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Article

An Empirical Study of Financial Development and Economic Growth in Africa

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Abstract: The article reports on the nexus between financial development and economic progress between English-speaking and French-speaking African countries from 1970 to 2017, focusing on non-linearities. To this end, Smooth Transition Regression together with Granger Causality modelling methods are employed to achieve the objectives of this study. Empirical evidence obtained is such that, there exits significant short and long-term relationships between financial development and economic growth in English-speaking countries. During economic contractions, a statistically significant error correction term indicates rapid adjustment of financial development towards long-term equilibrium, while in periods of rapid economic expansion, the rate of adaptation becomes negligible. In French-speaking countries, during economic contractions, a statistically significant error correction term indicated a slow adjustment of financial development towards long-term equilibrium, suggesting a steady correlation even in challenging economic conditions. Granger causality analysis showed unique patterns in both language groups, emphasizing complex contextual connections between financial development and economic growth. Furthermore, the study rejects linearity in both sets of countries, emphasizing the necessity for nuanced understanding and policy considerations to foster economic growth in African nations. This research provides valuable insights for policymakers aiming to promote sustainable economic development in the dynamic contexts of English-speaking and French-speaking African countries.

Keywords: economic growth; English-speaking African countries; financial development; French-speaking African countries; panel smooth transition regression vector correction model

1. Introduction

There is an extensive body of literature covering economic growth and financial development. The issue of financial development and economic growth has grown in importance; it encompasses various components such as markets, institutions, and a legal and regulatory framework that enables the facilitation of credit transactions to be completed (Beck et al., 2000). Recently, there has been significant interest in the relationship between financial development and economic growth. The concept of financial development continues to attract a lot of focus because of the potential it has for sustainable economic growth; this is considered a solution to the alleviation of poverty in the African continent.

Largely, the literature focuses on examining the linear correlation between financial development indicators, financial markets, effectiveness of financial intermediaries and economic growth (among others, see Beck et al., 2014). Furthermore, earlier studies presumed that there exists a direct linear relationship between financial development and economic growth (McKinnon & Shaw, 1973; Orgun, 1986; Akinboade, 1998; Huang & Lin, 2009 and Chen et al., 2013). Moreover, these studies suggest that financial development consistently leads to higher economic growth. Despite the findings of these studies, Huang and Lin (2009) used a non-linear estimation and found that financial development and economic growth have a significant relationship. Later, Nazlıoğlu and AğırH

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(2011) showed the inadequacy of the linear estimation of the relationship between financial development and economic growth.

Therefore, assuming a linear structure produces inadequate findings. Hence, allowing for nonlinear estimation of the relationship gives way to determining the diverse connection between financial development and economic growth. The financial development and growth may be minimal at the initial stages, but as more investment and other opportunities associated with it manifest, then it may grow rapidly. Hence, modelling the relationship linearly may result in misguided findings (Deidda & Fattouh, 2002). The rate of development of financial and economic indicators differs at each stage of development. In this case, the most appropriate method of modelling the behaviour is through a nonlinear estimation.

Africa has faced obstacles such as restricted availability of financial services, a wide array of economic frameworks, and differing levels of institutional advancement (Rosenthal, 2020). The region's distinct challenges, such as the influence of globalisation, unpredictable commodity prices, and geopolitical dynamics, have emphasised the significance of comprehending the complex relationship between financial development and economic progress. Moreover, there is an increasing acknowledgement that promoting financial inclusion and enhancing the effectiveness of financial institutions can aid in tackling poverty, encouraging entrepreneurship, and attaining wider economic development objectives in the African setting. It is worth noting that there is a growing acknowledgement that nonlinearities may have a significant impact on shaping this association.

The main objective of this article is to examine the characteristics and existence of nonlinear patterns in this correlation. Furthermore, it investigates the constraints on the expansion of financial development strategy, focusing particularly on African nations, namely those inside the English and French-speaking country's block of economies.

2. Theoretical Framework

The importance of financial development in economic growth theories depends on the assumptions made about the influence of flows in capital markets on the long-term rate of growth. While the examination of this link can be explained by several prominent Growth theories, such as: Harrod-Domar theory, Neoclassical theory, Keynesian theory, Schumpeterian theory, and Endogenous Growth Theory. Our analysis highly leans on the conceptual understandings of both the Keynesian and the Schumpeterian theories. As a result, the present subsection discusses these two theories, among others.

2.1. Keynesian and Schumpeterian Theory

Keynes (1936) contextualises financial markets within a comprehensive monetary and macroeconomic framework while presenting his liquidity preference theory. In contrast to the neoclassical viewpoint, which posits that money has little effect on the real economy (see Tobin, 1989), Schumpeter (1942) argues that the monetary attributes of financial assets exert a considerable influence on real economic activities. The discrepancy highlights the contrasting Keynesian and Schumpeterian paradigms in the realm of macroeconomic management, with both acknowledging the role of financial markets in driving economic growth. These frameworks recognise the impact of expectations in financial markets on agent behavior and the important influence of prevailing market conditions on resource allocations in real marketplaces.

The Keynesian and Schumpeterian theories revolve around models that determine the supply and demand of financial assets. The underlying assumption in these models is that the equilibrium interest rate in capital markets is determined by the interest rates set in financial markets. As a result, the determination of interest rates has a broad impact on the level of investment in an economy. Fundamentally, these viewpoints propose that financial markets possess a coordinating impact on capital markets, wherein interest rates play a crucial role in establishing equilibrium and influencing investment dynamics.

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Schumpeter's theoretical framework can be understood by illustrating a model in which the entrepreneur plays a pivotal role in economic activity, working with other financial stakeholders such as bankers and capitalists (Schumpeter, 1942). In this framework, the role of the banker is to facilitate debt financing, whereas the capitalist contributes to the financial structure through equity financing. The entrepreneur, positioned at the nexus of economic activities, assumes the responsibility of producing novel concepts and strategic amalgamations with the objective of optimising financial gains. Both the banker and capitalist play crucial roles in facilitating financial assistance to entrepreneurs, so creating a connection where savings and the flow of monetary resources, facilitated by financial intermediaries, drive investment, and hence foster economic growth.

Nevertheless, Schumpeter's theories concerning the association between finance and economic growth had inadequate recognition due to two main factors. Initially, his concepts were regarded as overly optimistic about markets, a perspective that clashed with the prevalent atmosphere of doubt in the aftermath of the significant economic hardships witnessed during the Great Depression in the 1920s and 1930s. Further, the absence of a mathematical framework in Schumpeter's theories presented a hurdle for their adoption, particularly during a time when the field of economics was progressively adopting mathematically derived policy interventions (Ruzive,2020).

The model presented in this section highlights the significant impact of financial dynamics: alterations in savings result in the generation of monetary reserves that can be used for investment purposes. The determination of overall levels of savings and investment within the economy is intricately influenced by the magnitude and fluctuations in these balances. The process occurs as intermediaries engage in intertemporal resource transfers, thereby transforming monetary assets into tangible and substantial real investments (Winkler, 1998 and Ruzive, 2020). A considerable portion of Keynes's ideas encountered limited prominence, particularly in their practical application to the real economy compared to financial policy. The revelation of the ineffectiveness of monetary policy, exemplified by the liquidity trap, in explicating the complexities of the Great Depression in the 1920s, contributed to the general neglect of Keynes's theories pertaining to money and finance.

The examination of financial development and economic growth in Africa, particularly regarding nonlinearities, necessitates a significant consideration of the historical perspectives surrounding Keynesian concepts. Although Keynesian theories were often disregarded in practical applications during the Great Depression due to their perceived ineffectiveness, this study acknowledges their significance, particularly in comprehending nonlinear linkages. The recognition of the liquidity trap and past difficulties in implementing monetary policy is consistent with the objective of this study, which is to examine the financial dynamics in Africa. The examination of nonlinearities in this work serves to overcome the constraints of traditional strategies, so enhancing our comprehension of the complex connection between financial development and economic growth within the African environment.

