			
M3GDP	-7.95	**		
	(3.97)			
CENTRI	9.94			
	(3.83)			
OPEN	19.36			
	(9.71)			
WPOP	-387.1	***		
	(149.40)			
GFCFGDP	3.36			
	(3.29)			
Non-Linear Parameter Estimates				
GAMMA	35.7			
C_1	7.94			

Table 7 further indicates that a unit increase in DCPSGDP reduces GDP growth. This also confirms the second regime behavior. Figure 6 (b) illustrates reversal of the DCPSGDP effect as a share of GDP on the response variable. It is clear that, although DCPSGDP growth contributes positively to GDP growth, a high-level centrality index (beyond around 1) reverses that effect. This observation suggests that the effect of DCPS growth is dependent on the respective degree of centrality of a country. Periphery countries enjoy a relatively higher growth in response to DCPS expansion while such expansion is detrimental to GDP growth of the Center countries.

In terms of GFCFGDP, it contributes positively to GDP growth although the effect is not statistically significant. This observation is also reflected in the second regime rather than the first. Figure 7 (b) illustrates reversal of the GFCF growth effect on the response variable. It is evident that, although GFCF contributes

negatively towards GDP growth, a high-level centrality index (beyond around 1) reverses that effect. This observation suggests that the GFCF effect is to some extent determined by the respective degree of centrality though such effect is negligible. Based on this observation, it is suggested that there is limited evidence that GFCF is associated with economic growth regardless of the centrality regime under consideration.

FIGURE 6
Visualisation of the Centrality Effect on the Finance-Growth Indicators

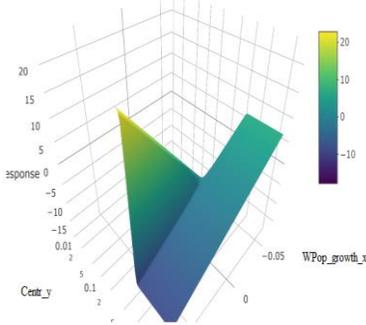| (a) Trade centrality in the M3-GDP growth relationship | (b) Trade centrality in the DCPS-GDP growth relationship |
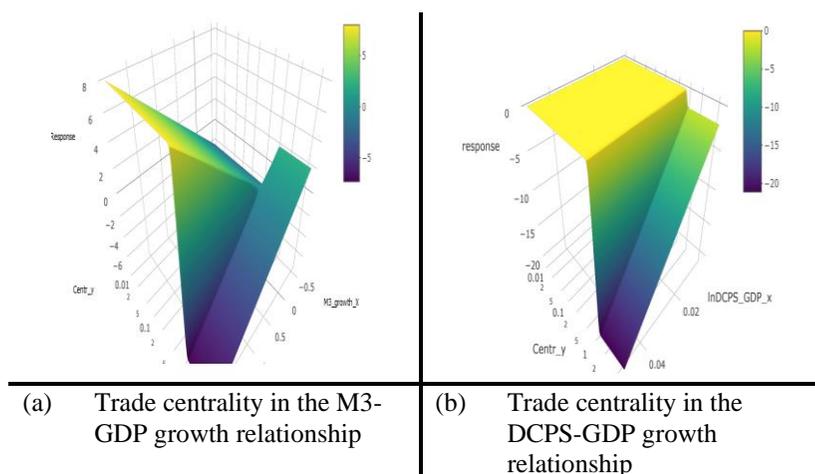
These nonlinear model results also confirm the behavior of the second regime where trade dependence reverses the effect of WPOP on growth. Figure 7 (c) illustrate the reversal of the effect of WPOP growth on the response variable. It is noted that WPOP growth contributes positively to GDP growth up to zero levels where the maximum GDP growth is achieved for regimes with a centrality index lower than 0.2. A high-level centrality index (beyond around 0.2) reverses that effect though marginally. Based on our observations it is suggested that there is limited evidence that WPOP growth is associated with economic growth where trade centrality is lower than 0.2.

