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IMPACT OF STRUCTURAL ADJUSTMENT PROGRAMS ON AGRICULTURAL SECTOR GROWTH IN KENYA

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ABSTRACT

Purpose: The study was an examination of the impact of structural adjustment programs on agricultural growth in Kenya.

Methodology: The study examined the short run and long run determinants of agricultural sector performance in Kenya. To achieve this, the study use time series regression modeling for data spanning from 1975 to 2010. Tests of normality, unit roots test and cointegration test was applied to determine the properties of the data. Upon proof of cointegration, an error correction model was estimated to link the short run and the long run relationships.

Results: Results indicate that structural adjustment programme (SAPs) had a negative and significant long run effect on per capita agriculture GDP. The study concluded that Post Election Violence has a negative and significant long run effect on the per capital agriculture GDP. The study also concluded that the lagged per capital agricultural performance has a positive and significant effect on the per capita agricultural performance. The results also led to the conclusion that the long run per capita agricultural growth may be linked to the short run growth by an error correction term of -0.242583 which indicates that 0.242% of the disequilibria in short run per capita agricultural sector GDP achieved in one period are corrected in the subsequent period. The results also conclude that weather indicators (temperature and precipitation), and per capita infrastructure did not have a significant effect on the short run and long run per capita Agricultural GDP Correlation and regression results indicate that human resource management practices have a positive and significant relationship with firm performance. This was supported by correlation coefficient of 0.346; (p value 0.039) and a regression coefficient of 0.32 ;(p value 0.039) The results led to the acceptance of hypothesis that human resource management practices have a positive effect on firm performance.

Unique contribution to theory, practice and policy: The study recommends that some harmful policies need to be eliminated such as the removal of subsidies. Other policy recommendation are to enhance the adaptation of privatized agricultural institutions; encouragement of value

addition in primary agricultural products; non price mechanisms such as Infrastructure should be encouraged especially in the rural areas; and enhancement of the political stability of the country especially during electioneering years.

Keywords *SAP, determinants. agricultural growth*

1.0 INTRODUCTION

There has been a considerable amount of empirical research on the relationship between certain In 2006, almost 75 percent of working Kenyans made their living by farming, compared with 80 percent in 1980. About one-half of Kenya's total agricultural output is non-marketed subsistence production. Agriculture is also the largest contributor to Kenya's gross domestic product (GDP). In 2005, agriculture, including forestry and fishing, accounted for about 24 percent of the GDP, as well as for 18 percent of wage employment and 50 percent of revenue from exports (Mwanda, 2008). Other reports, for instance, Kirwa (2006) assert that agriculture accounts for about 26% of the GDP directly, while the indirect contribution to GDP stands at 27%. These figures are also confirmed by World Development Indicators (2012) which place the contribution of agriculture to gdp at 25.0% in year 2007, 25.8% in year 2008, 27.18% in year 2009, 25.18% in year 2010 and 23.13% in year.

The agricultural sector in Kenya is mainly constituted of smallholder farms, large mixed farms, plantations (or estates), ranches and pastoralists (mainly in the arid and semi-arid regions). The smallholder sector, accounts for over 95 percent of holdings (using a threshold of 12.5 hectares). This sector is the most dominant. About 8.6 million hectares (i.e. less than 20 percent) of land is considered to be of high or medium potential. Of this, about 2.8 million hectares are under crop production, 2.4 million hectares are under dairy farms, and the remaining 3.4 million hectares under extensive grazing and national parks.

An observed trend in agriculture throughout Africa, including Kenya, has been the steadily declining land-to-person ratio. Arable land is scarce and the problem is compounded by rapid population growth. FAO data shows that between 1960 and 2000, the amount of arable land under cultivation (including permanent crops) rose marginally, but the population of households engaged in agriculture tripled, progressively diminishing the ratio of arable land to agricultural population. This ratio is predicted to keep declining. By 2020, the land-to-agricultural person ratio may be about half as large as it was in the 1960s.

