

## **Economic Growth, Innovation and Institutions in Emerging Economies in Africa: Evidence from Dynamic Simultaneous Equation Model**

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**Abstract:** This study simultaneously estimate dynamic model for each emerging economies in Africa which have achieve a sizeable level of economic growth overtime using annual time series data spanning 1980-2017. The choice of the period was explained by data availability as well as structural reform associated with the period. The study found long run equilibrium among real GDP, innovation proxy by high tech export and institutions in South Africa and Egypt while Nigeria, Kenya, Ghana and Senegal shown absence of long run association. Additional, the coefficient of long run estimates shows that innovation is positively and significantly related to real GDP in the short run for Egypt, Ghana, South Africa and Senegal while that of Kenya and Nigeria shows negative effect, long run coefficient of the models revealed that innovation is positively related to economic growth in Egypt, Kenya and Senegal while that of Nigeria, South Africa and Ghana shows negative relationship. This study recommend holistic approach to technological innovation in Africa as well enabling environment that allows for technological transfer and catch up process.

**Key words:** Emerging economies, real GDP, dynamic model, innovation, institutions, economic growth

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### **INTRODUCTION**

Recently emerging markets have become hub of international investment due to prospect of high returns and sustainable trade. Just like it counterparts in Asia and Latin America, emerging market economies in Africa has for long devise multi-dimensional means to attract FDI into their economies and built institutions to help in achieving robust growth. Such policies ranges from investment promotion, export promotion and trade liberalization aimed at attracting inward FDI (Casanova and Miroux, 2017; Kehl, 2007; UNECA., 2002). Historically, South Africa and Egypt were first recognized as emerging economies in Africa, during 1999-2000, a considerable number of North African countries (Algeria, Egypt, Tunisia and Morocco) were also designated as emerging economies a position that raise private capital inflow from \$4.9b-\$9.5b within a year. Africa's progress over the past few years has been outstanding, the growth in the continent can also be measure by recent enlisting of some African countries-Botswana, Ghana, Kenya, Mozambique, Nigeria, Tanzania, Uganda and Zambia by IMF to the rank of emerging market economies. African economic outlook remains positive as par global economic recovery right from the global recession, statistics shows an estimate of 3.7 and 3.8% in 2017 and 2018, respectively. This shows significant improvement from the 2.2% growth recorded in 2016 which was slowest in a decade

(IMF., 2017). Recent trend in Africa's growth was explained by four main factors; recovery in global economy; secondly, increase in domestic demand coupled with infrastructural development in the region and thirdly, development in institutions (especially, financial and political institutions), finally, decline in fiscal and current account deficit. Innovations that spur industrialization and diversification can help maintain the growth in the region overtime (OECD, 2018).

African economies has identify importance of spending on research and development as well as strengthening institutions to achieve growth (Acemoglu and Johnson, 2005; Perman and Stern, 2003; Masanjala, 1999). In the study of growth, many models emanates pointing to diverging factors as key to economic growth. Solow (1956) for instance emphasize the role of technological progress and labour force as key to steady growth while endogenous growth models led by Romer (1986) and Lucas (1988) believe that capital entails not only physical capital but also technological knowledge acquired through Research and Development (R&D) which has spill-over effect.

The link between growth and innovation dated back to the research by Schumpeter (1911) and Porter (1992). To compete favourably in international market, nations most put in extra effort to finance innovations to achieve competitive advantages (Na-Allah and Iyoboyi, 2014). Advanced industrialized economies today achieved competitive advantages through innovations and

inventions as such place them in the top rank in global GDP, emerging economies especially in Africa adopt and adapt innovative idea of the developed world to converge their growth towards world average, extent to which they were able to translate such idea into reality determine their altitude in the realm of global growth (Acemoglu, Johnson and Thaicharoen). A considerable number of literature attempts to investigate the role of institutions towards enhancing sustainable economic growth in Africa. Emanating from both theoretical and empirical literatures are fact that institutions serve as germane of inclusive growth, although, extent to which institutions impact on growth depend on the indicators of the institutions be it social, economic, political and cultural institutions but a priori expectations require that all the indicators should be positively impact on the growth, empirical evidence might prove otherwise in African economies though many hiding and glaring factors.