FIGURE 7
Centrality Effect on Control Variables
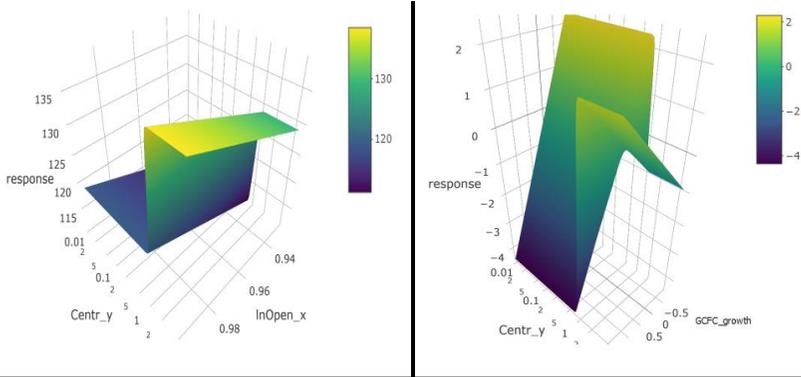
(a)   Trade centrality in the Openness-GDP growth relationship

(b)   Trade centrality in the GFCF-GDP growth relationship

(c)   Trade centrality in the WPOP-GDP growth relationship

5.2 CENTRALITY EFFECT IN THE PMG REGRESSION MODEL

Results of the PMG effect with error correction are presented in Table 11 for the three models implemented. In the overall model the long-run effect of lnCPSGDP and OPEN is positive suggesting that credit to the private sector and openness enhances growth in the countries studied. The positive effect of credit to the private sector seems to be a character of Center countries although it was not significant while in the periphery expanding credit to the private sector has negative impact on growth though not statistically significant. Trade openness has a significantly negative effect on GDP growth in Center countries even if it is negative as well in the periphery but not statistically significant. The conclusion here is that

expanding credit to the private sector is likely to increase the GDP of Center countries rather than Periphery countries principally in the long-run to reflect the capacity to absorb the expanded credit into other economic sectors. Openness is generally detrimental to growth in many SSA countries including those under this study regardless of their centrality status, potentially reflecting the strong position held by imports and marginal export that these countries are making.

The overall model further suggests that in the long-run WPOP and CENTRI are negative on GDP growth suggesting that centrality and the workforce quality will end-up having a negative implication on growth. Centrality has a significant and positive effect in Center countries alongside the PSTR model and a negative effect in the periphery thus confirming the regime switching effect. Improving the quality of the working population through education seem to be negative (though not statistically significant) on growth in both the Center and the periphery prompting some questions on the ability of the education system to produce an adequate workforce for the expanded GDP.

It was expected that Center countries will achieve higher GDP growth owing to their ability to attract and absorb both financial and non-financial resources. Centrality in the periphery seems to be oriented toward merchandise imports, hence having limited effect on real GDP growth or, as proven in the PSTR model, has a negative effect on growth. Additionally, it is notable that what matters to achieve long-run growth in the Center countries pertains to GFCF in addition to centrality while in the periphery countries foreign market potential coupled with reduced openness and centrality can bolster GDP growth.

The positive short-run effects in Center countries are manifest through credit to the private sector (also supported in the PSTR) and foreign market potentials while the negative short-run effect is realized via M3. While foreign market potential is a long-run positive effect in the periphery, it is a short run positive effect in Centers potentially reflecting the frequency with which trade takes place in Centers when compared to periphery. In the periphery, positive short-run effect is significant only for foreign market potential at 10% significance level, suggesting that FMP has both short and long-run effect among periphery countries though the magnitude is rather small. The slow pace for which exports reach destinations given the geographical localities of periphery countries

can partly explain this observation. In the overall model the short-run effect is observed to be significant only for openness at 10% significance levels and foreign market potentials at 1%. Although openness has a significant negative effect on growth in the long-run, the short-run effect could be negative only in the periphery and the effect is not statistically significant.

In terms of adjustment speed toward long-run equilibrium, Center countries are adjusting toward equilibrium at a rate of around 13% while periphery countries are adjusting at around 93% per annum and in both cases the adjustment speed is statistically significant. The sporadic adjustment in periphery countries can be attributed to relatively higher instabilities in these economies. The Center countries seem to be consistent in their adjustment speed and adjust slowly toward equilibrium partly confirming the growth convergence hypothesis.