3. Empirical Literature

The literature on the nexus between financial development and economic growth from the 1960s has thoroughly investigated five principal areas of interest including correlation, causality, endogeneity, optimization as well as threshold modelling. This section conducts a thorough examination of empirical research with a specific focus on the three out of the five strands of literature abovementioned. These includes correlation, causality and the utilization of threshold modelling within and outside the African context. Thereby contributing to a nuanced understanding of the complex dynamics of the intersection of finance and growth within and beyond the African continent.

The first strand of literature deals with studies that have devoted efforts towards the analysis of correlation between financial development and economic growth. These includes among other the works Marc (1972), Orgun's (1986), Spears (1992), Akinboade (1998), King and Levine's (1993a), Chen and Wen (2013), Gregorio and Guidotti (1994) Roubini and Martin (1995), Huang, and Lin (2009), Akinlo and Egbetunde (2019), according to these studies, results on the correlation dynamics between financial development and economic growth have rather remained diverse. While some

 doi:10.20944/preprints202501.0542.v1

studies have established a positive correlation between these two variables of interest others have found these variables to be negatively related. For instance, the empirical analysis of Marc (1972), sheds insights on the observation that nations with higher levels of affluence within the West African economic and monetary union tend to display much higher ratios of financial deepening. Further, Orgun's (1986) cross-sectional study of 20 African countries corroborated the significance of the real balance effect in explaining regional growth.

Building on the above, Spears (1992), revealed that there exists a strong association between financial deepening and growth in nine out of the 20 countries considered. Further, Odedokun (1996) reinforced this narrative, emphasising a robust correlation between various indicators of financial development and economic growth. Furthermore, Gregorio and Guidotti (1994) delved into the long run correlation between growth and financial development. Noting a positive correlation, particularly in middle- and low-income nations, however, it also revealed a significant negative correlation in Latin America. Expanding the investigation to encompass a wider range of analysis, Savvides (1995) utilised a sample of 28 African nations and identified a positive influence of the financial sector on growth, particularly when accounting for political freedom in the region.

Conversely, other studies have revealed a negative association between the variables of interest, while others have found mixed results highly influenced by the nature of the countries concerned, the methods used, and the data used. For example, Roubini and Martin (1995) added a nuanced perspective by implying a negative relationship between inflation and growth, attributing it to policies of financial repression. In a comprehensive study conducted by Odedokun (1996), a wide-ranging panel encompassing seventy-one countries, including 21 nations in sub-Saharan African countries, revealed a noteworthy and statistically significant correlation between the financial sector and economic growth; this relationship is particularly evident when examining the ratio of liquid assets to GDP.

In their study, Huang, and Lin (2009) employed a novel threshold regression with instrumental variables method to explore the relationship between the finance-growth nexus. Their findings indicated that, specifically for low-income countries, financial development has a positive impact on economic growth. This work contributes valuable insights to the literature by unveiling the conditional nature of the finance-growth nexus, emphasising the need for a nuanced perspective that considers the specific economic context. Further, Chen and Wen (2013) investigated the presence of nonlinear relationships within the finance-growth relationship, with a specific emphasis on samples of different nations. The findings of the study were such that there exists a positive and statistically significant impact of financial development on economic growth in more developed provinces. Conversely, in less developed provinces, a negative and statistically significant relationship between financial development and economic growth was seen. The complex finding highlights the significance of considering geographical inequalities and diverse economic situations when evaluating the impact of financial development on economic expansion.

In a more recent study, Akinlo and Egbetunde (2019) explored the role of financial institutional quality on the impact of financial globalisation on economic growth in SSA. Employing a dynamic panel GMM, the study revealed a significant and negative influence of financial globalisation on economic growth. Importantly, the results indicated that this quality of institutions, measured by government effectiveness, played a crucial mitigating role, diminishing the adverse effects of financial globalisation on economic growth in the SSA region. Overall, most of the abovementioned studies have established a positive association between financial development and economic growth with a few disparities. To date, there exists a positive association between our variables of interest. However, the question of which variable causes the other remains a question of interest in the literature.

Several studies have dedicated efforts towards the analysis of causality between financial development and economic growth as the second most important strand of literature (see Jung, 1986; Demetriades and Hussein,1996; Calderon and Liu, 2003; Agbetsiafa, 2004, among others). Accordingly, the nature of causality between these variables has rather remained varied. Some

 doi:10.20944/preprints202501.0542.v1

studies have found unidirectional causal relations running either from financial development to economic growth or vis-à-vis, while others have established the existence of bidirectional causality between the two. Explicitly, in a study conducted by Agbetsiafa (2004), a long-term equilibrium and causal connection between financial development and economic development in 8 Sub-Saharan African (SSA) nations was examined. The outcomes of the study revealed a sustained economic connection, with a predominant one-way causation from financial development to economic development. Using the same model and technique, Odhiambo (2004) investigated the relationship for South Africa and found contrasting results. The study concluded that there is a unidirectional causality between growth and finance.

Further, Odhiambo's (2007) study added a significant dimension to the prevailing literature by empirically exploring the historical direction of causality between financial development and economic growth in three SSA countries: Kenya, South Africa, and Tanzania. The study unveiled that the strength and clarity of the causality evidence exhibit variability across countries and over time, particularly, the study's findings revealed a more pronounced demand-following response in Kenya and South Africa, contrasting with Tanzania, where a supply-leading response was predominantly observed. In a subsequent study by Odhiambo (2008b), the investigation dynamically scrutinised the causal relationship between financial depth and economic growth in Kenya. The empirical findings of the study indicated a unidirectional causal flow from economic growth to financial development.

Conversely, the works of Demetriades and Hussein (1996) utilised Johansen's Co-integration technique to investigate the enduring association between financial development and real GDP. The findings of their study provided limited evidence to substantiate the notion that finance plays a leading role in the progression of economic development. Nevertheless, a substantial amount of evidence regarding bidirectionality was discovered, along with some indications of reverse causation. This highlights the diverse nature of causality patterns observed across different countries. Further, the analysis by Khalifa Al-Yousif in 2002 provided valuable and enlightening insights. The research findings demonstrated the existence of a reciprocal relationship between financial development and economic growth. Nevertheless, it is important to acknowledge a significant limitation: the findings were particular to individual countries and cannot be universally applied to the wide range of countries included in the study.

The third strand of literature has focused on the analysis of the relationship between financial development and economic growth through the utilisation of Threshold Modeling. To date, it is believed that Threshold modelling provides policymakers with a valuable framework for approaching the subject of financial development in a more objective manner. By utilising this technique, policymakers can assess the impact of financial development on economic growth throughout numerous stages. In the analysis of Deidda and Fattouh (2002), the intersection between financial development and economic growth was investigated. Using the panel threshold modelling technique and data consisting of 119 economies, it was found that the results demonstrated a dynamic interrelation that is both nonlinear and non-monotonic. The authors' findings also suggested that the relationship between financial development and economic progress has minimal effects in low-income nations but shows a positive and statistically significant impact in high income economies.

In a study conducted by Ng, Ibrahim and Mirakhor (2016), a threshold regression model was employed to analyze data encompassing eighty-five countries over the period 1980 to 2008. The study showed that there was a statistically significant influence of financial development on economic growth for institutions that fell below the predetermined threshold. In contrast, beyond this threshold, as a statistically significant positive association becomes apparent, the inference made is that the association between finance and economic growth may not result in favourable outcomes if there is a lack of strong institutions. Further, In Ruzive's (2020) study, Panel Smooth Transition regressions (PSTR) were employed to examine the relationship between financial development indices and economic growth in the BRICS nations. The findings revealed a positive association between financial inclusion and economic expansion in the initial stages of development exists; however, as financial inclusion initiatives expanded, the relationship exhibited a negative trend.

 doi:10.20944/preprints202501.0542.v1

Furthermore, Abeka et al. (2021) brought a contemporary dimension to the literature by researching the role of telecommunications infrastructure in the finance-growth nexus. Their study, encompassing 44 Sub-Saharan African nations from 1996 to 2017, utilised the GMM technique. The findings suggested that a robust telecommunications infrastructure not only enhances the size of the financial sector but also has an immediate and positive effect on economic growth. Overall, preceding studies highlighted a discernible gap in the existing literature, particularly in the context of African countries, with a dearth of studies exploring the non-linear dynamics between finance and economic growth. In addressing this void, this study makes a noteworthy contribution to the body of knowledge by delving into the intricacies of the non-linear relationship between financial development and economic growth in the African context.