The purpose of this study to establish a link between economic growth and innovation on one hand as well as relationship between economic growth and institutions within the context of simultaneous equation modelling. There is literature gap on the simultaneous link among the three variables, especially in emerging markets. However, current study will add to the sparse literature on the subject matter.

**Literature review:** Past studies in this field can be divided into two lines of research. The first focuses on the relationship between economic growth and innovations financing which dates back to the pioneering work of (Schumpeter, 1911). The second line of research focuses on the relationship between economic growth and institutions.

**Studies on economic growth and innovations:** We cannot dispute the fact that large body of research work both theoretical and empirical on relationship between economic growth and macroeconomic variables existed for decades (Masanjala, 1999; Solow, 1956; Romer, 1986; Acemoglu *et al.*, 2003; O'Connell and Ndulu, 2000) to mention but a few. However, literature on the relationship between growth and innovations are sparse, remarkable one among them was the research by Schumpeter (1911) which hypothesized that entrepreneur act as an innovator and innovation was a way of economic development in the society. Since, then subsequent researches centered on the ability of the developing economies to adopt and adapt the technology of the Western world to converge their growth overtime. Early suggestion on ways through which developing economies can catch up with developed ones was through capital transfer enabled by the activities of multinational corporations, considerable growth rate was achieved by most African countries immediately after independence. Model of technology catch up was first put

forward by Veblen (1915) which stipulate that capital export is more or less importing new technology and idea to the host country such capital goods imply new technical knowledge and enhance productivity. Importing in African context may not be enough argument to acquire technology but rather the specific countries with advanced technology matters, since, technology is concentrated in few developed world. Emerging economies in Africa gain access to technical knowledge through trading with emerging Asian economies such as China and India (Falvey *et al.*, 2002).

Empirical study on nexus between economic growth and innovation can be classified into two. First group of empirical studies utilized country level data (Perman and Stern, 2003; Na-Allah and Iyoboyi, 2014; Falvey *et al.*, 2002; Maillat, 1998). While the second group focus on the capital and credit market as major source of innovation by firms and such inventions are mostly registered in patent right commission of individual countries in the world, although, both has different impact on innovation. Equity market spur innovation while credit market impedes innovation, a well-developed financial market helps in providing required fund for research and development and consequently enhance productivity (Hsu *et al.*, 2014; Aghion *et al.*, 2006; Hall, 1993; Fang *et al.*, 2010; Blundell *et al.*, 1999). Empirical estimation by Na-Allah and Iyoboyi (2014) on Nigerian data revealed positive relationship between economic growth and innovation. Johansen statistics shows long run relationship between economic growth, trade openness and government size and institutions quality. Similarly, O'Connell and Ndulu, estimated Arellano and Bond version of GMM to found positive relationship between country industrial innovation growth and economic development. Similar findings were reported by Hussain *et al.* (2011), Acemoglu and Johnson (2005).

**Studies on economic growth and institutions:** Recent trend in growth modelling has focus attention on how institutions plays a significant role in ensuring robust growth in developing economies. It has been severally hypothesized that countries with strong institutions that lock up political figures and elites from rent seeking have significant higher growth within close range compare to countries with weak institutions (Acemoglu and Johnson, 2005). Fosu (2013) empirically examine the impact of institutions on African economic performance and found that democracy as government institutions turn out to be positively impacted on the agricultural sector, also strong institutions play critical role in ensuring growth by refraining politicians from getting easy access to national resources and tightening security in the region. Flachaire *et al.* (2014) further classify institutions to measure the effect of each class on economic growth of some selected Asian countries. They estimated three

different models using panel technique their results tends to show that financial institutions proxy by stock market capitalization and domestic credit provided by banks and legal institutions measured by the quality of property rights are more effective in increasing economic growth. Sarwar *et al.* (2013) estimate second stage least square method on the data of developing and developed economies they found that anomalies in output growth and unemployment in developing economies was not cause by poor macroeconomics policies rather by weak institutions in those countries. Similar findings was reported by Aisen and Veiga (2013) though economic institutions show significant positive impact on growth, political institutions that are responsible for providing enabling environment are very weak and mostly characterized with bureaucratic bottleneck. Stable polity and unconditional change of cabinet in polity account for significant cause of dwindling effect of output growth in developing economies. In a nutshell countries that achieve rapid growth for decades maintain strong institutions and substitute the weaker institutions with new ones, so as not to jeopardize the growth rate of economy overtime (Knack and Keefer 1995; Haggard and Tiede 2011).