A summary of country specific observations is further provided in Appendix 1. It is observed that countries classified as Periphery in this study comprises Burundi, Tanzania and Rwanda from among those in the EAC regional block and Angola, Lesotho, Eswatini, Mozambique, Zambia, Zimbabwe and Madagascar from those among the SADC. All the remaining countries are considered Centers. Based on Appendix 1, the adjustment speed among Center countries based on ECT seem to be sporadically highest in South Africa at around 123% followed by Mauritius at 122% and Botswana at 86% per annum. Among periphery countries the highest adjustment speed is sporadically high for Madagascar at around 113% followed by Eswatini at 98% and Rwanda at 96% per annum. Overall, all countries adjust accordingly to their respective long-run equilibrium with South Africa leading the race among SADC members and Rwanda among EAC member states.

Appendix 1 also suggests that although money growth is generally detrimental to growth, only two countries among the Center countries are significantly affected.   The GDP growth declines by 36% and 25% in Mauritius and Kenya respectively in response to a one percent increase in M3GDP. A similar negative effect is observed for four countries in the periphery where a 1% expansion in M3GDP reduces GDP growth by 75% in Eswatini; by 74% in Madagascar, by 111% in Rwanda and by 68% in Uganda. These observations for Center and periphery countries suggest that although expanded M3 reduces growth across countries such effect tend to be even higher among periphery rather than Center countries.

TABLE 11
Pooled Mean Group Regression[9]

VARIABLE	CENTER		PERIPHERY		OVERALL	
	COEF.	SIG	COEF.	SIG	COEF.	SIG
ECT						
M3GDP	-0.04		0.07		0.05	
	(0.03)		(0.04)		(0.02)	
LNCPSGDP	0.08		-0.04		3.99	**
	(0.02)		(0.07)		(0.02)	
GFCFGDP	5.27	**	0.20		0.25	
	(0.06)		(0.03)		(0.02)	
OPEN	-0.03		-6.25	**	-0.68	***
	(1.88)		(1.06)		(0.79)	
WPOP	-0.40		-0.22		-0.24	**
	(0.03)		(0.02)		(0.02)	
LNFMPRV	0.85		0.27	*	0.09	
	(0.38)		(0.41)		(0.27)	
CENTR	0.00	***	-1.39	***	-0.96	***
	(0.57)		(1.23)		(0.50)	
SR						
ECT	-0.13		-0.93	**	-1.01	**
	(0.10)		(0.09)		(0.07)	
M3GDP	-0.32	*	-0.46		-0.37	
	(0.08)		(0.13)		(0.09)	

TABLE 11 *(continued)*

VARIABLE	CENTER		PERIPHERY		OVERALL	
	COEF.	SIG	COEF.	SIG	COEF.	SIG
LNCPSGDP	11.70	**	3.49		-4.36	
	(0.17)		(0.17)		(0.13)	
GFCFGDP	-0.21		0.03		0.05	
	(0.20)		(0.12)		(0.10)	
OPEN	2.43		-12.70		-5.13	*
	(5.86)		(12.92)		(8.79)	
WPOP	66.63		-0.69		-0.45	
	(0.19)		(5.46)		(3.17)	
LNFMPRV	5.09	***	1.33	*	1.11	***
	(1.55)		(2.40)		(1.69)	
CENTR	0.00		1.10		0.94	
	(155.50)		(107.11)		(84.42)	
CONS	0.00		11.79		14.18	
	(0.58)		(1.61)		(1.16)	
NUMBER OF OBS.	252.00		462.00		714.00	
NUMBER OF GROUPS	6.00		11.00		17.00	
OBS PER GROUP: MIN	42.00		42.00		42.00	
AVG	42.00		42.00		42.00	
MAX	42.00		42.00		42.00	
LOG LIKELIHOOD	(605.86)		(1,188.30)		(1,802.82)	

In terms of expanded CPS, Appendix 1 suggest that three Center countries are significantly impacted negatively; expanded credit to the private sector will have a 109% reduction in GDP growth in Botswana, a 17% reduction in Mauritius and 46% in Namibia. In contrast, expanded CPS in the periphery increases the GDP growth of Eswatini by 54%, Tanzania by 17% and Uganda by 132%. Combining with the previous observation, it is notable that while in Center countries, the two monetary policy instruments can have the same effect but to different countries, in the periphery, the effect could be different even within the same country. Growth in Periphery countries such as Eswatini and Uganda respond negatively to expanded money supply but positively to expanded credits. Thus, it may be concluded that the expanded FSD is significantly detrimental to GDP growth in Center countries but can benefit some periphery countries if appropriate instruments are targeted and, in this case, the best instrument is credit expansion to the private sector rather than broad money supply growth.