A number of policies have been formulated to revitalize the agriculture sector. Some of these policies include the Fourth and Fifth Development plans, Millenium Development Goals, Economic Recovery Strategy (ERS), the Strategy for Revitalizing Agriculture (SRA) and the Vision 2030.

Fourth and Fifth Development Plans which spanned (1979 – 83) and (1983 – 88) respectively, were aimed at addressing the incentive structure in the agricultural sector. Specifically, the plans were borne out of the need for a stabilization policy following dramatic changes in the economy. Specifically, the plans which were in the form of structural adjustment programes led to the phasing out of import restrictions and the waiver of tarrif protection (Alila and Atieno, 2006).

The economic recovery strategy (ERS) was launched by GOK in 2003.The strategy outlined the development strategy and policies that the government planned to pursue by 2008. The strategy aimed to reduce the cost of doing business and to reduce poverty by providing people with income earning opportunities. It also took into account existing policy documents, particularly the Poverty Reduction Strategy Paper (PRSP), the NARC Manifesto, and the Post Election Action Plan. The ERS strongly recognized that economic recovery is primarily the result of improvements in the productive sectors of the economy -agriculture, tourism, trade and industry.

To deal with the deteriorating economic conditions, the Kenyan government with the assistance of the World Bank designed a structural adjustment program (SAP) which was to be implemented at the beginning June 1986. The SAP aimed at facilitating economic growth as a means of jump-starting the economy towards sustainable economic growth and development.

Kimuyu (2005) asserts that Structural adjustment policies (SAPs) pursued introduced in the late 1980s are important events in Kenya's policy history. In particular, SAPs in Kenya consisted of price decontrols, tariff adjustments, the reforming of state corporations and cost sharing in the delivery of social services. Kimuyu (2005) further argues that even though the productivity consequences of most of elements of SAP were positive, the cost sharing element led to a decline in access to health and education. This negatively affected productivity.

Nyangito and Okello (1998) assert that the Kenyan dominance in private business and the consequent inability to continuously supporting the activities financially and technically, after privatization of most activities, led to a decline in agricultural growth and development. Specifically, a lack of harmony and co-ordination of the implementation for the privatization process led to poor agricultural sector performance which translated to the general poor performance of the economy.

Non Kenyan studies that have found a negative impact of Saps on agricultural sector performance include Igbedioh and Aderiye (1994), Awoyomi (1989), Momoh, (1995); Yamaguchi and Sanker (1998); Qualman and Wiebe (2002); Hazell et al (1995); Meertens (2000); Baazara (2001) and Bryceson et al (2010).

There also a host of studies that have found a positive relationship between the introduction of SAPs and agricultural performance. These include; Van Royen et al (1996) and Tackie and Abhulimen (2001); Reed, 1996; Nwosu, 1992; Olomola, 1994. The existence of studies that find appositive relationship while others find a negative relationship implies that the empirical areas are riddled with inconclusiveness

1.2 Statement of the problem.

The agricultural sector in Kenya is the backbone of the economy due to its numerous back and forward linkages in the economy. Policy measures aimed at revitalizing agriculture have been found to have wider distributional effects than policies aimed at any other sector. The performance of the Agricultural sector is crucial for food security. However, the agriculture sector has been performing dismally and this may have impacted negatively on food security.

There are many causes of food insecurity in Kenya. Authors such Nyangito (2004) have cited poor infrastructure as a possible cause of food insecurity in Kenya. Kimani (2011) argued that

poor agricultural research systems and poor weather conditions are a possible cause of food insecurity. Onjala (2002) cites lack of trade openness as a possible cause of food insecurity. The World Bank Pro-Poor Agriculture Report (2010) observes that inconsistent policies are partly to blame for the poor agricultural production and the resultant food insecurity. For instance, the report highlights various policies which are strewn across institutions responsible for agricultural production. Such institutions include the ministry of agriculture, ministry of livestock, ministry of fisheries and ministry of cooperative development. It is also evident that the PRSP and ERS were also biased against agriculture since they favored a model of industry led growth. However, the World Bank Pro-Poor Agriculture Report (2010) asserts that any policy that ignores the role of agriculture in economic growth is misguided. Therefore, World Bank Pro-Poor Agriculture Report (2010) advocates for a balanced growth model which included both agriculture and industry.