4. Database and Methodology

4.1. Database and Data Modifications

The article utilised a panel data methodology, examining data from 1970 to 2017 for a subset of African nations, including Botswana, Benin, Burundi, Chad, Côte d'Ivoire, Gabon, Ghana, Gambia, Kenya, Niger, Nigeria, Rwanda, Mali, Togo, Senegal, Sierra Leone, Seychelles, Sudan, and South Africa. The selection of these countries was based on data availability. The study seeks to address a significant gap in the literature by examining the correlation between financial development and economic growth in English- and French-speaking African nations. It emphasises the significance of comprehending Africa's distinct financial systems, which are comparatively underdeveloped and characterised by banking institutions that predominantly allocate resources to government assets rather than private sector financing. This research holds considerable significance for policymakers and stakeholders seeking to improve financial inclusion and sustainable development in these areas.

Language is crucial to Africa's financial development and economic growth, stemming from the colonial legacy that influenced the continent's institutions. English and French, enforced by colonial authorities, profoundly impacted legal systems, administrative structures, and commerce networks. Anglophone nations frequently maintain connections with Anglo-Saxon institutions, promoting assimilation into worldwide English-speaking markets. In contrast, French-speaking countries sustain robust connections with Francophone organisations, impacting their financial and economic trajectories. These language boundaries have historically influenced the characteristics of legal systems, trade relations, and human capital development, affecting financial integration and the formulation of economic policy. The article utilises data from the World Bank Indicators (WBI) and World Bank Financial Indicators (WBFI), employing liquid liabilities (M2) as a proxy for financial development and GDP as an indicator of economic growth. Liquid liabilities accurately assess financial intermediation and inclusivity, both essential for economic advancement. The research investigates the influence of real economic policy on financial systems, utilising accessible and comparable data to elucidate Africa's financial dynamics within a linguistically and historically intricate framework.

Table 1. Description of variables.

Variable	Description
Gross Domestic Product (GDP) at constant prices	Gross domestic product is the value of all final goods and services produced within the borders of a country during a specific period. The study will use GDP at constant prices as a measure of economic growth. GDP at constant prices estimates is calculated by expressing numbers in terms of base period and refers to GDP on a volume basis.

 doi:10.20944/preprints202501.0542.v1

Ratio of Liquid liabilities to GDP	The ratio of liquid liabilities to GDP or M3 is the sum of currency and central bank deposits (M0) plus transferable deposits and electronic currency (M1), plus time and savings deposits, certificates of deposit and securities repurchase agreements (M2) as well as travellers' checks, foreign currency time deposits, commercial research study and shares of mutual funds or market funds held by residents. Liquid liabilities are used in this study as a proxy and measure of financial development since it is often referred to a measure of financial deepening measure because it examines the depth of financial intermediaries in the country, and it measures the degree of monetization in an economy as well as the overall size of the financial sector as suggested by (King and Levine, 1993) and World Bank (1989).

4.2. Model Specification for the Interactions of Financial Development and Economic Growth

This research utilised a panel smooth transition regression (PSTR) model to rigorously investigate the nonlinear dynamics between economic growth and financial development. This methodology presents numerous benefits. Smooth transition regression models are theoretically superior to traditional threshold and Markov regime-switching models, as they allow for gradual and continuous transitions instead of sudden regime shifts. Omay and Kan, (2010) contend that this approach more effectively captures the gradual adjustments in regimes, given that economic mediators seldom shift cohesively in a singular direction simultaneously. The PSTR model's inherent flexibility facilitates a range of nonlinear and asymmetric dynamics contingent upon the chosen transition function. For example, when the correlation between variables corresponds with the phases of the economic cycle, employing a first-order logistic transition function is suitable for examining the relationship between financial development and output growth. In contrast, when the emphasis is placed on the magnitude of changes rather than their direction, an exponential or second-order logistic transition function is deemed more appropriate. This flexibility allows scholars to identify the pertinent switching variable and the most effective transition function, providing a detailed examination of the relationship between financial development and growth.

This study also adopts an econometric approach influenced by the nonlinear panel smooth transition vector error correction methodology established by Omay and Öznur Kan (2010). This approach effectively encompasses both short-term and long-term dynamics while also considering potential nonlinearities and behaviours specific to different regimes in the relationship between financial development and economic growth.

A panel regression model is considered as follows.

$$y_{i,t} = \alpha_i + \beta_i x_{i,t} + u_{i,t} \ for\ i - 1, \dots, N\ and\ t = 1, \dots, T \qquad (1)$$

The nonlinear adjustment framework offers a dynamic view of the correction process for deviations from equilibrium, with the adjustment speed contingent upon the extent of the disequilibrium. Greater deviations prompt more rapid corrections, whereas lesser deviations demonstrate a gradual tendency towards mean reversion. The model mitigates serial correlation in errors by integrating lagged differences of the equilibrium error, thereby accounting for past disturbances and improving the robustness of the equilibrium adjustment process. Cointegration testing in this framework assesses whether the parameter governing the speed of adjustment is significantly greater than zero. The null hypothesis posits no cointegration, while the alternative indicates a nonlinear adjustment process. The first-order Taylor approximation streamlines the transition function for indirect testing under the null hypothesis.

 doi:10.20944/preprints202501.0542.v1

The study incorporates varying lag orders among entities in panel regression and utilises the panel cointegration tests developed by Ucar and Omay (2009), which average individual test statistics for a thorough assessment. Following the confirmation of cointegration, the panel error correction model investigates dynamic adjustments and long-run relationships, further extending to the nonlinear panel smooth transition vector error correction (PSTRVEC) model.

4.2.1. Panel Smooth Transition Regression Vector Error Correction (PSTRVEC)

The study explores the following PSTRVEC model, which is based on the work of González et al. (2003) and Omay and Kan (2010).

$$\Delta gdp_{it} = u_1 + \beta_1 ec_{i,t-1} + \sum_{j=1}^{pi} \theta_1 \Delta gdp_{i,t-j} + \sum_{j=1}^{q1} \vartheta_{1j} \Delta FD_{i,t-j} + G_{(s_{i,t};\gamma,c)} \left\{ \beta_{1ec_{i,t-1}} + \sum_{j=1}^{pi} \theta_{ij} \Delta gdp_{i,t-j} + \sum_{j=1}^{qi} \vartheta_{1j} \Delta FD_{i,t-j} \right\} + \xi_{1it} \cdots$$

$$\Delta FD_{it} = u_2 + \beta_2 ec_{i,t-1} + \sum_{j=1}^{pi} \theta_2 \Delta gdp_{i,t-j} + \sum_{j=1}^{q1} \vartheta_{1j} \Delta FD_{i,t-j} + G_{(s_{i,t};\gamma,c)} \left\{ \beta_{2ec_{i,t-1}} + \sum_{j=1}^{pi} \theta_{2j} \Delta gdp_{i,t-j} + \sum_{j=1}^{qi} \vartheta_{1j} \Delta FD_{i,t-j} \right\} + \xi_{2it} \quad (2)$$

For $I = 1 \ldots N$ and $t = 1 \ldots T$, and N and T represent the cross section and time dimensions of the panel. GDP is economic progress, and FD is financial development. Moreover, u_i denotes fixed distinct effects, $ec_{it,}$is the error correction term estimated and ξ_{it} is the error term that is presumed to be a martingale difference with respect to the history of the vector $z_{it} = gdp_{it,} fd_{it}$ up to time $t - 1$ and that the conditional variance of the error term is constant. Contemporaneous correlation across the errors of the N equations is noted.

