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The Impact of Economic Growth on Poverty Reduction in Kenya: Empirical Analysis Using Autoregressive Distributed Lag (ARDL) Model

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ABSTRACT

This paper is an empirical analysis of the impact of economic growth on poverty reduction while controlling for inflation and employment over the period 1997-2019. The study seeks to provide insights into the process of alleviating poverty in Kenya. Empirical analysis is done using Autoregressive Distributed Lag (ARDL) model approach. The time series was first transformed into logarithmic form before contacting unit root test for stationarity using the Augmented Dickey-Fuller (ADF) test. According to the ADF test results, the dependent variable is integrated of order one while the explanatory variables are integrated of different orders. None of the variables is integrated of order above one. As a result, bounds test was used to test for cointegration. The bounds test null hypothesis of no levels relationship was rejected. Due to the presence of long-run relationship, Error Correction (EC) model was specified for estimation. The coefficient of the error correction term was negative as expected and statistically significant at 5% level. The error terms were free from serial correlation and their variance was constant. Multicolinearity was not a problem and the model was very stable thus valid for forecasting. The results provide evidence that economic growth fosters poverty reduction in Kenya.

KEYWORDS: Economic growth, poverty reduction, Autoregressive Distributed Lag (ARDL) model.

1. INTRODUCTION.

Between 2000 and 2020, Kenya experienced economic developmentof unprecedented magnitude. Despite all the gains, poverty remains a major challenge. We still have masses languishing in poverty. Achieving the first Sustainable Development Goal of ending poverty by all its forms as stipulated by the United Nations (UN)is likely not to be realised. Poverty in Kenya is defined using three poverty lines that are computed based on monthly adult consumption expenditure. The lines are; Food poverty, Overall poverty and Extreme or Hardcore poverty. Households and individuals whose monthly adult equivalent food consumption expenditure per person is less than 1,954 Kenya shillings in rural and peri-urban areas and less than 2,551Kenya shillings in core-urban areas are considered to live in Food poverty. Overall poor exist when the monthly adult equivalent total consumption expenditure per person is less than 3,252 Kenya shillings in rural and peri-urban areas and less than 5,995 Kenya shillings in core-urban areas respectively. On the other hand, when the monthly adult equivalent total consumption expenditure per person is less than 1,954 Kenya shillings in rural and peri-urban areas and less than 2,551 Kenya shillings in core-urban areas respectively, then that is extreme poverty(KNBS, 2018). Table 1 presents summary of poverty levels in Kenya within the period of study.

Table 1: Summary of poverty levels, 1997-2016

Year	Food poverty Incidence (%)	Overall Poverty Incidence (%)	Extreme Poverty Incidence (%)
1997	48.3	52.3	29.6
2005/06	45.8	45.9	19.1
2015/16	32.0	36.1	8.6
2019	**	34.4	**

Source: Kenya Integrated Household Budget Survey,(2005/06, 2015/16) and WorldBank(2022).*Note*: ** implies that the figures are yet to be updated.

The summary of poverty levels in table 1, depict a declining trend over time across all levels. Between 1997 and 2019, overall poverty declined by roughly 18%. This is equivalent to decline rate of less than a unit.

Kenya's growth has been rising gradually over time. Between 1995 and 2005, economic growth averaged at 3 percent while between 2006 and 2016, the growth remained resilient at an average of 5.2 percent. This was majorly driven by favourable macroeconomic environment and structural changes especially on the financial sector (KIHBS, 2005/6 and 2015/16).

The same period also had its own challenges. The economy experienced a myriad of major shocks such as draught, global crisis and electoral shocks that required economic recovery plans. For instance, the post-election violence of 2007/2008 brought about crisis that plummeted growth to 1.5 percent and 2.6 percent in 2008 and 2009 respectively (KNBS, 2011).

Against such background, this study seeks to determine the role of economic growth in promoting poverty reduction. Economic growth is measured using GDP per capita. On the other hand, due to lack of regular data on poverty incidence, a measure for well being is used to proxy poverty. This measure is Human Development Index (HDI).This measure captures human development in terms heath, education and standard of living and these components have been found to influence poverty. According to Rosyadi *et al,* 2020 and Amaluddin *et al,* 2018, HDI indicators have negative significant impact on poverty level.