The effect of GFCF on growth is positive for two Center countries and two periphery countries and is negative in Eswatini, thus suggesting a limited reliance on GFCF to bolster growth in Eswatini. Openness is also positive for three Center countries namely Mauritius, Botswana and South Africa and one country in the periphery (Madagascar). Two countries in the periphery, namely Angola and Rwanda, are negatively affected by enhanced openness. Potentially, the meager size of export as noted earlier could be responsible for this observation. The effect of WPOP is insignificant in any of the Center countries, possibly a good indicator that, in such countries, having a high education is not among the key inputs in production. In contrast, WPOP seem to be a key factor in GDP growth for five periphery countries.

In Angola, Eswatini and Rwanda WPOP reduces GDP growth suggesting that as the share of those with high education increases in these countries, GDP growth declines. This could be embedded in the nature of the education system in these countries. Contrariwise enhanced high education attainment in Burundi contributes positively to growth, an indicator that productive sectors of Burundi are dominated by a high education workforce. Generally, improving workforce quality has an insignificant effect in centers and varied effect in periphery countries, potentially reflecting on the nature of the education system.

Among the Center countries FMP is only significant in South Africa where a positive effect is observed. In the periphery FMP has a positive effect on GDP growth in Angola, Lesotho, Madagascar and Tanzania and a negative effect in Rwanda. The positive FMP effect on GDP growth is attributed to trade flows which can have a multiplier effect in local economies. Therefore, for countries such as Rwanda such multiplier effect could be minimal given the nature of trade flows pertinent in those countries. Generally, FMP is conclusively positive in Center countries but can vary in Periphery countries depending on a country's specific attributes. In terms of CENTRI, Appendix 1 suggest that it could be negative or positive even in some Center countries, although the ultimate effect is expected to be positive in Center countries and negative in the periphery.

5.3 DISCUSSION OF THE FINDINGS

This study suggests that the finance-growth nexus could be positive in the short run among Periphery countries if implemented via credit to the private sector and is generally positive to growth of Centers in the long run save only for Botswana, Mauritius and Namibia where it is negative on both monetary policy indicators. Based on this observation, the ability of regional trade Centers to withstand monetary shocks in the long run is highly questionable despite emerging evidence on the same (Clark, Dollar, and Micco, 2004). The observation in the second regime where centrality values are higher than one (1), suggest that increasing the WPOP in trade Center countries tends to lower economic growth. The fact that this observation is linked to trade Center countries rather than Periphery countries is an indication that as a country becomes dependent on international trade, most of its labor force forsake the productive sector in favor of business sectors mainly for merchandise trading.

The results in Table 11 suggest a negative centrality effect on growth (with the exception of Namibia) which somehow contradicts the geographic thesis as hypothesized in this study where it was theorized that trade-Center countries benefit from agglomeration or localization of economic activities. The observation in this study, however, is in line with Bhupatiraju and Verspagen (2013) who note insignificant effect of localization on GDP that changes over circumstances. Similar observations were also evident in Nakajima et. al. (2010) and Hinlo and Arranguez (2017) where localization and concentration had no significant effect

on GDP growth.   This primarily is a typical characteristic of developing countries which instead of linking economic activities to the productive sector which may end up attracting more employment, a larger share of the workforce is engaged in petty trading of imported merchandise (Mahawiya, 2015).