Other studies that recognize the role of policy in agriculture and its effect on food sustainability include Tackie and Abhulimen(2001) who investigated the impact of the Structural Adjustment Program on the Agricultural Sector and Economy of Nigeria.The study by Tackie and Abhulimen (2001) found a positive relationship between SAPs and agricultural production as well as the overall economy. Shimanda(1999) investigated the effect of the structural adjustment program on the increased food production in Nigeria from a local level perspective.Mwakalobo(1997) attempted to investigate the effects of price reform measures on smallholder production systems in Rungwe district (Tanzania). The study by Mwakalobo(1997) also investigated responses and changes that have taken place in smallholder agricultural production systems in the study area following the institution of price reform policies in Tanzania. Specific studies focusing on SAP and Kenya are scarce. For instance, Rono (2002) examined the effects of structural adjustment programmes (SAPs) on Kenyan society and linked SAPS to high rate of income inequality, inflation, unemployment, retrenchment, and so on, which have lowered living standards, especially, those relating to the material resources in the family. A study gap is identified in that the studies that concentrate on agricultural policy and its effects on agricultural production as well as economic growth are usually inconclusive. Specifically, the studies either paint a positive or a negative picture about SAPs and their effect on agricultural production. A study to reduce the heat to light ratio in the discourse of the impact of SAPs on agricultural production is therefore necessary. The current study sought to bridge this gap by empirically examining the impact of SAPs on agricultural growth in Kenya.

1.3 Objectives of the study

The study objectives are as follows:

i) To investigate the impact of SAPs on agricultural growth in Kenya

ii) To determine short run determinants of agricultural growth in Kenya

iii) To establish the long run determinants of agricultural growth in Kenya.

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2.0 LITERATURE REVIEW

2.1 Theoretical Foundations of the Study

2.1.2 The Classical Theory of Economic Growth and Structural Adjustment Programmes

The classical theory of economic growth was advocated by David Ricardo. He argued that the growth of a country stems from the participation in free trade resulting from the comparative advantage it has in producing goods and services. It therefore made sense to buy those goods that could not be produced at a comparative advantage and produce with an intention of selling goods which could be produced at a comparative advantage. The relevance of this theory to structural adjustment programs is obvious as structural adjustment programmes advocated for liberalization of trade. Developing countries were therefore guided to open up their local economies to competition from external economies.

2.1.3 The Harrod Dommar Growth Model and Structural Adjustment Programmes

Harrod-Domar Equation of economic growth and development indicates that the rate of growth of GDP ($\Delta Y/Y$) is determined jointly by the national saving ratio (usually expressed as a percentage), **s**, and the national capital-output ratio (expressed as an integer), k. Therefore, is a direct linear relationship between economic growth of a country and its savings ratio. The more the savings, the higher the growth in national income. In addition, the growth rate of national income is (negatively) related to the capital-output ratio of an economy, that is higher capital output ratios are associated with low rate of GDP growth.

In equation form;

$S = s(Y)$……..(1)

Savings is a function of income

$\Delta K/\Delta Y = k$ ……..……(2)

Change in capital in relation to change in income equals capital output ratio (k). K is determined exogenously

$\Delta K = k(\Delta Y)$……..(3)

Therefore, change in capital is an increasing function of changes in national income given the capital output ratio

$I = \Delta K$ and **$\Delta K = k(\Delta Y)$**……..(4)

Investment =change in capital; and change in capital is a function of changes in income given the capital output ratio

$I = k(\Delta Y)$……(5)

Investments is therefore directly related to changes in income given the capital output ratio

Therefore: since $S(Y)=I$; then $s(Y)$ can be given by;

$s(Y) = k(\Delta Y)$……(6)

Now, divide both sides of the equation above first by **Y** and then by **k**, we obtain the following equation:

s/k= ∆Y/Y…………………………………………..(7)

Note that ∆**Y/Y** is equal to the rate of growth of GDP (the percentage change in GDP)

The relevance of the Harrod Dommar model to the introduction of structural adjustment programs stems from the importance of national savings and its role in GDP growth rate. The wisdom behind the model can then be used to support calls in reduced government expenditure.