The logistic transition function described in González, Teräsvirta, and Dijk (2005) and Omay and Kan (2010) for time series STAR models is examined as follows:

$$G(s_{i,t-1;\gamma,c}) = \left[1 + \exp\{-\gamma \prod_{j=1}^{m} (s_{i,t-1} - c_j)\}\right]^{-1} \quad (3)$$

$$\text{With } \gamma > 0 \text{ and } c_m \geq \cdots \geq c_1 \geq c_0;$$

where $c = (c_1, \ldots, c_m)'$ is a dimensional vector of location parameters and the slope parameter γ denotes the smoothness of the transition between the regimes. If $m = 1$, there is a first order logistic transition function and the extreme regimes correspond to low and high values of s_{it}, so that the coefficients in (2) change smoothly from β_j, θ_j and ϑ_j to βj + βj̃, θj + θj̃and ϑj + ϑj̃ respectiviely as s_{it} increases. When $\gamma \to \infty$, the transition function $G(s_{i,t-1;\gamma,c})$ becomes an indicator function $I[A]$, which takes a value of 1 when event A occurs and zero otherwise. The PSTR model reduces to the two regimes of Hansen (1999b).

For $m = 2, G(s_{i,t-1;\gamma,c})$ takes a value of 1 for both low and high s_{it}, minimizing at $\frac{c_1+c_2}{2}$. In that case, if $\gamma \to \infty$, the PSTR model reduces into a panel three regime threshold regression model. If $\gamma \to \infty$,, the transition function will reduce into a constant and the PSTR model will collapse to a linear panel regression model for any value of m.

The specification technique for estimating a PSTR, according to González, Teräsvirta, and Dijk (2005), Omay and Kan (2010), and Omay (2012), consists of the following steps:

1. Determine the best linear panel model for the data under consideration.

2. Compare the null hypothesis of linearity to the alternative hypothesis of smooth transition type nonlinearity. If linearity is rejected, select the suitable transition variable s_{it} and transition function form.

3. Determine the parameters of the chosen PSTRVEC model.

The linearity tests face complexity due to the presence of unidentified nuisance parameters under the null hypothesis. This complexity arises from the fact that the null hypothesis of linearity can be expressed in various ways. Apart from the equality of parameters in the two regimes,$H_0; \beta_j =$

 doi:10.20944/preprints202501.0542.v1

$\beta j^{\sim}$ and $\theta_j = \theta j^{\sim}$, the alternative null hypothesis $H_1; \Upsilon = 0$ also implies an appropriate Taylor approximation, as suggested by Luukkonen et al. (1988). For instance, Ak^{th} Taylor approximation of the (first order) logistic transition function around $\gamma = 0$ results in the following auxiliary regression:

$$\Delta z_{i,t} = \lambda_1 + \pi'_0 ec_{i,t-1} + \sum_{j=1}^{p_i} \varphi_{oj} \Delta z_{i,t-1} + \sum_{h=1}^{k} \pi^{\sim'}_h s^h{}_{i,t} ec_{i,t-1} +$$

$$\sum_{h=1}^{k} \sum_{j=1}^{p_i} \varphi^{\sim}_{hj} s^h{}_{i,t} \Delta z_{i,t-j} + e_{i,t} \qquad (4)$$

In this expression $z_{i,t} = (gdp_{it}, fd_{it})$ and $\lambda, \pi', \vartheta, \pi^{\sim} and\ \vartheta^{\sim}$ are functions of $u_i, \beta, \theta_j, \vartheta^{\sim}{}_j \gamma\ and\ c_j\ and\ e_{i,t}$ comprises the original disturbance term ξ_{it} as well as the error term arising from the Taylor approximation. Testing $H_0; \Upsilon = 0$ in equation (2) is equivalent to testing the null hypothesis $H_0; \omega_1 = \omega_2 = \omega_3\ where\ \omega_i \equiv (\pi^{\sim}, \varphi^{\sim})$ in equation (4) above. To conduct this test using an LM-type test, which possesses an approximate F-distribution, it is defined as follows:

$$LM = \frac{\frac{SSR_0 - SSR_1}{kp}}{\frac{SSR_0}{TN - N - k(p+1)}} \sim F\big(kp, TN - N - k(p+10)\big) \qquad (5)$$

where $SSR_0\ and SSR_1$ are the sum of squared residuals under the null hypothesis and alternative hypothesis, respectively. The appropriate transition variable $s_{i,t}$ can be selected by computing LM-statistics for several candidates. The chosen variable would be the one for which the P-value of the test statistic is the smallest. After selecting the appropriate transition variable $s_{i,t}$ the next step in specifying a panel STR model involves choosing between $m = 1\ and\ m = 2$. Teräsvirta (1994) suggests a decision rule based on a sequence of tests in Equation (4), the sequence test is as follows, using the auxiliary regression (4) with k=3, test the null hypothesis $H^*{}_0; \omega_1 = \omega_2 = \omega_3 = 0$ if it is rejected then test $H^*{}_{03}; \omega_3 = 0$ then $H^*{}_{02}; \omega_2 = 0 | \omega_3 = 0\ and\ H^*{}_{01}; \omega_1 = 0 | \omega_2 = \omega_3$. These hypotheses are examined through standard F-tests, denoted as *F*3, *F*2, and *F*1, respectively. The decision criterion is straightforward: if the P-value linked with *F*2 is the minimum, then choose the exponential transition function; otherwise, in all other instances, prefer the first-order logistic function.

4.2.2. PSTRVEC Models and Regime-Wise Granger-Causality Estimation Tests

Upon selecting the transition variable and determining the form of the transition function, the estimation of the PSTRVEC model involves employing a nonlinear least squares estimator. This estimation process is facilitated by utilising an optimisation algorithm, further aided by the provision of suitable starting values. When the parameters in the transition function, γ, and c are fixed, the PSTRVEC model becomes linear in terms of parameters like $u_i, \beta, \theta_j, \vartheta^{\sim}{}_j, \beta^{\sim}{}_j \theta^{\sim}{}_j \vartheta^{\sim}{}_j$ and can be estimated using a least squares estimator. To acquire suitable starting values for the subsequent nonlinear least squares estimation, a practical approach involves conducting a two-dimensional grid search over γ and c. The values from this search that minimise the panel sum of squared residuals are then selected. In the estimation of panel regression models, a significant challenge arises in the form of cross-section dependency. Equation (2) accounts for contemporaneous correlation among the errors in the system.

Given the strong connections among the chosen English-speaking countries and French speaking countries, this cross-section dependency issue could be substantial. To address this challenge, the study adopts the approach of Omay et al (2012), resolving the growth and financial development equations for all sample countries concurrently through an iterative application of the nonlinear Generalized Least Squares (GLS) estimator, thereby obtaining maximum likelihood (ML) estimates. Upon estimating the coefficients of the PSTRVEC model as presented in equation (2), Granger causality tests are conducted to explore bidirectional causal relationships between output growth and financial development.

 doi:10.20944/preprints202501.0542.v1

The estimated model, accommodating regime-dependent dynamics between the variables, allows for separate Granger causality tests within each regime, following Li (2006). In the PSTRVEC model, regimes are associated with extreme values of the transition function $G(s_{i,t-1;\gamma,c})$. For instance, if the appropriate transition variable in the transition function is the output growth rate and the transition function is a first-order logistic function, the regimes could be linked to low growth and high growth episodes. Consequently, the causality tests are conducted separately for periods of low growth and high growth.

For instance, assuming the transition variable is indeed the output growth rate, and the transition function is a first-order logistic function. Within the framework of the PSTRVEC model in equation (2), the null hypotheses of no Granger-causality can be formulated for low growth and high growth periods as follows:

Table 2. Tests for granger causality.