The implication of the preceding observation is that even when finance tools are used, the impact on the local economy may be marginal or even negative because the infrastructure to support and channel the expanded financial resources to productive venture is lacking (Escobal D 'Angelo and Torero Cullen, 2000). Theoretically, positive GDP growth response to FSD should happen only in the short run (Boulhol and de Serres, 2008; Radelet and Sachs, 1998), but in as far as the growth threshold is consistent, countries in this study have not attained that minimum growth level necessary for FSD to positively contribute to higher growth (Ibrahim, 2017; Zerbo, 2015). Only Tanzania, Eswatini and Uganda do exhibit positive relationship between FSD and Growth which is however short lived rather than long-term.

This study shows that even in the relatively higher trade Center countries, GDP growth may decline over time in response to M3 growth though the effect is not statistically significant. Thus, the H0: 3 that increased openness in a center country has a significantly lower FSD-growth effect than in a periphery is rejected. Potentially, trade in these economies does not encourage production and thus could be detrimental to growth as observed in Mahawiya (2015). Similarly, the control variable OPEN has been observed to have a positive effect in Center countries of Botswana, Mauritius and South Africa while in the periphery only Madagascar's growth does benefit from openness. Openness is generally negative in the Periphery with Angola and Rwanda bearing the brunt of the effect. For the majority of the remaining countries openness is neutralized with more imports rather than exports thus making trade openness sterile on GDP growth similar to the observations of Nyasha and Odhiambo (2015) for South Africa. Countries within the EAC and SADC region that have historically benefited from trade openness include Kenya (Waiyaki, 2016), Mauritius (Matadeen, 2015), South Africa (Hashikutuva, 2016) and Malawi (Chirwa and Odhiambo, 2016). The observation in this study contradicts these previous studies but complement a different line of literature suggesting that trade effect

is first and foremost on productivity; otherwise, it is neutral (Bhupatiraju and Verspagen, 2013).

The observed negative openness effect in the periphery countries of Angola and Rwanda could be linked to the sequencing hypothesis, whereby for a positive effect of openness on GDP growth, FSD needs to be preceded with financial openness or both trade and financial openness (Rajan and Zingales, 2003). The challenge to many countries under this study is that they act as transit route to land locked countries instead of being exporters themselves. The negative effect of trade openness could also be linked to poor institutional quality and/or low level of development (Waiyaki, 2016).

GFCF growth contributes positively to growth in Center countries in the long run, an indicator that capital investment rather than financial investment is what matters to achieve higher GDP growth in Center countries. Thus, the H0: 4 that increased gross fixed capital formation for a Center country has a significantly lower FSD-growth effect than in a periphery is rejected. A similar effect has also been observed in the short run in the Periphery countries of Madagascar and Rwanda. In a cross-country study, Chirwa and Odhiambo (2016) provide ample evidence that GFCF has a positive effect on growth in Zambia, Malawi and South Africa. For trade Center countries such as Kenya and South Africa, increased GFCF is by far the most beneficial strategy to achieve higher GDP growth specifically in the long run. Empirical studies alluding to this fact include Urgai, (2016) and Uddin et al. (2013) for Kenya, Ziramba (2016) and Nyasha and Odhiambo (2015), for South Africa, and Matadeen (2017) in Mauritius. The productive sector will nevertheless shrink in the short run leading to lower or constant GPD growth and as more capital stock is put into full production, GDP will eventually increase (Hashikutuva, 2016).

In the short run, the results of this study suggest that the GFCF effect is negligible in contrast to empirical observation in some previous studies (Urgaia, 2016; Uddin et al., 2013; Ziramba, 2016). Based on this observation, it is suggested that there is limited evidence that GFCF is associated with economic growth in the short run save for Eswatini where it is negative and Madagascar and Rwanda where it is positive. Potentially, both the SADC and EAC countries limitedly rely on GFCF as a strategy to bolster short run economic growth. In the long run, however, substantial evidence in this study exists that GFCF will increase GDP growth in line with

expectations.   This observation augurs well with Chirwa and Odhiambo, (2016) in Zambia, as well as Ziramba, (2016) and Polat et al., (2013) in South Africa.