The rest of the study is organised as follows; section 2 presents literature review. Section 3 constitutes methodology. Section 4 and 5 is on estimation results, interpretation and diagnostics and tests respectively. Lastly, section 5 is about discussions and conclusions.

2. LITERATURE REVIEW

Economic Growth has been viewed as thecentrepiece when it comes to alleviating poverty. During the years after 1950, it was greatly held that enhancing economic growth would resolve the problem of poverty(Jhingan, 2011). Economies therefore, focussed on economic growth as way of mitigating poverty. By 1970s economic growth through trickle-down effect failed to meet the expectations of uplifting people from poverty.This led to shift of focus to more directly ways like providing food grains and other basic commodities at a subsidized price. In 1980s and 1990s, there was a shift back to trickle-down theory after the World Bank had established that, economic growth had benefitted poor people even without special focus on anti-poverty measures. It is this realisation that laid the ground work for Structural Adjustment Programs (Ahuja, 2014).

Thurlow*et al* (2007) explains that, broadening the base of economic growth by way of developing the rural, investing in agriculture and infrastructure bridges inequalities thereby lowering poverty levels. AneelKarnani(2011) thinks of economic growth as engine that powers the process of poverty reduction. The study finds varying impactof economic growth to poverty reduction across countries.

Son and Kakwani(2004) present that, not all countries that have experienced same growth performance have achieved same development in poverty reduction. There are countries with great economic growth that are struggling to end poverty.Rapid economic growth may lead to a slower reduction in poverty reduction. It can alsolead to increase in poverty. It all depends with how inequality increases. In some countries, with inequality remaining constant, increase in economic growth has even resulted in an increasingly proportional decrease in poverty. Only when poverty line is less than mean income, increase in inequality causes increase in poverty.

Peter Warr (2000) studied the effect of economic growth poverty reduction in East and South East Asia economies. The results indicate that,economic growth led to changes in poverty across the chosen economies. However, the proportional change in poverty incidence from change in economic growth was not uniform across the economies. The responsiveness of poverty to change in economic growth was high in economies where on average, levels of poverty incidence is low and vice versa. So, in economies with low poverty incidence, a change in growth led to great decline in poverty as opposed to economies with high poverty incidence. The study also establishes that some change in poverty occurred irrespective of rate of growth.

Lisa Nansadiqa*et al* (2019) used Vector Error Correction Model (VECM) approach to explore the relationship between poverty and economic growth Indonesia. The analysis shows strong relationship between growth and poverty. Poverty is caused by decline in economic growth and it in turn causes economic growth to fall. There is therefore bi-directional relationship between the two.

Gary Moser *et al* (2001) related economic growth to poverty reduction in Sub-Saharan Africa over 1972-1977. By use of a panel of 46 countries established a significant connection between economic growth and poverty reduction. Their study also presented that, providing basic social services alongside ensuring low income inequality lead to low poverty levels.

The relationship between poverty and economic growth appears to be complex. While it has been established that economic growth leads to decline in poverty overtime, some countries have not succeeded in ending poverty despite having impressive growth performance.

To conclude, from the literature reviewed it can be argued that, there are varying views on the impact of growth on poverty. Economic growth may or may not lead to poverty reduction. In some economies, while growth has occurred with great reduction in poverty, in others growth has not borne any meaningful impact. These varying observations inform this study in Kenya by assessing the impact of economic growth on poverty reduction where empirical evidence is not sufficiently developed.

3. METHODOLOGY

Theoretical Framework

The economic theory relied in this study for analysing the impact of growth on poverty reduction is drawn from the theory of production. The theory is generally about transformation of inputs into outputs. It relates physical input to physical output.Output is a function of inputs.The short-run production function of a firm is studied by holding constant quantities of some factors while varying the others. Algebraically, the function is written as Q=f ($\alpha_1, \alpha_2, \alpha_3$.........) where Q is the quantity of output whileα_1,α_2,α_2 are quantities of input. This relationship implies that there exists some relationship between the output and the inputs. However, the specific form of relationship is not clear. The quantity of output that a firm would produce with each set of input would be determinedif the function was given in a mathematical form.

