AGRICULTURAL GROWTH NEXUS ECONOMIC GROWTH IN KENYA

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Abstract

The probe of study is to examine and test Kaldor's first growth law insights on the inter-temporal causal relationship between agricultural sector growth and economic growth in Kenya. This study employs bounds testing approach to cointegration method known as ARDL (autoregressive distributed lag) and Granger causality test. The empirical results reveal agricultural growth is a causal effect to economic growth and also economic growth is a causal effect to agricultural growth, both in the long-run relationship. This is a comforting result for agricultural economists because it validates the standard policy recommendations aimed at stimulating growth and development through expansion of agriculture.

Keywords**:** Kaldor's growth laws, Economic growth, Agriculture, Cointegration, ARDL.

1. Introduction

Kenya has experienced many economic cycles of booms and busts but it is interesting to note that most boom years were positively related to more favorable agricultural performance whereas the bust years were negatively related to poor agricultural performance. The importance of agricultural sector is reflected in relationship between its performance and that of the Key indicators like GDP and employment. Trends in the growth rates for agriculture, GDP and employment, show that the declining trend experienced in the agricultural sector growth is reflected is reflected in the declines employment and GDP as a whole (Patrick & Rosemary, 2006). Although economic growth has not been entirely determined by agricultural sector performance, the Kenyan experience indicates that agriculture has been the most important driving force in force of the economy since independence in 1963. Growth in the agricultural sector is therefore expected to have a greater impact on a larger section of population than any other sector. The development of the agricultural sector is therefore important for the development of the economy as a whole.

In spite of its tremendous potential, the performance of Kenya agriculture has been disappointing in the last three decades. The share of agricultural output in total output has declined significantly in Kenya, from about 35% in the 1960s to about 25% in 2010. In parallel with this decline, there has also been an increase in the share of service over the years from about 46% in the 1960s to about 55% in 2010. The share of the industry has increased by a small margin from about 18% in the 1960s to about 19% in 2010 (World Bank, 2012).

To understand the linkage between agriculture and the rest of the economy, it is important to view its inter-and-intra sectoral linkages in the light of the development theory literature. It is in this context that the Kaldorian sectoral growth laws (Kaldor 1966; 1967) become relevant as an approach to understanding if agriculture is the growth engine of the Kenya economy although its share in the national GDP has declined over time and if the agriculture is the driving force for the other sectors. The Kaldorian laws bring together the notion of "engine of growth" sectors and "sectoral shifts" in a simple yet informative way. The Kaldorian framework recognizes that some sectors may play a more important role in pulling the rest of the economy and in generating productivity gains through economies of scale (Felipe *et al.,* 2009). The Kaldor's Laws allow this study to address empirically the following questions: (a) Is Agriculture an engine of growth in Kenya? (b) Can Kenya expect continued economic growth, given the recent decline in agricultural development?

2. Kaldor's first Growth Law

According to Kaldor's first law, there is a strong relation between the growth of manufacturing output $\left(g_t^m\right)$ and growth rate of GDP $\left(g_t^{GDP}\right)$. Kaldor (1966) argued that the faster the growth of the manufacturing sector the faster will be the rate of growth of GDP. The explanation for the correlation between the growth of manufacturing output and the overall performance of the economy is to be found on the impact of the former on the growth of productivity in the economy. According to Kaldor this the characteristic of the transition from "immaturity" to "maturity", where "immature" economy is defined as one in which there is a large amount of labor available in low productivity sectors (particularly in agriculture) so that labor can be transferred to industry in relatively unlimited quantities. In emphasizing the importance of manufacturing, he found an insignificant relation between the growth of GDP and agriculture. To demonstrate that the agricultural sector did not have any significant impact on economic growth in developed countries, he ran a regression of GDP growth on agricultural growth $\left(g^a\right)$using a reduced form model:

$$g_t^{GDP} = \alpha + \beta g_t^a + \varepsilon_t \qquad (1)$$

Where g_t^{GDP} is the growth of GDP, is the g_t^a g rowth of agricultural output, β indicates the strength and size of the impact (elasticity) of the agricultural sector's growth on the rest of the economy and ε_t is the error term.