Evidence from previous studies revealed that various results come out of the use of different proxies, sample periods, countries and continent and econometrics techniques. We discover that there are few studies on the subject matter focusing on Africa in particular and emerging economies specifically, the main objective of this study is to fill the gap by simultaneously investigating the cross linkages between economic growth, innovation and institutions in emerging market economies in Africa.

## MATERIALS AND METHODS

In the current study, we intend to simultaneously estimate the relationship between economic growth, innovations and institutions in emerging African economies within the context of panel autoregressive distributed lagged model as earlier proposed by Pesaran *et al.* (2001). As against this background, we collected annual series on panel of 6 selected emerging market economies from 1981-2017. The choice of the period was explained by institutional reforms as well as transition from autocratic to democratic dispensation in the region. World development indicators and world governance indicators prepared by World Bank is the major and exclusive source of data for this analysis.

**Variable measurement:** Real GDP per capita will serve as proxy for economic growth following the general convention in the study of growth available in literatures (Masanjala, 1999).

**Innovation:** Choice of proxy for innovation is highly explained by data availability. Studies from US and China mostly used research and development as well as number of patent right registered by firms in a particular country. Unfortunately such data is not available for African countries in some instance where the data is available it is incomplete and unbalance. A reasonable available data in this respect is high tech export which has also been used as proxy for innovation by several studies. For more detail see (Blundell *et al.*, 1999; Hussain *et al.*, 2011).

**Institution:** Several proxy has been used previously. It is important to classify institutions according the roles played in enhancing growth just the way it has been classified by Flachaire *et al.* (2014). The quality of institution is categorized into two: economic institutions and political institutions. Economic institution is proxy by rule of law while political institution is proxy by democratic accountability and political stability.

**Trade openness:** This is measure as total trade share of GDP.

## RESULTS AND DISCUSSION

Table 1 depicts the results of the ADF and P-P tests of the unit root test for selected emerging economies annual time series data. The table shows that with exception of few variables that shows stationarity at level all other variables are stationary after the first difference. This can be seen by comparing the observed values (in absolute terms) of the ADF and PP test statistics with the critical values of the test statistics at the 1, 5 and 10% levels of significance. The results provide strong evidence of stationarity in both level and first difference. Therefore, the null hypothesis is accepted and it is sufficient to conclude that there is a unit root in the variables at the various levels except for some variables in nearly all the countries. Thus, the null hypothesis of non-stationarity is rejected and it is harmless to settle that the variables are stationary at I (0). On the other hand, the rest of the variables are stationary at I (1). This implies that the variables are jointly integrated in order zero and one that is I (0) and I (1) which signifies an incentive to apply the ARDL approach.

A long-run equilibrium relationship among real GDP, high-tech export, political institutions, economic institutions and trade openness was found at the 1% significance level in Egypt and South Africa but there is no long-run relationship among these variables in the case of Ghana, Kenya, Nigeria and Senegal. While alternating the models for each country, long run equilibrium is detected for example in the case of high-tech model in Ghana, Kenya and Nigeria (Table 2).