In low-growth periods, specifically when the output growth rate is below a certain threshold value, the evidence suggests that financial development does not Granger cause changes in the output growth rate in the short run.	$H_0; \vartheta_1 = 0$
In low growth periods, financial development does not Granger cause changes in output growth rate in the long run.	$H_0; \beta_1 = 0$ and/or $H_0; \beta_1 = \vartheta_1 = 0$
In high growth periods, financial development does not Granger cause changes in output growth rate in the short run.	$H_0; \vartheta_1 = \vartheta^{\sim}_1 = 0$
In periods of high growth, there is no Granger causality between financial development and output growth rate, especially when the output growth rate exceeds a certain threshold value, over the long run.	$H_0; \beta_1 = \beta^{\sim}_1 = 0$ and/or $H_0; \beta_1 = \beta^{\sim}_1 =; \vartheta_1 = \vartheta^{\sim}_1 = 0$
In low growth periods, there is no Granger causality from output growth to financial development, particularly when the output growth rate falls below a certain threshold value, in the short run.	$H_0; \theta_2 = 0$
In low growth periods, there is no Granger causality from output growth to financial development, especially when the output growth rate is below a certain threshold value, in the long run.	$H_0; \beta_2 = 0$ and/or $H_0; \beta_2 = \theta_2 = 0$
In high growth periods, there is no Granger causality from output growth to financial development, particularly when the output growth rate exceeds a certain threshold value, in the short run.	$H_0; \theta_2 = \theta^{\sim}_2 = 0$
In high growth periods, there is no Granger causality from output growth to financial development, especially when the output growth rate surpasses a certain threshold value, in the long run.	$H_0; \beta_2 = \beta^{\sim}_2 = 0$ and/or $H_0; \beta_2 = \beta^{\sim}_2 = \theta_2 = \theta^{\sim}_2 = 0$

5. Estimation Results and Analysis

5.1. Panel Unit Root and Cointegration Tests

The findings of the study, as presented in Tables 3 and 4, elucidate the results of linear and non-linear panel unit root and cointegration tests conducted for French- and English-speaking African countries. Linear tests utilising IPS and LLC methodologies reveal the existence of unit roots in GDP and financial development (FinD) across both linguistic groups. Additionally, non-linear tests support these conclusions, demonstrating a persistence of unit roots. This supports the approach of considering all variables as possessing unit roots and advancing with cointegration analysis.

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Table 3. Linear and non-linear panel unit roots.

IPS			UO test			
Intercept		**Intercept & trend**	**Intercept**		**Intercept & trend**	
	w-t-stat	**w-t-stat**	**t-stat**	**z-stat**	**t-stat**	**z-stat**
French speaking countries						
GDP	-1.538*	-0.278	-0.113	-0.133	-1.109	-1.145
FinD	-3.420***	-3.104***	-1.537***	-1.528***	-0.489	-0.642
English speaking countries						
GDP	-1.182	-1.203	-1.212**	-1.205**	-0.256	-0.321
FinD	-2.901***	-2.783***	-1.504**	-1.572**	-1.568**	-1.523**

*,**,*** denote rejection of the null hypothesis of unit root at 1%.5% and 10%.

Table 4. Linear and non-linear cointegration tests.

Model	IPS Linear tests	Ucar & Omay non-linear tests
	T-bar	T-bar
English speaking countries		
$\hat{u}_{it} = gdp_{it} - X_{it}\mathcal{B}$	-3.8892^{***}	-4.2486^{***}
$\hat{u}_{it} = fd_{it} - X_{it}\mathcal{B}$	-7.4751^{***}	-8.1418^{***}
French speaking countries		
$\hat{u}_{it} = gdp_{it} - X_{it}\mathcal{B}$	-4.0746^{***}	-4.5421^{***}
$\hat{u}_{it} = fd_{it} - X_{it}\mathcal{B}$	-10.5572^{***}	-11.8550^{***}

*4 maximum lags used with 1000 bootstraps replications, *** denote significance at 1%.

The findings indicate substantial evidence of both linear and non-linear cointegration relationships between GDP and FinD, with non-linear tests showing a more pronounced rejection of the null hypothesis of no cointegration. This highlights a strong, non-linear relationship between financial development and economic growth in both English- and French-speaking countries, offering important insights into the interconnected dynamics of these variables within the varied economic contexts of Africa.

5.2. Panel Vector Error Correction Model and Linearity Tests

5.2.1. Panel Vector Error Model

English countries model

$$\Delta Gdp_{i,t} = \mu_1 + 2.230ec_{i,t-1} + 0.323\Delta Gdp_{i,t-1} - 0.077\Delta Fd_{i,t-1}$$
$$(1.313) \quad (0.052) \quad (0.057)$$
$$\Delta Fd_{i,t} = \mu_1 - 5.373ec_{i,t-1} + 0.197\Delta Fd_{i,t-1} - 0.042\Delta Gdp_{i,t-1}$$
$$(1.262) \quad (0.055) \quad (0.055)$$

The panel vector error correction model for English-speaking African countries is illustrated above, the negative and statistically significant error correction term in the FD equation suggests the presence of a corrective mechanism that drives the system towards equilibrium. The error correction term in the GDP equation is positive; however, its significance is limited to the 10% level. A brief examination indicates that an increase in FD adversely affects GDP, whereas a rise in GDP is associated with a decrease in FD; nonetheless, these relationships do not demonstrate statistical significance.

$$\Delta Gdp_{i,t} = \mu_1 + 0.375ec_{i,t-1} + 0.264\Delta Gdp_{i,t-1} - 0.075\Delta Fd_{i,t-1}$$
$$(0.914) \quad (0.041) \quad (0.041)$$
$$\Delta Fd_{i,t} = \mu_1 - 5.139ec_{i,t-1} + 0.128\Delta Fd_{i,t-1} - 0.035\Delta Gdp_{i,t-1}$$

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(0.939) (0.0422) (0.042)

In French-speaking countries, the error correction term in the FD equation is consistently negative and statistically significant, suggesting a strong adjustment towards equilibrium. The error correction term in the GDP equation is positive and significant; however, the results indicate an unexpected negative short-term effect of FD on GDP growth. This indicates that, against anticipated outcomes, short-term rises in financial development result in a decrease in output growth within French-speaking countries, underscoring distinct challenges faced by these economies.

In this study, both models and the respective sets of countries are found to be non-linearly cointegrated, prompting the estimation of a Panel Smooth Transition Regression Vector Error Correction Model (PSTR-VECM). The study begins by performing linearity tests, incorporating various transition variables including the error correction term, output growth, and financial development index. These variables are selected based on the author's perspective, with the goal of capturing all potential sources of non-linearity in the dynamic interaction between financial development and output growth.

The decision to use the output growth rate as a transition variable implies that non-linearities in the relationship between the variables may fluctuate according to different stages of the business cycle. Alternatively, the use of the error correction term as the transition variable suggests that the nonlinear relationship between financial development and output growth may vary depending on deviations from the long-term equilibrium. If financial development itself is chosen as the transition variable, then the nonlinear dynamics will be influenced by the rate of change in financial development.

The results of the linearity tests are summarized in Table 4, with further detail provided in Table 5, which presents the findings from the linearity tests across both sets of countries. For English-speaking countries, the null hypothesis of linearity is strongly rejected, especially when the lagged output growth rate and error correction term are used as transition variables in the output growth equation. Similarly, when the lagged rate of financial development is used as the transition variable in the financial development equation, the null hypothesis of linearity is also strongly rejected.

Table 5. Linearity tests.

Model	Transition variable		
	$\Delta FinD_{i,t-1}$	$\Delta Gdp_{i,t-1}$	$ect_{i,t-1}$
English speaking countries			
Gdp	0.544	9.697^{***}	5.444^{***}
FinD	5.866^{***}	0.790	0.386
French speaking countries			
Gdp	1.769	5.380^{***}	5.444^{***}
FinD	5.866^{***}	2.276^{**}	5.966^{***}

Notes. F-versions of the tests were used. **,*** denote rejection of the null hypothesis at the 5% and 1%.

In French-speaking countries, there is a significant rejection of linearity in the output growth equation when either the lagged output growth rate or the error correction term is used as the transition variable. Furthermore, when the lagged rate of financial development or the error correction term is employed as the transition variable in the financial development equation, the null hypothesis of linearity is overwhelmingly rejected. Notably, the null hypothesis is rejected when the lagged output growth rate is used as a transition variable, but only at the 5% significance level.