Kaldor's findings showed that there is no correlation between the rate of growth of GDP and agricultural output. However, while his results would have been expected by many in the profession as far as developed countries are concerned, since agriculture accounts for small proportions of national GDP in the highly developed economies (Japan, Italy, West German, France, Denmark, Netherlands, Belgium, Norway, Canada, U.K. and United States) Kaldor sampled for analysis. Clearly, the relative economic importance of agriculture in these countries is not high, and in this context it is very difficult to explain why the sector might retain its leading role in the growth process. Unlike, in several developing countries where growth of the national economy is highly correlated to growth and development in agriculture. In 2011 for example, in Kenya where the agriculture sector is the backbone of the economy and the means of livelihood for most of rural populations, agriculture contributes 25% of the GDP annually, whereas, it accounted for only 1.2% of the total output in United States (World Bank, 2012).

According to Abdulai & Reider (1996), to derive the relationship between the agricultural and non-agricultural sectors, in an economy, consider the identity:

$$GDP_t = A_t + NA_t \qquad (2)$$

That is, the Gross Domestic Product (GDP) is made up of the agriculture $\left(A_t\right)$ and non-agricultural $\left(NA_t\right)$ sectors.

However, each of the variables in equation (2) can be represented as

$$\begin{aligned} GDP_t &= (1+g_t^{GDP})GDP_{t-i} \qquad (3) \\ A_t &= \left(1+g^a\right)A_{t-i} \\ NA_t &= (1+g_t^a)NA_{t-i} \end{aligned}$$

Equations (3) can be substituted into equation (2) to obtain the following relation:

$$(1+g_t^{GDP})GDP_{t-i} = (1+g_t^{a})A_{t-i} + (1+g_t^{na})NA_{t-i} \quad (4)$$

Rearranging equation (4) gives

$$g_t^{GDP} = g_t^{a}\left(A/GDP\right)_{t-i} + g_t^{na}\left(NA/GDP\right)_{t-i} \quad (5)$$

It is apparent from equation (5) that the overall growth of the economy in period $t-1$ can be expressed as a weighted average of the sectoral growth rates in this period, where the weights are the relative share of the corresponding sectors to GDP during previous years. This implies that the rate of growth of GDP depends not only on the rate of growth of output in the agricultural sector in the same period, which represents the economic performance in period t, but also on the share of agriculture during the previous period, which is an index of cumulative performance of the agriculture until the beginning of period t (Abdulai & Reider 1996). Unlike in Kaldor's and Abdulai & Rieder's original work, equation (5) were estimated in log levels using cointegration techniques, it is the relationship in levels that captures the dynamic and equilibrium relationship between variables. It is for this reason that cointegration matters.

3. Data and methodology

The data set used in the analysis consists of annual observations over 1967 to 2014, gathered from World Bank, World Development Indicators (WDI) CD-Rom (2014). All data are in terms of value added; determined by International Standard Industrial Classification (ISIC) and were transformed into logarithm form with year 2000 referred to as the base year price. The variables are presented by 1) the value of gross domestic product of agriculture ($AGRI$) which utilizes as the proxy for agricultural variable, and 2) the total value of gross domestic product (GDP) which utilizes as the proxy for economic growth variable.

In order to examine and test Kaldor's first law, insights on the inter-temporal causal relationship between agricultural sector growth rate and economic growth rate in Kenya, this study follows the following procedures.

Firstly, according to the time series econometrics literature, the regression results may be spurious if the variables are non-stationary (Grander and Newbold, 1974). The non-stationary means that the mean and variance of the time series are unstable throughout the period of the time and the auto-covariance is varying by the time change (Enders, 2004). Therefore, the stationarity properties of the time series data used were examined with the aim of determining their order of integration. Thus, unit root tests were carried out by employing the Augmented Dickey Fuller (ADF) (1981) and Philips-Perron (PP) (1988) unit roots tests.