2.1.3 The Neoclassical Growth Model and Structural Adjustment Programs

Robert Solow and Stewart Swan developed the Solow-Swan Growth Model, which involved a series of equations which showed the relationship between labor-time, capital goods, output, and investment. Accordingly, the role of technological change became important, far much more important than the accumulation of capital. In equation form the solow growth model start with a production function;

Y= f(K, AL)…………………………………………………………..(8)

After several manipulations, the final solow swan model is;

$$\frac{d}{dt}k(t) = sf(k) - (g + n + \delta)k(t) \qquad (9)$$

Equation 9 is the expression for the equation of motion of capital in the Solow Growth Model. Equation 9 stipulates that capital will increase (decrease) when the amount of savings $sf(k)$ is larger (smaller) than the combined cost of technology growth $gk(t)$, labor growth $nk(t)$ and capital depreciation $\delta k(t)$.

The relevance of the model to the introduction of structural adjustment programs is that the Bretton woods institution assumed that the only way that developing countries can grow is through capital accumulation. Capital accumulation is achieved through savings. Therefore, they advocated for the reduction of government budgets and the elimination of subsidies to agricultural sectors.

2.2Empirical Review

Qualman and Wiebe (2002) conducted a review of the impact of structural adjustment programmes in Canadian Agriculture. The authors asserted that since the 1980s, the canadian government has carefully implemented every component of an IMF program :export expansion; reduced government spending, deregulation , liberalized foreign investment , privatization , term termination of subsidies and prices supports , devaluation of currency, and a general move towards "market oriented " economic reforms. Qualman and Wiebe (2002) identify various specific programs that were implemented in Canadian agriculture to include a federal government cut of $2.8 billion worth of programs from its annual agriculture spending. The authors argue that two decades of structural adjustment have devastated farm families and rural communities.

Furthermore, statistics on declining farm incomes and farm numbers tell only half the story. Specifically, the SAPs that supported exported agricultural export expansion led to the concentration of wealth in large corporations and the marginalization of the rural farmer. This in effect widened the gap between the rich and the poor.

Yamaguchi and Sanker (1998) conducted a study to evaluate the impact of structural adjustment programmes on the Sri Lankans agricultural sector with a focus on the domestic food sector. The paper used the Two Sector EquilibriumModelswith Growth Accounting Approach. The two sector identified were agricultural and non agricultural sector. In their model, agricultural production depended on factors that are fixed in the short term such as land and capital as well as variable factors such as labor and imported input fertilizer. The study concluded that although the impact of SAPs on the growth of the overall agricultural sector was positive, it was negative in relation to domestic food sector. Specifically, the changes in fertilizer prices due to SAPs had a tremendous negative effect on agricultural production and specifically domestic food production. In addition, the liberalization of food imports also negatively affected domestic agricultural food production

Bryceson et al (2010) investigated structural adjustment programmes in Africa. The authors examination of the structural adjustment programmes in African countries suggest that African agriculture's poor performance was not necessarily due to the negative effect of internal factors such as poor governance found in African governments, but could also, in large part, be attributed to the structural adjustment policies advocated by the international financial institutions and donor countries. The author argued that the solution of the problems associated with these structural adjustment policies lay in improving the ability of African farmers to benefit from new agricultural technologies that raise staple food productivity and thereby enhance food security and national stability.