5.2.2. PSTRVEC Model Results

English speaking countries model

$$\Delta gdp_{i,t} = -0.155 + 0.104\Delta FinD_{i,t-1} - 0.391 ect_{i,t-1} - 0.567\Delta gdp_{i,t-1+}$$

(0.073) (0.092) (0.134) (0.117)

 doi:10.20944/preprints202501.0542.v1

$$gdp_{i,t-1+}[-0.157\Delta FinD_{i,t-1} + 0.494\Delta gdp_{i,t-1} - 0.009ect_{i,t-1}]G(\Delta gdp_{i,t-1};\gamma;c)$$
(0.081) (0.097) (0.143)

$$\Delta FinD_{i,t} = -0.003 - 0.049\Delta FinD_{i,t-1} - 0.133ect_{i,t-1} + 0.178\Delta gdp_{i,t-1+}$$
(0.058) (0.082) (0.049) (0.096)

$$gdp_{i,t-1+}[-0.518\Delta FinD_{i,t-1} - 0.151\Delta gdp_{i,t-1} - 0.129ect_{i,t-1}]G(\Delta gdp_{i,t-1};\gamma;c)$$
(0.121) (0.078) (0.104)

$$G(\Delta gdp_{i,t-1};\gamma;c) = (1 + \exp(-772(\Delta gdp_{i,t-1} - 0.122)))^{-1}$$
(0.000) (0.000)

The model reveals regime changes governed by a transition function, with output growth (y) and financial development (c) significantly influencing the speed of transition and the conversion midpoint. The threshold value of −12.2% indicates transitions between regimes characterized by both negative and positive output growth rates, with a low but statistically significant speed of adjustment estimated at −0.772, suggesting gradual shifts. For English-speaking countries, the output growth equation shows that in low-growth regimes, the error correction term's coefficient is −0.391-0.391−0.391, statistically significant, indicating a 39% annual correction to long-term equilibrium, while the lagged financial index has an insignificant 0.10% short-run effect on growth. In high-growth regimes, the adjustment rate increases to −0.4 (calculated as −0.391−0.009), and the influence of financial development diminishes. For the financial development equation, the error correction term coefficients are −0.133 and −0.262 (calculated as −0.133−0.129) for low- and high-growth regimes, respectively, with statistically significant adjustment at 13% annually only during low-growth periods. These findings illustrate the dynamic and regime-dependent relationship between financial development and output growth.

French speaking countries model

$$\Delta gdp_{i,t} = 0.014 - 0{,}003\Delta FinD_{i,t-1} - 0.399ect_{i,t-1} - 0.295\Delta gdp_{i,t-1+}$$
(0.021) (0.190) (0.089) (0.117)

$$gdp_{i,t-1+}[0.048\Delta FinD_{i,t-1} + 0.137\Delta gdp_{i,t-1} - 0.010ct_{i,t-1}]G(\Delta gdp_{i,t-1};\gamma;c)$$
(0.034) (0.074) (0.100)

$$\Delta FinD_{i,t} = 0.021 - 0.421\Delta FinD_{i,t-1} - 0.046ect_{i,t-1} - 0.136\Delta gdp_{i,t-1+}$$
(0.038) (0.051) (0.064) (0.074)

$$gdp_{i,t-1+}[-0.021\Delta FinD_{i,t-1} - 0.104\Delta gdp_{i,t-1} + 0.015ect_{i,t-1}]G(\Delta gdp_{i,t-1};\gamma;c)$$
(0.120) (0.106) (0.107)

$$G(\Delta gdp_{i,t-1};\gamma;c) = (1 + \exp(-363(\Delta gdp_{i,t-1} - 0.100)))^{-1}$$
(0.000) (0.000)

The output growth equation reveals that the estimated coefficients indicate a negative influence on $\Delta gdp_{i,t}$ from the lagged financial development (−0.003), the error correction term (−0.399), and its own lag (−0.295). Furthermore, the component related to smooth transitions, as defined by the transition function $G(\Delta gdp_{i,t} - 1;\gamma;c)$, indicates that financial development (0.048) and lagged output growth (0.137) exert positive yet modest influences, whereas the error correction term (−0.010) plays a role in moderating this relationship.

In the financial development equation, $\Delta FinD_{i,t}$ is notably affected by its lag (-0.421), the error correction term (-0.046), and lagged output growth (-0.136), each exhibiting negative coefficients. The transition function $G(\Delta gdp_{i,t} - 1;\gamma;c)$ indicates that in high-growth regimes, the interaction terms reveal negative effects from lagged financial development (-0.021) and lagged output growth (-0.104), while the error correction term shows a positive influence (0.015). The transition function, $G(\Delta gdp_{i,t} - 1;\gamma;c) = (1 + exp(-363(\Delta gdp_{i,t} - 1 - 0.100))) - 1$, indicates a distinct shift between regimes, characterised by a threshold value of 0.100 and a steep slope of γ=363. The results highlight the varying interactions dependent on the regime, indicating that both output growth and financial development respond differently at various stages of growth.

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5.2.3. Regime Wise Causality Tests

The concluding phase of the examination involves scrutinising the Granger causality results within the context of specific regimes. This examination involves the analysis of lagged variables to determine short-run causality and assess the speed of adjustment for long-term causality. The findings have been summarised and are presented in Table 6.

Table 6. Regime wise causality tests.

Source of causation	Dependent variable			
	ΔGdp		ΔFinD	
	Recession	Expansion	Recession	Expansion
English speaking countries				
In the short run				
ΔGdp			*3.265**	1.884
ΔFinD	1.284	*4.899****		
		In the long run		
ect	*4.616****	*11.775***	*5.042**	*2.716***
French speaking countries				
In the short run				
ΔGdp			*3.389**	1.999
ΔFinD	0.029	1.043		
		In the long run		
ect	*11.113****	*12.154****	1.845	1.179

*,**,*** denote rejection of no granger causality at the 1%, 5% and 10%.

The findings presented in the table indicate that English-speaking countries exhibit distinct short-term and long-term dynamics. In times of low economic growth, a statistically significant correlation exists between output and financial development, where output demonstrates a granger-causal relationship with financial development at a 10% significance level. In periods characterised by significant economic growth, the causality shifts, indicating that financial development precedes and influences output growth. The importance of the test for rejecting the null hypothesis is evident at the 1% level. The findings suggest that, in the short term, the null hypothesis is accepted, which implies that there is no causal relationship between output and financial development in high-growth regimes. In a similar vein, one can observe that there is no causal link between financial development and output in low-growth regimes. In the context of long-run analysis, it is evident that financial development has a Granger causal relationship with output in both regimes, as the null hypothesis is robustly rejected in each scenario. The results further suggest that output Granger causes financial development in both regimes over the long term. The null hypothesis that output does not Granger cause financial development is consistently rejected, particularly in high growth regimes.

The findings for French-speaking countries indicate notable disparities. The Granger causality findings indicate that, in the short term, only output growth exerts a causal effect on financial development within low-growth regimes. Over time, a clear pattern emerges indicating that the progression of financial systems correlates with increased output in both low and high growth regimes, as demonstrated by Granger causality analysis. The robust dismissal of the null hypothesis at the one percent significance level over the long term underscores the critical role of financial development in facilitating sustained economic growth. This indicates that in nations where French is prevalent, the enduring relationship between financial development and output growth is marked by financial development preceding economic expansion. This highlights the importance of developing a strong and forward-thinking financial sector for overall economic advancement. The findings illustrate the significant correlation between financial development and economic growth in French-speaking African nations. Additionally, they underscore the necessity for policymakers to

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adopt a thorough and targeted approach to foster a resilient financial system capable of sustaining long-term economic growth.

6. Conclusions

These findings underscore the importance of considering the nuanced nature of the financial development-economic growth nexus, as advocated by the Endogenous Growth Theory. The presence of threshold effects and asymmetries suggests that policymakers need to adopt adaptive economic policies that recognize the varying impacts of financial development on economic growth in different phases, aligning with the principles of the Neoclassical Growth Model. Furthermore, the observed Granger causality relationships highlight the need for tailored policy interventions that address the unique dynamics of both low and high-growth regimes, resonating with the principles of the Keynesian and Schumpeterian Theory.