Secondly, the long-run relationship between the variables ($AGRI$) and (GDP) was examined empirically by employing the Autoregressive Distributed Lag (ARDL) bounds testing approach. The ARDL modeling approach was originally introduced by Pesaran and Shin (1999) and further extended by (Pesaran *et al*., 2001). This approach is based on the estimation of an Unrestricted Error Correction Model (UECM) which enjoys several advantages over the conventional type of cointegration techniques. First, it can be applied to a small sample size study (Pesaran *et al.*, 2001) and therefore conducting bounds testing will be appropriate for the present study. Second, it estimates the short- and long-run components of the model simultaneously, removing problems associated with omitted variables and autocorrelation. Third, the standard Wald or F-statistics used in the bounds test has a non-standard distribution under the null hypothesis of no- cointegration relationship between the examined variables, irrespective whether the underlying variables are $I(0)$, $I(1)$ or fractionally integrated. Fourth, this technique generally provides unbiased estimates of the long-run model and valid t-statistic even when some of the regressors are endogenous (Harris and Sollies, 2003). Inder (1993) and Pesaran and Pesaran (1997) have shown that the inclusion of the dynamics may correct the endogenity bias. Fifth, the short as well as long-run parameters of the model could be estimated simultaneously. Sixth, once the orders of the lags in the model have been appropriately selected, we can estimate the cointegration relationship using a simple Ordinary Least Squares (0LS) method.

In view of the above advantages, the ARDL-UECM model is utilized to present the Kaldorian approach in estimating the direction of a long-run causal relationship between agricultural and economic growth, which can be expressed by in Equation (6) as follows;

$$\Delta \ln GDP_t = \beta_0 + \beta_1 \ln GDP_{t-1} + \beta_2 \ln AGRI_{t-1} + \sum_{i=1}^{p} \delta_1 \Delta \ln GDP_{t-i} + \sum_{i=0}^{q} \delta_2 \Delta \ln AGRI_{t-j} + \varepsilon_t \quad (6)$$

where, *GDP* and *AGRI* are gross domestic product and agricultural gross domestic product, Δ denotes a first different order, ln represents a natural logarithmic transformation; β_0 is an intercept, β_1 and β_2 are the long-run coefficients, the terms with the summation signs represent the error correction dynamics, ε_t is the white noise error.

The first step in the ARDL bounds testing approach is to estimate Equation (1) by ordinary least squares in order to test the existence of a long-run relationship among variables by conducting an F-test for the joint significance of the coefficients of the lagged level variables. Therefore, the condition of testing the null hypothesis of no cointegration must hold such that:

$$H_0 : \beta_1 = \beta_2 = 0$$

and

$$H_1 : \beta_1 \neq \beta_2 \neq 0$$

Peseran and Smith (1999) provided two asymptotic critical values for cointegration test when the independent variables are $I(m)$ where $0 \leq m \geq 1$. A lower value assumes the regressors are $I(0)$ and an upper value assumes that the regressors are purely $I(1)$. If the computed F-test (test statistic) is above the upper bound critical value, then the null hypothesis will be rejected irrespective of the orders of integration for the time series. Contrary, if the computed F-statistic falls below the lower bound critical value, then the null hypothesis cannot be rejected. Lastly, if the test statistics fall within the critical value bounds, inferences remain inconclusive. Under such circumstance, knowledge of the order of integration of the underlying variables is needed to proceed further.

In the second step, once the cointegration is determined, the conditional ARDL (*p, q*) long-run model for GDP_t can be estimated as follows;

$$\ln GDP_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \ln GDP_{t-i} + \sum_{i=0}^{q} \beta_2 \ln AGRI_{t-j} + \varepsilon_t \quad (7)$$

Equation (7) is estimated by using OLS, and the estimated error, $\hat{\varepsilon}_t$ can be obtained to apply in equation (8) as an error correction term. The orders of the ARDL (p, q) model in the two variables are selected by using Schwarz Information Criterion (SIC) and Akaike Information Criteria (AIC).

In the third and final step is the estimation based on UECM-ARDL model. If there is cointegration between the two variables, then the ECM model can be utilized. This model is derived from obtaining the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. This is expressed as follows;

$$\Delta \ln GDP_t = \beta_0 + \sum_{i=1}^{p} \delta_1 \Delta \ln GDP_{t-i} + \sum_{i=0}^{q} \delta_2 \Delta \ln AGRI_{t-j} + \varphi ecm_{t-1} + \varepsilon_t \quad (8)$$

where, δ_1 and δ_2 are the short-term dynamic coefficients of the model's convergence to equilibrium and φ is the speed of adjustment parameter and ECM is the error correction term. To ascertain the appropriateness of the ARDL-UECM model, the diagnostic and the stability tests are conducted and are reported in the results.