Model Specification

Taking the economic theory into consideration, the mathematical equation of the model for this study is specified as;

$$\text{Poverty} = \beta_0 + \beta_1 \text{GDP} + \beta_2 \text{EMP} + \beta_3 \text{CPI}$$

EconometricModel

The econometric model is formulated in equation (1)

$$\ln\text{HDI}_t = \beta_0 + \beta_1 \ln\text{GDP}_t + \beta_2 \ln\text{EMP}_t + \beta_3 \ln\text{CPI}_t + u_t \qquad (1)$$

β_1,β_2, and $\beta_3$are coefficients representing the partial elasticity of poverty reduction (HDI) with respect to economic growth (GDP),employment rate (EMP) and Inflation(CPI)respectively , u_t is the error term and subscript t is time variable.

Autoregressive Distributed Lag model

This approach by Pesaran*et al*. (2001) is the most suitable when the variables are integrated of different orders. In this model,the explanatory variables are; the lagged values of the dependent variable and the current and lagged values of regressors. The model has proved to be relatively more efficient particularly when the data sizes are small and finite. The general ARDL model is specified as

$$Y_t = \beta_{oi} + \sum_{i=1}^{p} \delta_i Y_{t-i} + \sum_{i=0}^{q} \gamma_j X_{t-i} + \varepsilon_{it}$$

Where Y_t is the dependent variable; Y_{t-i} represents lagged values of the dependent variable and; X_{t-i} is a vector of explanatory variables integrated of order zero and one: β is a constant, $i = 1, \dots \dots k$; p and q are optimal lag orders for dependent and exogenous variables respectively and ε_{it} is white noise.

The ARDL form of equation (1) isformulated in equation(2):

$$\Delta \boldsymbol{lnHDI\_d1_t} = \boldsymbol{a_{01}} + \boldsymbol{b_{11} lnHDI\_d1_{t-i}} + \boldsymbol{b_{21} lnGDP_{t-i}} + \boldsymbol{b_{31} lnEMP_{t-i}} + \boldsymbol{b_{41} lnCPI\_d1} + \sum_{i=1}^{p} \boldsymbol{a_{1i}} \Delta \boldsymbol{lnHDI_{t-i}} + \sum_{i=1}^{q} \boldsymbol{a_{2i}} \Delta \boldsymbol{lnGDP_{t-1}} + \sum_{i=1}^{q} \boldsymbol{a_{3i}} \Delta \boldsymbol{lnEMP_{t-i}} + \sum_{i=1}^{q} \boldsymbol{a_{4i}} \Delta \boldsymbol{lnCPI\_d1_{t-i}} + \boldsymbol{e_{1t}} \qquad (2)$$

Depending on the results of cointegration, either an Error Correction (EC) Model or a short-run ARDL model can be specified and estimated. In this study, EC model was specified and estimated. The general form is specified as follows;

$$\Delta Y_t = \beta_{oj} + \sum_{i=1}^{p} \delta_j \Delta Y_{t-i} + \sum_{i=0}^{q} \gamma_j \Delta X_{t-i} + \boldsymbol{\gamma} ECT_{t-1} + \varepsilon_{it}$$

Where; ECT is the error correction term. It captures the long-run relationship in the model, $\boldsymbol{\gamma}$is the speed of adjustment parameter and should have a negative sign otherwise there will not be convergence.$\delta_j$and$\gamma_j$are the short-run dynamic coefficients. $p$and$q$ are the optimal lag orders of the dependent and explanatory variables respectively. $\Delta$is difference operator, Y_t is the dependent variable; Y_{t-i} represent lagged values of the dependent variable,X_{t-i} represent lagged values of the regressors; β is a constant, $j = 1, \dots \dots k$; and ε_{it} is the error term.

The error correction model representation is specified in equation (3):

$$\Delta \boldsymbol{lnHDI\_d1_t} = \boldsymbol{b_0} + \sum_{i=1}^{p} \boldsymbol{b_{1i}} \Delta \boldsymbol{lnHDI\_d1_{t-i}} + \sum_{i=1}^{q} \boldsymbol{b_{2i}} \Delta \boldsymbol{lnGDP_{t-i}} + \sum_{i=1}^{q} \boldsymbol{b_{3i}} \Delta \boldsymbol{lnEMP_{t-i}} + \sum_{i=1}^{q} \boldsymbol{b_{4i}} \Delta \boldsymbol{lnCPI\_d1_{t-i}} + \boldsymbol{\gamma ECT_{t-1}} + \boldsymbol{e_t} (3)$$

Where: $\boldsymbol{\gamma} = (\mathbf{1} - \sum_{i=1}^{p} \delta_j)$ is the speed of adjustment parameter,

ECT=($lnHDI\_d1_{t-1} - \emptyset X_t$) is the error correction term,

$\emptyset$is the long- run parameter.

b_{1i},b_{2i},b_{3i} and b_{4i} are the short-run dynamic coefficients of the model's adjustment to long-run equilibrium.