Table 1: Unit root test

| Variables      | Egypt        |             | Ghana               |             | Kenya          |             |
|----------------|--------------|-------------|---------------------|-------------|----------------|-------------|
|                | ADF          | KPSS        | ADF                 | KPSS        | ADF            | KPSS        |
| Lnrgdpp        | 0.467578     | 0.17776***  | -1.416430           | 0.151704    | -3.029240      | 0.0852290   |
| Lnhightech     | -3.190553    | 0.106314*   | -1.594607           | 0.107157    | -2.289578      | 0.166481*** |
| Lntop          | -2.524179    | 0.114861*   | -3.094576           | 0.114650*** | -2.808143      | 0.087546    |
| Lneconins      | -3.855734*** | 0.119295    | -4.470106***        | 0.500000    | -2.517853      | 0.204165*** |
| Lnpolins       | -2.898007    | 0.129903    | -3.81039***         | 0.149918*   | 3.145112       | 0.188369*   |
| Δ Lnrgdpp      | -3.56230***  | 0.117361*   | -4.110990***        | 0.092105*   | -4.136892***   | 0.097283*   |
| Δ Lnhightech   | -6.105958*   | 0.089587*   | -6.309336*          | 0.176079*   | -5.861831*     | 0.258249*   |
| Δ Lntop        | -2.515403*** | 0.131454*** | -4.095252***        | 0.142794*** | -3.710368***   | 0.120856*** |
| Δ Lneconins    | -7.335374*   | 0.191217*   | -5.517967*          | 0.499921*   | -5.206226*     | 0.085397*   |
| Δ Lnpolins     | -4.818688*   | 0.217150*   | -5.138874*          | 0.50000***  | -2.751432*     | 0.131876*** |
| <b>Nigeria</b> |              |             | <b>South Africa</b> |             | <b>Senegal</b> |             |
| Lnrgdpp        | -4.869808*   | 0.103016    | -2.196569           | 0.122197    | -2.674781      | 0.079079    |
| Lnhightech     | -4.637478*   | 0.117834    | -2.668774           | 0.067550*   | -2.315370      | 0.159871    |
| Lntop          | -2.120321    | 0.185446    | -3.192126           | 0.139719    | -5.650523*     | 0.093350*   |
| Lneconins      | -0.903583    | 0.175761    | -4.264623***        | 0.348846    | 0.306226       | 0.118835    |
| Lnpolins       | -8.534689*   | 0.194091*** | -2.018802           | 0.139164*** | -4508473*      | 0.076547    |
| Δ Lnrgdpp      | -5.462543*   | 0.116978*** | -2.79397***         | 0.094451*   | -3.252495***   | 0.103946*   |
| Δ Lnhightech   | -5.409567*** | 0.268775*   | -4.333580***        | 0.064680*   | -3.947409***   | 0.204440*** |
| Δ Lntop        | -6.552221*   | 0.50000     | -4.404241***        | 0.178577*** | -5.092514*     | 0.320152*   |
| Δ Lneconins    | -5.228399*   | 0.127612*** | -3.36727***         | 0.459344*   | -10.16783**    | 0.138055*** |
| Δ Lnpolins     | -7.973345*   | 0.148186*   | -7.432854*          | 0.064489*   | -7.282614*     | 0.230396*   |

\*, \*\*, \*\*\* denotes the significant level of 1, 5 and 10%, respectively; For ADF and P-P tests,  $H_0$ : series has a unit root

Table 2: Cointegration among the variables (F-bound test with intercept)