4. Results and discussion

4.1 Unit Roots

Before testing whether the agricultural growth and economic growth are cointegrated, the order of integration of each series is investigated. In practice, the choice of the most appropriate unit root test is difficult (Mohammad and Zulkornian 2010). Enders (1995) suggested that a safe choice is to use both types of unit root tests - the Augmented Dickey-Fuller (ADF) (1981) test and the Philips-Perron (PP)(1988) test. The PP test was taken into consideration due to the fact that PP procedures compute a residual variance that is robust to auto-correlation and are applied to test for unit roots as an alternative to ADF unit root test. Therefore, in order to determine the underlying properties of the process that generated the time series variables employed in this research; that is, whether the variables in the model are stationary or not, the approach of Augmented Dickey-Fuller and the Philips-Perron unit root tests were used. The unit roots tests were at level and first difference for both variables with a drift and trend, with drift and without trend and without a drift and trend. The optimal lag used in ADF test was selected by using Akaike Information Criterion (AIC). For the Philiph-Perron unit root tests the optimum lag lengths were determined by Newey-West Bandwith as determined by Bartlett-Kernel. The results in levels and first difference are shown in table 1.

Table 1: Unit Root Tests Results

Variables	ADF Statistics					
	Level			First Difference		
	$\tau_{\mu}(ADF)$	$\tau_{T}(ADF)$	$\tau(ADF)$	$\tau_{\mu}(ADF)$	$\tau_{T}(ADF)$	$\tau(ADF)$
$\ln AGRI$	-3.5777	-3.3466	3.7341	-3.8627*	-4.1710*	0.8166
$\ln GDP$	1.8892	-0.0249	3.7829	-8.0398*1	-7.9444*	-5.7677*
Variables	PP Statistics					
	Level			First Difference		
	$\tau_{\mu}(PP)$	$\tau_{T}(PP)$	$\tau(PP)$	$\tau_{\mu}(PP)$	$\tau_{T}(PP)$	$\tau(PP)$
$\ln AGRI$	0.9515	-3.843***	5.58947	-12.2009*	-12.4247*	-5.8663*
$\ln GDP$	2.8851	1.0473	8.2836	-3.8363*	-4.4110*	-1.4962*

Notes:*, **, *** - indicate significance at the one, five and ten per cent levels, respectively. Optimal lag length is determined by the Schwarz Bazesian Criterion (SBC). τ_{T}, τ_{μ}, τ - represent a model with a drift and trend, a model with drift without trend; and a model without a drift and trend, respectively. Source: Authors own computation, 2012

Both tests reveal that AGRI and GDP are all non-stationary at their levels but they are stationary at their first difference at 1% level of significance. The unit root test results reveal that the AGDP and GDP are integrated of order one, I(1). The essence of testing for the stationarity properties of variables is because the (ARDL) bounds testing approach to cointegration becomes applicable only in the presence of an I(0) or (1) variables. Thus the assumption of bounds testing will collapse in the presence of I(2) variable as pointed out by Omisakin (2008). The results therefore, implie that the bounds testing approach is applicable in this study since, the variables are stationary at first difference; that is I(1).

Now, a long run relationship between the series is observed. The most favorable lags are preferred by Akaike Information Criterion (AIC) which is projected by Pesarn and Shin (1999). ARDL bounds test results are shown in Table 2. The calculated F-statistics (Wald test) is necessary for testing the presence of cointegration relation among the variables.

Table 2: Results of Bounds Test for Cointegration

Computed F-Statistic: 10.7605*	Critical Values	
	Lower Bound	Upper Bounds
1% Significance Level	5.15	6.36
5% Significance Level	3.79	4.85
10% Significance Level	3.17	4.14

Notes: *, denotes significance at 1 percent level. The A symptotic critical value bounds are obtained from Table C1. iii,

Case III with unrestricted intercept and no trend for K=2 (Pesaran et. al., 1999). K is the number of the independent variables.

Based on the fact that all the variables under consideration are stationary at the first difference, the long-run coefficients can now be estimated by using the bounds test for cointegration within the ARDL model. The results on the long-run coefficients are reported in Table 3.