Data Source

The study relied on secondary time-series data from 1997-2019. The data was sourced from Africa Development Bank (AfDB) and United Nations Development Programme (UNDP) data bases in Kenya National Bureau of Statistics (KNBS) Portal.

4. ESTIMATION RESULTS AND INTERPRETATIONS

Unit root test

The empirical process started by conducting unit root test to determine on whether the time series is stationary. This was done using the Augmented Dickey- Fuller (ADF) test. The method was found suitable because of its ability to take care of serial correlation in the error terms.The null hypothesis of the ADF suggests that the time series is nonstationary whereas the alternative hypothesis suggests that the time series is stationary (Dickey and Fuller, 1979). Table 2 gives a summary of the unit root test results.

Table 2: Unit root test results

	Test-statistic	**Level of significance**			**Order of Integration**
Variables		**1% Critical Value**	**5%Critical Value**	**10%Critical Value**	
lnHDI_d1	**-2.124**	**-2.602**	**-1.753**	**-1.341**	**I(1)**
lnGDP	**-1.781**	**-2.583**	**-1.746**	**-1.337**	**I(0)**
lnCPI_d1	**-3.768**	**-2.602**	**-1.753**	**-1.341**	**I(1)**
lnEMP	**-4.034**	**-2.583**	**-1.746**	**-1.337**	**I(0)**

Note: The order of integration shows the number of times the values were differenced in order to become stationary.lnHDI_d1andlnCPI_d1 became stationary after first difference while lnGDP and lnEMP are level stationary.

Table 2 shows that the values of the computed t-statistic for all the variables are smaller than the corresponding critical value of t-statistic at 5%. For this reason, the null hypothesis is rejected. However, variables lnHDI_d1 and lnCPI_d1 became stationary upon differencing once. $lnHDI\_d1$ and $lnCPI\_d1$ are integrated of order one while $lnGDP$ and $lnEMP$ are level stationary .With the dependent variable being integrated of order one and the explanatory variables integrated of different orders, we adopted the approach of Autoregressive Distributed Lag model.

Optimal Lag Length

Prior to cointegration test, it is crucial to determine empirically, the optimal lag length of the ARDL model. The optimal lag length is established through statistical criteria such the Akaike Information Criteria (AIC), Hannan-Quinn Information Criteria (HQIC), Schwarz Information Criterion (SIC). AIC is most suitable for small sample size and it tends to reduce the chances of serial correlation (Adekoya and Abdul Razak, 2017).

Table 3: ARDL model Optimal Lag Length

Selection-order criteria
Sample: 2002 - 2019 Number of obs = 18

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-34.4734				.000845	4.27482	4.3021	4.47268
1	-5.14647	58.654	16	0.000	.000204	2.79405	2.93046	3.78335
2	19.987	50.267	16	0.000	.000103	1.77922	2.02476	3.55996
3	58.6726	77.371*	16	0.000	.000026	-.741401*	-.386731*	1.83078*
4	.	.	16	.	-2.8e-55*	.	.	.

Note: * denote the optimal lag length

Due to the sample size of the data the optimal lag length was established using the AIC selection criterion. Results in table 3 shows that,the optimal lag length for the ARDL model is 3.

Cointegration Test

After determining the optimal lag length for the model and for each variable, the next step is to establish the nature of relationship among the variables. This step is important because it determines whether to specify a short-run ARDL or Error Correction Model for estimation.Since the series are integrated of different orders, we used bounds test method by Pesaran, Shin and Smith (2001). The null hypothesis suggests no levels relationship while the alternative hypothesis suggests that the null is not true. The decision criteria suggest that, we reject the null hypothesis and conclude presence of cointegration in case the calculated $F-$ statistic is greater than the critical value for the upper bound $I(1)$.One should then proceed to estimate Error Correction Model which is a long-run model. On the other hand, if the calculated $F-$ statistic is lower than the critical value for the lower bound $I(0)$, the null hypothesis should not be rejected.The conclusion is that, there is no cointegration or long-run relationship. In this case one should only estimate short-run ARDL model.