In English-speaking countries, it is advisable that Policymakers should give priority to implementing adaptive economic policies that recognize the subtle effects of financial development during various stages of growth. This requires the ability to respond to both periods of low and strong economic growth quickly and effectively, enabling flexible adaptations to changing economic conditions. Moreover, it is advisable to make continuous investments in financial infrastructure, considering the importance of long-term relationships and the findings of Granger causality. Additionally, policymakers should build strong monitoring and surveillance tools to regularly examine regime-wise Granger causation.

Policymakers in French-speaking nations are strongly advised to develop customized policy responses. These measures should be carefully adjusted to cater to the distinct features of both recessions and expansions, recognizing the varied outcomes of financial development in each stage. Given the identification of the Granger causation association between output growth and financial progression, it is advisable for policies to prioritize measures that promote stability in output growth. Economic stability can lead to a positive cycle of influence, affecting financial progress, and vice versa. Efforts focused on including a broader portion of the people in the financial system can have a substantial influence on long-term economic expansion. Furthermore, it is recommended to adopt a versatile approach to economic planning. Policymakers should include adaptive strategies that address evolving causal relationships, thus strengthening the robustness of economic policies in the dynamic context of French-speaking countries in Africa.

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References

1. Abeka, M., Andoh, E., Gatsi, J. and Kawor, S. 2021. Financial development and economic growth nexus in SSA economies: The moderating role of telecommunication development. *Cogent Economics & Finance*, 9(1), p.1862395.
2. Adeniyi, O., Oyinlola, A., Omisakin, O. and Egwaikhide, F. 2015. Financial development and economic growth in Nigeria: Evidence from threshold modelling. *Economic Analysis and Policy*, 47, pp.11-21.
3. Agbetsiafa, D. 2004. The finance growth nexus: evidence from Sub-Saharan Africa. Savings and Development, pp.271-288.

 doi:10.20944/preprints202501.0542.v1

4. Akinboade, O.A. 1998. Financial development and economic growth in botswana: a test for causality/développement financier et croissance économique au botswana: un test de causalité. Savings and Development, pp.331-348.
5. Akinlo, A.E. and Egbetunde, T. 2010. Financial development and economic growth: The experience of 10 sub-Saharan African countries revisited. The review of finance and banking, 2(1).
6. Al-Yousif, Y.K. 2002. Financial development and economic growth: another look at the evidence from developing countries. Review of financial economics, 11(2), pp.131-150.
7. Arcand, J.L., Berkes, E. and Panizza, U. 2015. Too much finance?. Journal of Economic Growth, 20(2), pp.105-148.
8. Arestis, P., Demetriades, P.O. and Luintel, K.B. 2001. Financial development and economic growth: the role of stock markets. Journal of money, credit and banking, pp.16-41.
9. Asongu, S. A., & Odhiambo, N. M. 2021. Mobile Phones, Institutional Quality, and Financial Inclusion in Africa. Journal of Economic Studies, 48(3), 633-658.
10. Assefa, T. and Mollick, A. 2017. Financial Development and Economic Growth in Africa. *Journal of African Business*, 18(3), pp.320-339.
11. Bai, J. 2009. Panel data models with interactive fixed effects. *Econometrica*, *77*(4), pp.1229-1279.
12. Banerjee, A., Dhillon, I., Ghosh, J. and Merugu, S. 2004. An information theoretic analysis of maximum likelihood mixture estimation for exponential families. In *Proceedings of the twenty-first international conference on Machine learning* (p. 8).
13. Beck, T., Demirgüç-Kunt, A. and Levine, R. 2000. A new database on the structure and development of the financial sector. *The World Bank Economic Review*, *14*(3), pp.597-605.
14. Beck, R., Georgiadis, G. and Straub, R. 2014. The finance and growth nexus revisited. *Economics Letters*, *124*(3), pp.382-385.
15. Ben Jedidia, K., Boujelbène, T. and Helali, K. 2014. Financial development and economic growth: New evidence from Tunisia. *Journal of Policy Modeling*, 36(5), pp.883-898.
16. Betz, F. 2015. Disequilibrium Systems Representation of Growth Models—Harrod-Domar, Solow, Leontief, Minsky, and Why the U.S. Fed Opened the Discount Window to Money-Market Funds. Modern Economy, 6, 1189-1208. http://dx.doi.org/10.4236/me.2015.612113
17. Bittencourt, M. 2012. Financial development and economic growth in Latin America: Is Schumpeter right?. Journal of Policy Modeling, 34(3), pp.341-355.
18. Calderón, C. and Liu, L. 2003. The direction of causality between financial development and economic growth. Journal of development economics, 72(1), pp.321-334.
19. Caporale, G.M., Howells, P. and Soliman, A.M. 2005. Endogenous growth models and stock market development: evidence from four countries. Review of Development Economics, 9(2), pp.166-176.
20. Cecchetti, S.G. and Kharroubi, E. 2012. Reassessing the impact of finance on growth.
21. Chen, K., Wu, L. and Wen, J. 2013. The relationship between finance and growth in China. *Global Finance Journal*, 24(1), pp.1-12.
22. Christopoulos, D. K. and Tsionas, E. G. 2004. "Financial development and economic growth: evidence from panel unit root and cointegration tests." Journal of development Economics 73(1): 55-74.
23. Chukwu, J.O. and Agu, C.C. 2009. Multivariate causality between financial depth and economic growth in Nigeria. African Review of Money Finance and Banking, pp.7-21.
24. Claessens, S., Van Horen, N., Gurcanlar, T. and Mercado Sapiain, J. 2008. Foreign bank presence in developing countries 1995-2006: data and trends. *Available at SSRN 1107295*.
25. Darrat, A.F., Elkhal, K. and McCallum, B. 2006. Finance and macroeconomic performance. Some evidence for emerging markets. *Emerging Markets Finance and Trade*, *42*(3), pp.5-28.
26. De Gregorio, J. and Guidotti, P.E. 1995. Financial development and economic growth. World development, 23(3), pp.433-448.
27. Deidda, L. and Fattouh, B. 2002. Non-linearity between finance and growth. Economics Letters, 74(3), pp.339-345.
28. Demetriades, P.O. and Hussein, K.A. 1996. Does financial development cause economic growth? Time-series evidence from 16 countries. Journal of development Economics, 51(2), pp.387-411.