Although DCPS growth contributes positively to GDP growth, a high-level centrality index (beyond around 1) reverses that effect as in Ibrahim (2017). Trade periphery countries enjoy a relatively higher growth in response to DCPS expansion while such expansion is detrimental to GDP growth of the Center countries. This observation provides evidence that in Center countries too much finance incentive is susceptible to moral hazard as it diverts talents and human capital away from productive sectors (Ikhide, 2015). Too much financial incentive may also end up in financing unproductive ventures, thus shifting resources away from productive investment and hence exacerbating decline in GDP growth (Acaravci et al., 2009).

Similarly, the effect of WPOP growth is to some extent determined by the respective degree of centrality though such effect is negligible specifically in the short run. Thus H0: 2 that increased quality of the working population for a center country has a significantly lower FSD-growth effect than in a periphery is rejected. Based on our observations, it is suggested that limited evidence exists that WPOP growth is associated with economic growth where trade centrality is lower than 0.2 as in Boulhol et. al. (2008). This effect however, dominates in the short run where WPOP may provide a link to understanding FSD-growth linkages Boulhol et al., 2008).

This is highly supported with panel data evidence where the variable WPOP is highly detrimental to GDP growth in both the short and long run as shown by Chirwa and Odhiambo (2016). Exceptions, however, exist, since countries such Burundi do benefit significantly in the short-run in response to expanded WPOP. Increasing labor at a fixed GDP, however, is subject to the law of diminishing marginal returns unless GDP is expanded in the long run. Thus, the negative long run effects of WPOP growth are supported by Chirwa and Odhiambo (2016) in Malawi and Zambia, Shawa (2014) in Malawi, and Matadeen (2015) in Mauritius. For developing countries, the GDP's long run response to WPOP is almost flat and this makes the WPOP effect per GDP negative both in the short and long runs with exceptions of countries such as Burundi.

6. CONCLUSION

Based on our findings, two observations can be made with regard to the long run behavior of the finance-growth nexus: The first relate to Center countries where both M3 and DCPS are detrimental to long run GDP growth. Thus, the H0: 1 that Center countries have a significantly higher FSD-growth effect than periphery countries is rejected. Based on long-run behavior of the variables, this effect is bidirectional meaning that trade Center countries attempting to expand M3 or DCPS will end-up with lower growth and such lower growth will again call for expanded finance. For trade Centers this feedback response in the finance-growth nexus may be associated with the need for liquidity to support the business sector as economies dwindle (Mahawiya, 2015). The second is that the long run behavior among periphery countries means credit to the private sector can contribute positively to growth with a feedback mechanism unlike in Center countries where the effect of FSD in general is negative. In the periphery the feedback is upward in some countries; as DCPS is expanded, GDP growth is realized which again calls for further expansion of credits. The mechanism translating inflationary credit expansion policy into the real economy could be country specific but a good explanation is the mainly economic and physical infrastructure growth to absorb the increased credits.

Data from Center countries within the regions under this study have provided evidence for inflationary shock stabilization effect specifically to external shocks. This inflationary effect of Periphery countries does not spill over to nearby trade Centers within their respective regions. This observation suggests that negative spillover effect of monetary expansion may be expected from trade Center toward the periphery and not the other way around. The higher ability of Center countries to absorb imported shocks could explain this behavior since centers are presumed to have the internal capabilities to translate financial resources from nearby countries into real exportable products thus cushioning off the inflationary environment.

Center countries such as Namibia, Botswana and Seychelles seem to benefit little from GFCF as their respective centrality is not determined by real production rather through trading in merchandise or tourism whose capital investment is relatively light. Periphery countries such as Angola, Tanzania and Zambia are transit route for tradable *en-route* land locked destinations within their regions. As such most of the FSD end up being either inflationary or stimulating

economies elsewhere. Periphery countries, however, achieve higher GDP growth in response to DCPS growth and that leads to an upward GDP growth due to a two-way causality effect. Deeper insight on this indicates that Tanzania is a transit route with a middle lower middle-income status, while the remaining two (Eswatini and Uganda) are landlocked which means that trade volumes could be lower because of the physical constraints they face although internal production structures could be adequate to absorb monetary shocks.