Rono (2002) study examined the effects of structural adjustment programmes (SAPs) on Kenyan society. The authors noted that the economic and political reforms initiated by the World Bank and International Monetary Fund in Kenya since 1988 and especially after 1991 had transformed many aspects of the daily life of Kenyan people. The SAPs had been linked to the high rate of income inequality, inflation, unemployment and retrenchment. This had led to the unintended consequences of lowered living standards, especially, those relating to the material resources in the family. Furthermore, Rono (2002) argues that the SAPs in Kenya have been linked to the increasing social problems such as deviant and crime rates, ethnic hatred and discrimination and welfare problems, especially in the areas of education and health. However, Rono (2002) failed to systematically address the impact of SAPs on the agricultural sector productivity in Kenya.

3.0 RESEARCH METHODOLOGY

The study examined the short run and long run determinants of agricultural sector performance in Kenya. To achieve this, the study use time series regression modeling for data spanning from 1975 to 2010. Tests of normality, unit roots test and cointergarion test was applied to determine the properties of the data. Upon proof of cointegration, an error correction model was estimated to link the short run and the long run relationships.4.0

4.0 RESULTS AND DISCUSSIONS

4.1.1 Normality tests

The skewness coefficients displayed in table 4.1reveals that the distribution of the variables KAGRICGD, SAP, KCAPITAL, PRECIPITATION and TEMP was normal. This conclusion was arrived after since all the skewness coefficients were between +1 and -1 for these variables. However, the kurtosis coefficients indicate that all the variables had a leptokurtic distribution (sharp peak compared to a normal distribution) since the reported excess kurtosis was more than the rule of the thumb of -1 and +1. The high peakedness indicated lack of normality. Since skewness and Kurtosis coefficient were not conclusive on whether the data was normal or not, the Jacque Bera test offered a more conclusive test on normality.

The Jarque-Bera test statistic tested the null hypothesis that the distribution of the variables was not significantly different from a normal distribution. The test reveals that KAGRICGD, KCAPITAL, PRECIPITATION and TEMP were normally distributed as the reported p values were more than the critical p value of 0.05. High p values indicate that there is a very high probability that the distribution of the data is normal. The results indicate SAP, PEV and KINFRAST are not normally distributed as the reported p values are less than the critical p values.

Table 1: Descriptive Results before natural logs

	KAGRICGD	SAP	PEV	KCAPITAL	KINFRAST	PRECIPITATION	TEMP
Mean	20094.49	0.686	0.229	478.8	476.3	932.3	20.50
Median	19552.35	1.00	0.00	347.5	309.7	925.0	20.23
Maximum	24101.71	1.00	1.00	863.4	2366.	1304.	24.98
Minimum	16344.08	0.00	0.00	100.4	80.45	621.9	18.00
Std. Dev.	2237.916	0.471	0.426	275.6	448.4	144.6	1.655
Skewness	0.196	-0.800	1.293	0.188	2.589	0.179	0.398
Kurtosis	1.573	1.640	2.671	1.401	10.52	3.248	2.900
Jarque-Bera	3.194	6.431	9.907	3.933	121.6	0.277	0.938
Probability	0.203	0.040	0.007	0.140	0.000	0.871	0.626

Observations	35	35	35	35	35	35	35

Source: Eviews computations

The results in table 2 indicated that it was necessary to convert the variables in an effort to introduce normality. However, the study did not convert the two dummies (SAP and PEV) into their log form. The results in table 4.2 indicates that the natural log of KINFRAST is normally distributed.

Table 2: Descriptive Results after natural logs

	LNKAGRICGDP	LNKCAPITAL	LNKINFRAST	LNPRECIPITATION	LNTEMP	PEV	SAP
Mean	9.902	5.973	5.875	6.826	3.017	0.229	0.686
Median	9.881	5.851	5.736	6.830	3.007	0.000	1.000
Maximum	10.09	6.761	7.769	7.173	3.218	1.000	1.000
Minimum	9.702	4.609	4.388	6.433	2.890	0.000	0.000
Std. Dev.	0.111	0.678	0.746	0.158	0.080	0.426	0.471
Skewness	0.106	-0.362	0.314	-0.332	0.206	1.293	-0.800
Kurtosis	1.576	1.898	3.237	3.315	2.590	2.671	1.640
Jarque-Bera	3.023	2.537	0.658	0.788	0.492	9.907	6.431
Probability	0.221	0.281	0.720	0.675	0.782	0.007	0.040
Observations	35	35	35	35	35	35	35