| Models  | Egypt         |                  | Ghana         |                  |
|---|---------------|------------------|---------------|------------------|
|   | F-bound value | Decision         | F-bound value | Decision         |
| $F_{lnrgdpp}$ (lnrgdpp/lnhightech, lntop, lneconins, lnpolins)    | 23.77839*     | Cointegrated     | 1.262771      | No cointegrated  |
| $F_{lnhightech}$ (lnhightech/lnrgdpp, lntop, lneconins, lnpolins) | 544.1545*     | Cointegrated     | 4.548650***   | Cointegrated     |
| $F_{lntop}$ (lntop/lnhightech, lnrgdpp, lneconins, lnpolins)      | 8.500339*     | Cointegrated     | 2.366802      | No cointegration |
| $F_{lneconins}$ (lneconins/lnhightech, lntop, lnrgdpp, lnpolins)  | 15.18561*     | Cointegrated     | 1311.690*     | Cointegrated     |
| $F_{lnpolins}$ (lnpolins/lnhightech, lntop, lneconins, lnrgdpp)   | 2.740040      | No cointegration | 7.469102*     | Cointegrated     |
| <b>Kenya</b>  |               |                  |               |                  |
| $F_{lnrgdpp}$ (lnrgdpp/lnhightech, lntop, lneconins, lnpolins)    | 1.494131      | No cointegration | 1.958765      | No cointegration |
| $F_{lnhightech}$ (lnhightech/lnrgdpp, lntop, lneconins, lnpolins) | 33.96983*     | cointegrated     | 135.8923*     | Cointegrated     |
| $F_{lntop}$ (lntop/lnhightech, lnrgdpp, lneconins, lnpolins)      | 17.33317*     | cointegrated     | 3.718071      | No cointegration |
| $F_{lneconins}$ (lneconins/lnhightech, lntop, lnrgdpp, lnpolins)  | 37.94435*     | cointegrated     | 6.738317*     | Cointegrated     |
| $F_{lnpolins}$ (lnpolins/lnhightech, lntop, lneconins, lnrgdpp)   | 9.099699*     | Cointegrated     | 48.78662*     | Cointegrated     |
| <b>South Africa</b>   |               |                  |               |                  |
| $F_{lnrgdpp}$ (lnrgdpp/lnhightech, lntop, lneconins, lnpolins)    | 147.1260*     | Cointegrated     | 3.350825      | No cointegration |
| $F_{lnhightech}$ (lnhightech/lnrgdpp, lntop, lneconins, lnpolins) | 1.530661      | No cointegration | 1.462272      | No cointegration |
| $F_{lntop}$ (lntop/lnhightech, lnrgdpp, lneconins, lnpolins)      | 4.184693***   | Cointegrated     | 5.203040*     | Cointegrated     |
| $F_{lneconins}$ (lneconins/lnhightech, lntop, lnrgdpp, lnpolins)  | 3.440210      | Inconclusive     | 11.23406*     | Cointegrated     |
| $F_{lnpolins}$ (lnpolins/lnhightech, lntop, lneconins, lnrgdpp)   | 87.69691      | Cointegrated     | 13.88908*     | Cointegrated     |

\*, \*\* denotes significant level of 1 and 5%, respectively

Table 3 shows the result of both short run and long run estimates of the ARDL with corresponding diagnostic tests. It shows that innovation being proxy by high-tech export is positively and significantly related to real GDP in the short run for Egypt, Ghana, South Africa and Senegal while that of Kenya and Nigeria shows negative. With exception of Egypt and South Africa, trade openness impact positively on economic growth. It has been observed that economic institutions has positive effect on economic growth of Egypt and Kenya while negatively related to growth in case of Ghana, Nigeria, South Africa and Senegal. Similarly, political institutions produced negative effect on growth of Egypt, South Africa and Senegal, although, not statistically significant in almost all the countries under investigation. Long run estimation

revealed that innovation is positively related to economic growth in Egypt, Kenya and Senegal while that of Nigeria, South Africa and Ghana shows negative relationship. Trade openness shows positive and significant relationship with real GDP for Egypt and Ghana, however, negative impact on growth for the remaining economies. With exception of Nigeria, political institution shows negative and significant effect on economic growth of all the economies under investigation. Meanwhile, economic institution produced mixed result across the countries.

The error correction term of individual estimate are satisfactorily negative and statistically significant, although, the speed of adjustment to the long run equilibrium is very low in all country except Senegal with 81.9%.

Table 3: ARDL results

| Regressor                     | Egypt      | Ghana      | Kenya      | Nigeria     | South Africa | Senegal    |
|-------------------------------|------------|------------|------------|-------------|--------------|------------|
| <b>Short run coefficients</b> |            |            |            |             |              |            |
| $\Delta$ Lnhightech           | 0.0145*    | 0.0735     | -0.0361    | -0.0553**** | 0.0606*      | 0.0481***  |
| $\Delta$ Lntop                | -0.2833    | 1.9367**** | 0.4894*    | 0.0234      | -0.1954*     | 0.3403*    |
| $\Delta$ Lneconins            | 0.0433     | -0.0051    | 0.0640**   | -0.0280**   | -0.0040****  | -0.0134    |
| $\Delta$ Lnpolins             | -0.0109    | 0.0257     | 0.0232     | 0.2326      | -0.0327*     | -0.0129    |
| ECT <sub>t-1</sub>            | 0.0499*    | -0.1445*** | -0.4052*** | -0.3985***  | -0.3329*     | -0.8192**  |
| <b>Long run coefficients</b>  |            |            |            |             |              |            |
| Lnhightech                    | 5.0887*    | -0.3608*** | 0.2821**** | -0.1387**** | -0.0296      | 0.0631*    |
| Lntop                         | 10.6343*** | 2.7640***  | -1.6348*** | -0.0596     | -2.9690*     | -0.8389*** |
| Lneconins                     | -3.2808*** | 0.5421     | 0.9682     | -0.0705     | -0.0046      | -0.0162    |
| Lnpolins                      | -0.8945    | -1.5644*** | -0.9430*   | 0.5837**    | -0.1355*     | -0.0996    |
| Constant                      | -79.8818   | 4.8278     | 6.7025     | 6.2188**    | 2.9472       | 0.4869     |
| DW statistics                 | 1.87       | 2.00       | 1.56       | 0.58        | 1.56         | 1.89       |
| R <sup>2</sup>                | 0.62       | 0.55       | 0.74       | 0.47        | 0.60         | 0.68       |
| Serial correlation            | 12.832     | 21.407     | 1.458      | 0.0461      | 35.752       | 2.4580     |
| Heteroscedasticity            | 1.0381     | 0.6987     | 16.111*    | 1.1546      | 0.6921       | 13.558     |
| Normality (Jarque Bera)       | 0.1622     | 1.4492     | 0.0420     | 0.4535      | 1.7963       | 0.0428     |