Using the Akaike Information Criteria, the optimal lags for HDI, GDP EMP and CPI are 3, 3, 3 and 2 respectively. These lags are to be imputed in the ARDL model to be able to perform bounds test.According to the bounds test the F-statistic is 4.251and is greater than 3.77, the critical value for the upper bound at 10%. We therefore reject the null hypothesis and conclude that there is cointegration. The implication of this is that, the series are related and can be combined in a linear fashion.We then proceed to estimate EC model.

Error Correction ModelEstimation Results

Table 4 shows the estimation results ofthe error correction model. The interpretation of the coefficients is simply ceteris paribus effects since these are ordinary least square estimates. 3, 3, 3 and 2 are optimal lags of the variables.

Table 4: ARDL (3, 3, 3, 2) Regression Results

Sample: 2001 - 2019 Number of obs = 19
R-squared = 0.9599
Adj R-squared = 0.8197
Log likelihood = 108.43522 Root MSE = 0.0018

D.lnHDI_d1	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnHDI_d1						
L1.	-1.841288	.5524754	-3.33	0.029	-3.375206	-.3073707
LR						
lnGDP	.0008317	.0003711	2.24	0.089	-.0001986	.0018621
lnEMP	-.0003717	.0004891	-0.76	0.490	-.0017295	.0009861
lnCPI_d1	.0014957	.0003096	4.83	0.008	.000636	.0023553
SR						
lnHDI_d1						
LD.	-.0758019	.2633314	-0.29	0.788	-.806927	.6553233
L2D.	-.2119436	.2281532	-0.93	0.405	-.8453984	.4215112
lnGDP						
D1.	-.000822	.0005087	-1.62	0.181	-.0022345	.0005904
LD.	.0000782	.0003748	0.21	0.845	-.0009623	.0011187
L2D.	-.0006712	.0003658	-1.83	0.140	-.0016868	.0003445
lnEMP						
D1.	-.000709	.0023201	-0.31	0.775	-.0071507	.0057326
LD.	-.0021646	.0014762	-1.47	0.216	-.0062632	.001934
L2D.	-.0050302	.0016041	-3.14	0.035	-.0094838	-.0005765
lnCPI_d1						
D1.	-.0016032	.0007192	-2.23	0.090	-.0036001	.0003936
LD.	-.0004668	.0003052	-1.53	0.201	-.001314	.0003805
_cons	.0454435	.057068	0.80	0.470	-.1130026	.2038895

Estimation results in table 4 depict that 96% of the variations of the dependent variable were explained by the independent variables. This helps us to conclude that, the model fits data observation very well.

-1.841288 is the adjustment parameter. The coefficient is negative and is statistically significant at 5% level. This implies that, errors of the previous period will be corrected in the current period.

A percentage point change in GDP per capita is associated with 0.0008317% increase in HDI on average, ceteris paribus at 10% level of significance.

A percentage point change in EMP is associated with 0.0003717% decrease in HDI on average, ceteris paribus. However, the results are statistically insignificant.

A percentage point change in CPI is associated with 0.0014957% increase in HDI on average, ceteris paribus at 1% level of significance.

5. DIAGONISTICS AND TEST

Autocorrelation Test

When the error terms across time periods are correlated, the standard errors of the estimated coefficients become biased hence affecting inference. To test on whether the present and past error terms have no relationship we used the Breush-Godfrey test.

This method is the most suitableespecially when the model contains lagged values of the dependent variable as regressors. The null hypothesis suggests that there is no serial correlation. The results indicate a p-value= 0.2920> 0.05. As a result, the null hypothesis is accepted.

Multicolinearity Test

Multicolinearity refers to perfect or exact linear relationship among regressors. The problem of multicolinearity interferes with the regression coefficient and statistical inference. Table 5 shows the test results using Variance Inflation factor.