Source: Eviews computations

4.1.2Multicollinearity test using Bivariate correlation and Variance Inflation Factor (VIF)

The next step was to check for multicollinearity among independent variables. However, even extreme multicollinearity (so long as it is not perfect) does not violate OLS assumptions. OLS estimates are still unbiased and BLUE (Best Linear Unbiased Estimators) in the presence of multicollinearity. Bivariate correlation results presented in table 4.3 indicate that there is a very

strong and significantly positive correlation between SAP and per capita Capital (lncapital) (r=0.828, p value <0.05). This implies that the two variables could be multi correlated.

Table 3: Multicollinearity test using Bivariate correlation

	lnkagricgdp	lnkcapital	lnkinfrast	lnprecipit~n	lntemp	pev	sap
lnkagricgdp	1						
lnkcapital	-0.7577*	1					
lnkinfrast	-0.1889	0.3066	1				
lnprecipit~n	-0.1989	0.3676*	-0.0082	1			
lntemp	-0.1793	0.2425	0.4106*	0.1898	1		
pev	-0.4018*	0.4300*	0.0422	0.1922	0.0956	1	
sap	-0.6386*	0.8280*	0.0165	0.2538	0.1792	0.3546*	1

*Significant at 0.05 2 tailed

Source: Stata 11 computations

A more objective test of multicollinearity is the variance inflation factor (VIF). The VIF is easiest calculated in stata. As a rule of the thumb, a VIF factor of more than 4 may imply serious mulitcollinearity. Thus further implies that as a rule of the thumb, a tolerance level (the reciprocal of VIF) should be less than 0.25. A result in table 4.4 indicates that lnkcapital introduces serious multicollinearity and it may be wise to drop it from the regression model.

Table 4: Multicollinearity test using Variance Inflation Factor (VIF)

Variable	VIF	1/VIF
lnkcapital	5.02	0.199361
sap	3.93	0.254725
lnkinfrast	1.75	0.57135
lntemp	1.39	0.717408
pev	1.26	0.795074
lnprecipit~n	1.25	0.797798

Mean VIF 2.43

Source: Stata 11 computations

4.2 Unit Root Tests

Prior to testing for a causal relationship and cointegration between the time series, the first step is to check the stationarity of the variables used in the model. The aim is to verify whether the series have a stationary trend, and, if non-stationary, to establish orders of integration. The study used both Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests to test for stationarity. The test results of the unit roots are presented next. Results in table 4.5 indicated that all variables are non stationary (i.e. presence of unit roots) at 1%, 5% and 10% levels of significance. This calls for first differencing of the non-stationary variables.

Table 5.: Unit root tests-Level

Variable name	ADF test	PP test	1% Level	5% Level	10% Level	Comment
lnkAgricGDP	-0.478368	-0.478368	-2.6300	-1.9507	-1.6208	Non Stationary
LAGLNKAGRICGDP	-0.723092	-0.723092	-2.6321	-1.9510	-1.6209	Non Stationary
lnkinfrast	1.190425	1.190425	-2.6300	-1.9507	-1.6208	Non Stationary
lntemp	0.150516	.150516	-2.6300	-1.9507	-1.6208	Non Stationary
lnprecipit~n	0.048188	0.048188	-2.6300	-1.9507	-1.6208	Non Stationary

Source: Eviews computation

Table6 displays the unit root tests after first differencing. It is clear from the results in table 4.6 that all the variables become stationary (unit root disappears) on first differencing.