\*, \*\*, \*\*\*\* denotes significant level of 1, 5 and 10%, respectively

Additionally, Table 3 equally presents diagnostics test for the models as shown below the models are free from serial correlation because we fail to reject the null hypothesis at 5%. Similarly, test of heteroscedasticity indicates that residuals of the models are homoscedastic except that of Kenya that shows residual heteroscedasticity. Jacque bera statistics indicates that residuals of the model are normally distributed while coefficient of multiple determination as shown below affirm the goodness of fit for the model estimated.

Quest for rapid economic growth in emerging economies, especially in Africa call for restructuring the economies to achieve sustainable development, mean while innovative capacity move together both in the short run and long run to achieve stable and robust economy, although, policy instrument being pursue by each and every economy differs but they should work towards gearing positive growth rate overtime. Empirical evidence from the current study shows that economic growth, institutions and innovation do not move together in the long run for most emerging economies in Africa. This is the reflection of low resource allocation to the R&D in the region, catch up process for African economies is very low, hence, contribution of high tech export to economic growth should be little expected as predicted by Veblen (1915). Each economy suffer from particular structural economic problem that limits its ability to achieve innovative technology needed for economic growth. Nigeria for example suffer from over dependency on crude oil and inability to cope with the consequential effect of external shock. South Africa prior to abandonment of apathy policy faced with economic downturn, reforms introduce aftermath has yield a positive result because it has been classified as largest economy in Africa this confirm the finding of this result where model for the economy yield long run co movement and positive impact of the innovation and institutions on economic growth in the long run.

Reforms such as Economic Recovery Program (ERP., 1983-1986) and the Structural Adjustment Program (SAP., 1987-1989) impacts (positive and negative) on the structure of the economy in Ghana coupled with huge poverty and fiscal imbalances account for low innovative capacity to stimulate growth despite a sizeable inward FDI (Kehl, 2007). The chain of adjustment programs in Kenya were aimed at restoring efficiency in all sectors of the economy and consequently raising the rate of economic growth. Economic and financial recovery program in Senegal has yield positive result in terms of reducing the role of the state in the economy. Overall performance of the economy was better observed when the economic reform on the poor was implemented in the country. All these innovation and institutional reforms has produced a desired result in the emerging economies in Africa to the extent that they attract more inward FDI China and India than any other economies.

## CONCLUSION

Findings emanating from the foregoing study revealed that innovation, institutions and economic growth are in long run equilibrium for South Africa and Egypt while the study could not find long run equilibrium among the variables for Nigeria, Ghana, Kenya and Senegal. The coefficient of short run dynamics indicate that innovation being proxy by high-tech export is positively and significantly related to real GDP for Egypt, Ghana, South Africa and Senegal while that of Kenya and Nigeria shows negative. The major implication of this study requires robust effort from the emerging economies to speedy up their technological catch up process in the light of the output growth objective, strengthening institutions and providing enabling business environment that allows for easy capital transfer should be the hallmark of African emerging economies.

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