Furthermore, evidence in this study suggests that centrality is manifested via merchandise rather than real production which is a typical characteristic of developing countries. "Merchandise centrality" thus costs "productive centrality" in the finance-growth nexus. This has a negative consequence on productive potential leading to declining GDP growth. For developing countries to reap the highest returns on expanded monetary policies, reliance on merchandise centrality needs to substantially decline. Countries need to build their own productive potentials to bolster employment and expand output. Short of these initiatives, expanded monetary instrument incentives will continue to negatively affect GDP growth.

ENDNOTES

1. East Africa Community
2. South African Development Community
3. The data were downloaded from http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6
4. Notes on significance ***, ** and * show significance at the 1%, 5% and 10% levels, respectively.
5. Notes on significance***, ** and * show significance at the 1%, 5% and 10% levels, respectively; mw test assumes cross-section independence; cips test assumes cross-section dependence is in the form of a single unobserved common factor; multipurt function was implemented and uses scott merryman's -xtfisher- and piotr lewandowski's -pescadf-
6. Notes on constants;
   b = consistent under Ho and Ha; obtained from xtpmg
   B = inconsistent under Ha, efficient under Ho; obtained from xtpmg
   The Prob>chi2 = 0.2809 is not significant
7. Notes on optimal lag: Optimal lag length determined by Akaike Information Criterion with a maximum lag length of 2; Width of Bartlett-kernel window set to 3; A constant, but no deterministic trend in the cointegration relationship; and Number of bootstraps to obtain bootstrapped p-values which are robust against cross-sectional dependencies set to 400.

8. Notes on significance ***, ** and * show significance at the 1%, 5% and 10% levels, respectively. transition variable 'centr' is used in the estimation; estimated standard deviation of the residuals is 4.487.
9. Notes on significance***, ** and * show significance at the 1%, 5% and 10% levels, respectively.

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APPENDIX 1
Country Specific Effects

Country	ECT	Sig	M3GDP	Sig	lnCPS GDP	Sig	GFCF GDP	Sig	OPEN	Sig	WPOP	Sig	Ln FMPRV	Sig	CENTR	Sig
Centre																
Botswana	-0.86	***			-1.09	**			14.37	*						
	-0.13				-0.35				-8.69							
Kenya	-0.72	***	-0.36	*			0.65	**								
	-0.14		-0.19				-0.23									
Mauritius	-1.22	***			-0.17	**			17.95	**						
	-0.14				-0.07				-7.05							
Namibia	-0.81	***			-0.46	*									773.23	*
	-0.18				-0.25										-412.3	
Seychelles	-0.62	***	-0.25	**												
	-0.14		-0.1													
South Africa	-1.23	***					1.08	**	35.6	**			7.34	**	-392.4	**
	-0.18						-0.38		-13.44				-3.55		-184.4	
Periphery																
Angola	-0.6	***							-39.37	***	-0.31	**	7.47	**		
	-0.13								-9.22		-0.15		-3.82			
Burundi	-0.76	***									0.35	*				
	-0.15										-0.19					
Eswatini	-0.98	***	-0.75	***	0.54	*	-0.37	**			-2.47	*				
	-0.13		-0.19		-0.31		-0.17				-1.38					
Lesotho	-0.88	***											6.04	**		
	-0.14												-2.46			

APPENDIX 1 *(continued)*

Country	ECT	Sig	M3GDP	Sig	lnCPS GDP	Sig	GFCF GDP	Sig	OPEN	Sig	WPOP	Sig	Ln FMPRV	Sig	CENTR	Sig
Madagascar	-1.13	***	-0.74	**			0.24	***	27.07	***		***	8.59	**		
	-0.11		-0.25				-0.06		-5.16		-		-3.9			
Mozambique	-0.69	***														
	-0.17															
Rwanda	-0.96	***	-1.11	**			1.03	*	-128.4	***	-0.87	***	-18.61	*	-1018	***
	-0.09		-0.56				-0.54		-26.99		-0.2		-10.23		-368.9	
Tanzania	-0.09	**			0.17	**							8.23	**		
	-0.04				-0.07								-2.73			
Uganda	-0.47	***	-0.68	***	1.32	***										
	-0.08		-0.18		-0.37											
Zambia	-0.8	***														
	-0.15															
Zimbabwe	-0.55	***														
	-0.15															

Notes: ***, ** and * show significance at the 1%, 5% and 10% levels, respectively