Table 5: Variance Inflation Table

Variable	VIF	1/VIF
lnGDP	1.57	0.635840
lnEMP	1.52	0.657766
lnCPI_d1	1.20	0.832348
Mean VIF	1.43	

The mean of the variance inflation factor is 1.43. The standard errors of the model are inflated by 1.43 degrees. As a rule of thumb, if the VIF values exceed 10, then the regressors are related.The model is therefore free from multicolinearity.

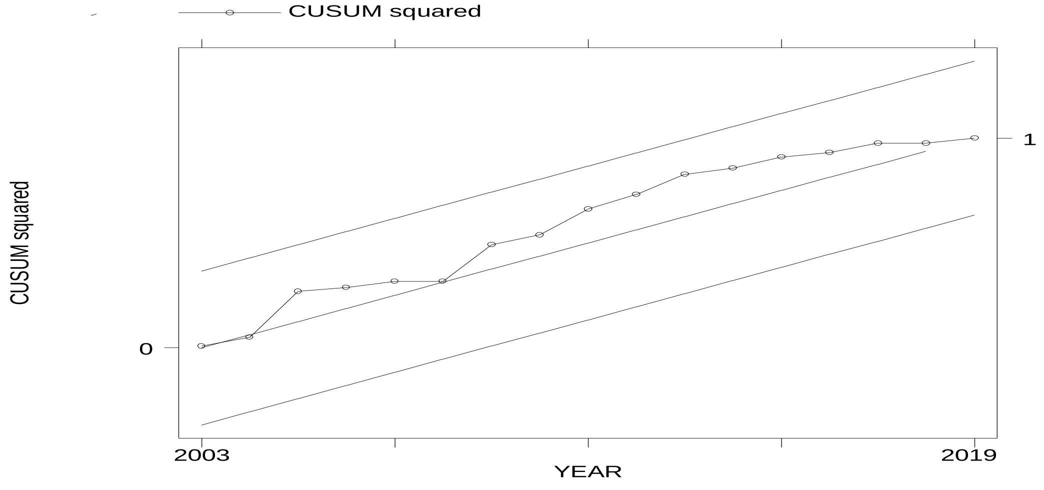
Heteroscedasticity Test

It is also important that the variance of the error terms across the observations remain constant for the regression coefficients to be efficient. This study used the Breusch-Pagan test. The null hypothesis suggests constant variance. According to the results, the p-value=0.3226>0.05. We accept the null hypothesis and conclude that, the variance of the error terms remained fixed.

Model Stability

The coefficients of a regression model should remain constant across observations otherwise the model suffers what is called structural break. This is caused by abrupt changes in the time series due to major disruptive events like shocks and change of policy. Such a model is not stable andcan be misleading if used to forecast(Mills, T.C. 2014).We used the method of CUSUM and CUSUMSQto determine the stability of the model.

Figure 1: Model Stability



In figure 1 above, the curve is within the critical bounds established at 5 percent significance level. The model istherefore very stable and the results can be used for forecasting purposes.

6. DISCUSSIONS AND CONCLUSION

According to this study, economic growth influences poverty reduction in Kenya. An increase in GDP per capita causes improvement in people's wellbeing thereby lifting them above poverty. As noted under table 1 on poverty levels, the process of fighting poverty in Kenya has been very slow. The empirical analysis of this study has confirmed that observation. One percent change in GDP per capita was associated with a far less than a unit increase in people's wellbeing. The benefits of economic growth have not had great impact in raising Kenyans from poverty.We conclude that, while economic growth has led to decline in poverty, growth alone cannot aid in eradicating poverty in Kenya.As noted earlier, the period of study had a myriad of shocks ranging from regional to international and this contributed to the limited impact of economic growth on poverty reduction. To combat povertyin Kenya effectively, a raft of measures need to be designed. We recommend the following to the policy makers;

(i) Adoption of measures to foster and sustain robust economic growthsuch assound economic recovery plans.
(ii) Economic diversification and rural development to help bridge income gaps that hinder the process of poverty alleviation.
(iii) Expanding the provision of basic social services such as education and universal health care to aid those who are vulnerable.
(iv) Agricultural development to mitigate the adverse effects of climate change that poses a challenge to achieving self-sufficiency in food production.

Adoption of the above policy measures alongside other anti-poverty measures that are already in place willgo a long way in ending poverty in Kenya.

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