When gross domestic product is the dependent variable, the calculated F-statistics is F_{GDP} $(GDP \mid AGRI)$ =10.7605. This value is greater than the critical value of the top level of the bound i.e 6.36 at the 1% level. Therefore, the null hypothesis of no long-run relationship is rejected, implying long run cointegration relationship amongst the agricultural growth and economic growth.

The table 3 results reveal that the estimated coefficient of agricultural growth is positive and significant at one per cent level. It shows that in the long run 1% increase in the agricultural sector leads to approximately 0.54 per cent increase in economic growth. The empirical evidence confirms the findings of (Awokuse, 2009; Katircioglu, 2006; and Tiffin & Irn, 2006) who agreed that agriculture is still important for economic development in the long-term, and that agriculture can lead in growth of gross domestic products, particularly in developing countries.

Table 3: Estimated ARDL (2, 3) Model Long Run Results

Dependent Variable: *lnGDP*			
Variables	Coefficients	t-statistics	Prob. Values
C	-2.0414	-4.1950*	0.000
LnAGRI	0.5370	4.6342*	0.000

Notes: *, denotes significance at 1 percent level.
Source: Authors own computation, 2012

Table 4 below demonstrates the results of the model employing cointegration error, which were defined as error correction model and provide the error correction that is representative of the selected ARDL (2, 3) models. The parameter of the cointegration error (ecm_{t-1}) in the model is determined as –0.805. The most important is the sign and value of the coefficient on the ecm_{t-1} term. The negative sign and statistical significance of the coefficient –0.805 confirms the convergence process in the long-run dynamics of agricultural growth and economic growth. More, precisely it indicates that 80.5 per cent of the disequilibrium from the previous year's disequilibrium will converge back to the long-run equilibrium in the current year, suggesting a good speed of adjustment in the relationship process following a shock. The estimated coefficient of the agricultural sector is positive and significant at one per cent level. This implies that there is a statistically significant short-term and positive impact of agricultural and economic growth in Kenya.

Table 4: ARDL (2, 3) Model Error Correction Results

Dependent Variable: *lnGDP*			
Variables	Coefficients	t-statistics	Prob. Values
C	0.00039	0.08269	0.935
$\Delta lnAGRI$	0.56755	8.0876*	0.000
ecm_{t-1}	-0.80516	-2.9860*	0.005

Notes: *, denotes significance at 1 percent level.

Having established that the series are cointegrated you proceed to test for Granger causality. According to the ARDL result, there exists a long run agricultural growth and economic growth relationship. Causality relationship must exist by definition in at least one direction, and is used in Granger causality by incorporating error correction term. It is estimated to examine the possible short run and long run causalities between these variables. The results are given in table 5.

Table 5: Granger Causality Results

Causal Relationship	Causal Flow	F-Statistics	P-value
Agriculture to economic growth	AGRI → GDP	8.5385*	0.005
Economic growth to Agriculture	GDP → AGRI	3.2156***	0.07

Note: *, ** &*** denote significance at 1%, 5% and 10% level of significance

5. Conclusion and policy implication

This study addressed the Kaldorian approach by estimating Kaldor's first law in examining if agricultural growth is the driving force in Kenyan economic growth, using a newly developed ARDL bounds testing procedure that allows testing for a level of integration irrespective of the order of integration of the underlying series. As discussed in text, the empirical results of the bounds test to cointegration indicate that there is a significant long-run equilibrium relationship between the agricultural growth and economic growth in Kenya. The negatively significant coefficient of the error-correction term in ARDL model further validates the existence of an equilibrium relationship among the variables. Therefore, since Kenya economy is characterized predominantly by agriculture, the agricultural sector can serve as an "engine of growth" for the whole economy. According to (Tiffin & Irz, 2006) this view is consistent with the popular paradigm among agricultural economists that agricultural productivity growth is necessary to "get the economy" moving because it releases a surplus of food, labor, raw materials, capital, and foreign exchange, while simultaneously generating demand for industrial goods and services. This is a comforting result for agricultural economists because it validates the standard policy recommendations aimed at stimulating growth and development through expansion of agriculture. Hence, macroeconomic policies, and those designed to raise agricultural incentives, therefore need to be closely coordinated if they are to provide maximum benefit to agricultural producers.

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