 doi:10.20944/preprints202501.0542.v1

29. Demirgüç-Kunt, A., and Levine, R. 2008. "Finance, Financial Sector Policies, and Long- Run Growth." M. Spence Growth Commission Background Paper 11, World Bank, Washington, DC.
30. Domar, E.D. 1946. Capital expansion, rate of growth, and employment. *Econometrica, Journal of the Econometric Society*, pp.137-147.
31. Durusu-Ciftci, D., Ispir, M.S. and Yetkiner, H. 2017. Financial development and economic growth: Some theory and more evidence. Journal of policy modeling, 39(2), pp.290-306.
32. Easterly, W. 1997. The ghost of financing gap: how the Harrod-Domar growth model still haunts development economics (No. 1807). World Bank Publications.
33. Eltis, W. 1987. "Harrod-Domar growth model." The New Palgrave: A Dictionary of Economics 4: 602-604. growth: New evidence from Tunisia. *Journal of Policy Modeling*, 36(5), pp.883-898.
34. Egbetunde, T. and Akinlo, A.E. 2019. Financial globalization and economic growth in sub-Saharan Africa: The role of institutional quality. Acta Universitatis Danubius. Œconomica, 15(4).
35. Ergungor, O.E. 2004. Market-vs. bank-based financial systems: Do rights and regulations really matter?. Journal of Banking & Finance, 28(12), pp.2869-2887.
36. Faujas, A. 2012. *Africa: Why francophones are lagging behind Anglophones*, *The Africa Report.com*. Available at: https://www.theafricareport.com/7810/africa-why-francophones-are-lagging-behind-anglophones/ (Accessed: 04 June 2022).
37. Graff, M. and Karmann, A. 2003. what determines the finance-growth nexus? An endogenous growth model and empirical evidence (No. 73). KOF Working Papers.
38. Hassan, M., Sanchez, B. and Yu, J. 2011. Financial development and economic growth: New evidence from panel data. *The Quarterly Review of Economics and Finance*, 51(1), pp.88-104.
39. Hicks, J.R. 1969. A theory of economic history.
40. Hussain, M.N. and Planning, S. 2000. Exorcism of the Ghost An Alternative Growth Model for Measuring.
41. Hsueh, S.J., Hu, Y.H. and Tu, C.H. 2013. Economic growth and financial development in Asian countries: A bootstrap panel Granger causality analysis. *Economic modelling*, *32*, pp.294-301.
42. Huang, H.C. and Lin, S.C. 2009. Non-linear finance–growth nexus: A threshold with instrumental variable approach 1. Economics of Transition, 17(3), pp.439-466.
43. Ibrahim, M. and Alagidede, P. 2018. Nonlinearities in financial development–economic growth nexus: Evidence from sub-Saharan Africa. *Research in International Business and Finance*, *46*, pp.95-104.
44. Law, S. and Singh, N. 2014. Does too much finance harm economic growth?. *Journal of Banking & Finance*, 41, pp.36-44.
45. Jedidia, K.B., Boujelbène, T. and Helali, K. 2014. Financial development and economic growth: New evidence from Tunisia. *Journal of Policy Modeling*, *36*(5), pp.883-898.
46. Kapetanios, G., Shin, Y. and Snell, A. 2003. Testing for a unit root in the nonlinear STAR framework. *Journal of econometrics*, *112*(2), pp.359-379.
47. Kapetanios, G., Shin, Y. and Snell, A. 2006. Testing for cointegration in nonlinear smooth transition error correction models. *Econometric Theory*, *22*(2), pp.279-303.
48. Kar, M., Nazlıoğlu, Ş. and Ağır, H. 2011. Financial development and economic growth nexus in the MENA countries: Bootstrap panel granger causality analysis. Economic modelling, 28(1-2), pp.685-693.
49. Khan, M.M.S. and Semlali, M.A.S., 2000. Financial development and economic growth: an overview (No. 0-209). *International Monetary Fund*.
50. King, R. G. and R. Levine. 1993. "Finance and growth: Schumpeter might be right." The quarterly journal of economics 108(3): 717-737.
51. Kibet, L. K. and Gichira, R. 2020. Financial Development and Economic Growth in Africa: Evidence from Panel Data. Journal of African Business, 21(4), 437-458.
52. Luukkonen, R., Saikkonen, P. and Teräsvirta, T. 1988. Testing linearity against smooth transition autoregressive models. *Biometrika*, *75*(3), pp.491-499.
53. Mankiw, G. 2003. "Macroeconomics 5th edition, Worth Publishes, USA. Measurement Systems." Business Process Management Journal 11(2): 109-122.
54. Matekenya, W. 2013. The impact of oil price volatility on economic growth in South Africa: A cointegration approach.

 doi:10.20944/preprints202501.0542.v1

55. Mckinnon, R.I. 1973. Money and capital in economic development Washington DC: The Brooklings Institutiion
56. Nattrass, N. 2002. Macroeconomics: theory and policy in South Africa, New Africa Books.
57. Nattrass, N. 1997. Macroeconomics – Theory and Policy in South Africa. Journal of
58. development Economics 22(1).
59. Ng, A., Ibrahim, M.H. and Mirakhor, A. 2016. Does trust contribute to stock market development?. Economic Modelling, 52, pp.239-250.
60. Mankiw, N.G., Romer, D. and Weil, D.N. 1992. A contribution to the empirics of economic growth. *The quarterly journal of economics*, *107*(2), pp.407-437.
61. Nyasha, S. and Odhiambo, N.M. 2015. The impact of banks and stock market development on economic growth in South Africa: an ARDL-bounds testing approach. Contemporary Economics, 9(1), pp.93-108.
62. Odhiambo, N.M. 2004. Is financial development still a spur to economic growth? A causal evidence from South Africa. Savings and development, pp.47-62.
63. Odhiambo, N.M. 2007. Supply-leading versus demand-following hypothesis: Empirical evidence from three SSA countries. African Development Review, 19(2), pp.257-280.
64. Odhiambo, N.M., Nyasha, S., Zerihun, M.F. and Tipoy, C. 2018. *Financial market evolution in Africa: Is it demand-following or supply-leading?* (No. 24947).
65. Odunga, R. and Ayoyi, I.R. 2016. Impact of financial markets on the economic growth of East Africa. *European Journal of Logistics, Purchasing and Supply Chain Management*, *4*(5), pp.25-33.
66. Omay, T. and Kan, E.Ö. 2010. Re-examining the threshold effects in the inflation–growth nexus with cross-sectionally dependent non-linear panel: Evidence from six industrialized economies. *Economic Modelling*, *27*(5), pp.996-1005.
67. Omay, T. 2012. The comparison of optimization algorithms on unit root testing with smooth transition.
68. Ogun, O.D. 1986. A note on financial deepening and economic growth: Evidence from Africa. The Nigerian Journal of Economic and Social Studies, 28(2), pp.275-283.
69. Pagano, M. 1993. Financial markets and growth: An overview. European economic review, 37(2-3), pp.613-622.
70. Rioja, F. and Valev, N. 2004. Does one size fit all?: a reexamination of the finance and growth relationship. Journal of Development economics, 74(2), pp.429-447.
71. Rioja, F. and Valev, N. 2004. Finance and the sources of growth at various stages of economic development. Economic Inquiry, 42(1), pp.127-140.
72. Romer, P. M. 1990. "Endogenous technological change." Journal of political Economy 98(5, Part 2): S71-S102.
73. Rosenthal, J. 2020. *Why are some African countries improving and others not?*, *The Economist*. Available at: https://www.economist.com/special-report/2020/03/26/why-are-some-african-countries-improving-and-others-not (Accessed: 30 June 2022).
74. Roubini, N. and Sala-i-Martin, X. 1995. A growth model of inflation, tax evasion, and financial repression. Journal of Monetary Economics, 35(2), pp.275-301.
75. Ruzive, T.M. 2020. The Influence of Financial Market Development on Economic Growth in Brics Countries (Doctoral dissertation, Nelson Mandela Metropolitan University).
76. Samargandi, N., Fidrmuc, J. and Ghosh, S. 2015. Is the relationship between financial development and economic growth monotonic? Evidence from a sample of middle-income countries. *World development*, *68*, pp.66-81.
77. Schumpeter, J. A. 1942. The Process of Creative Destruction, in Capitalism, Socialism and Democracy, 36, 132-145.
78. Schumpeter, J. and Backhaus, U. 2003. The theory of economic development. In Joseph Alois Schumpeter (pp. 61-116). Springer, Boston, MA.
79. Shaw, E.S. 1973. Financial deepening in economic development.
80. Shen, C.H. and Lee, C.C. 2006. Same financial development yet different economic growth: why? *Journal of Money, Credit and Banking*, pp.1907-1944.

81. Solow, R. M. 1956. "A contribution to the theory of economic growth." The quarterly journal of economics 70(1): 65-94.
82. Teräsvirta, T. 1994. Specification, estimation, and evaluation of smooth transition autoregressive models. Journal of the american Statistical association, 89(425), pp.208-218.
83. Tobin, J. 1989. Financial Intermediaries, in Finance. London: Palgrave Macmillan UK,
84. 35–52.
85. Uddin, G.S., Sjö, B. and Shahbaz, M. 2013. The causal nexus between financial development and economic growth in Kenya. *Economic Modelling*, *35*, pp.701-707.
86. Van den Berg, H. 2013. Growth Theory after Keynes, Part I: The Unfortunate Suppression of the Harrod-Domar Model. The Journal of Philosophical Economics, 7, 2-28.
87. Winkler, A. 1998. Financial development, economic growth and corporate governance (No. 12). Working Paper Series: Finance & Accounting.
88. World Bank. 2021. *Financial Development*. [online] World Bank. Available at: <https://www.worldbank.org/en/publication/gfdr/gfdr-2016/background/financial-development> [Accessed 05 May 2021]