Table 5: Unit root tests-First Differences

Variable name	ADF test	PP test	1% Level	5% Level	10% Level	Comment
DlnkAgricGDP	-5.143689	-5.143689	-2.6321	-1.9510	-1.6209	Stationary
DLAGLNKAGRICGDP	-4.777693	-4.777693	--2.6344	-1.9514	-1.6211	Stationary
Dlnkinfrast	-5.257330	-5.257330	-2.6321	-1.9510	-1.6209	Stationary
lntemp	-8.470068	-8.470068	-2.6321	-1.9510	-1.6209	Stationary
Dlnprecipit~n	-8.280664	-8.280664	-2.6321	-1.9510	-1.6209	Stationary

4.3 Long Run Results

The long run results presented in table 7 are generated from the nonstationary variables. An additive model was used to check the explanatory power of adding variables one after the other. Results in table 4.7 indicated that the R squared of the regression between LNKAGRICGDP and

PEV had an R squared of 16.1%. The Rsquared improved to 44.2% once the SAP dummy was introduced. The r squared increased marginally from 44.2% to 47.2% upon the introduction of LNKINFRAST. There was no observed change in R squared when LNPRECIPITATATION and LNTEMP were introduced. The introduction of the LAGLNAGRICGDP significantly improved the R squared from 47.2% to 89.09%

In all models, the f statistic indicated that the independent variables were good joint predictors of LNKAGRICGDP.

Results in table 7 (model 1 and Model 5) indicated that PEV had a negative and significant relationship with LNKAGRICGDP (-0.106, p value 0.015; -0.0321, p value= 0.0838). This implies that an increase in PEV by one unit leads to a decrease in LNKAGRICGDP by 0.106 and 0.0838 units respectively. The results agree with those in Bigsten & Kimuyu, (2002) who noted that the political agitation for multipartism in 1991, led to a decline of both the agricultural GDP growth and the aggregate GDP indicators, with both indicators establishing a new low in 1992. The authors also noted that in 1998, the political turmoil and the rigged general election led to a sharp decline in the two indicators. The results also agree with those in Bigsten & Kimuyu (2002) and Kimani (2011) who noted that the agricultural GDP growth and the aggregate GDP indicators sharply declined in the year 2002 as a result of political elections which saw the entry of the NARC regime and a change of guard in the governance of the country. The authors also noted that, the post election of year 2007 led to a sharp decline in the two indicators in the year 2008 and this drop was compounded by the global financial crises of year 2009.

Results in table 7 (model 2, 3, 4 and Model 5) indicated that SAP had a negative and significant relationship with LNKAGRICGDP (-0.136, p value=0.0003; -0.135, p value=0.0002; -0.135, p value= 0.0005; -0.036, p value=0.0768). This implies that the introduction in sap by one unit leads to a decrease in LNKAGRICGDP by 0.136, 0.135, 0.135, 0.036 units respectively. The results agree with those in Nyangito, Nzuma, Ommeh, Mbithi (2004) whose analysis indicated that agricultural prices and productivity have generally declined in the post reform period. Specifically, the authors noted that the performance of the agricultural sector in the 1990s was dismal, with annual growth in agricultural GDP averaging 2% compared with 4% in the 1980s. Agricultural export growth after the reforms had shown mixed trends due to market access limitations for Kenyan exports. The authors further noted that after the reforms, the country moved from broad self-sufficiency in production of most food staples to a net importer, a situation that begged for a re-thinking of the policy framework on agriculture. The findings also compare well with those in Nyangito and Karugia (2000) who conducted a study on the impact of recent changes in Kenyan agricultural sector and public agricultural research in Kenya and concluded that the policy reforms had a negative effect on the capacity of KARI to provide research and extension services. The authors also noted that, adjustment in the government fiscal policy has meant that KARI has fewer funds to do its research. The findings imply that SAPs which advocated for the reduction in research activities had a negative effect on the productivity of the agricultural sector.

Results in table 7 (model 5) indicated that the lagged per capita income had a positive and significant relationship with LNKAGRICGDP (0.829, p value = 0.0000). This implies that an

increase in the previous year per capita agricultural GDP by one unit leads to an increase in the current year per capital agricultural GDP by 0.829 units.

Results in table 7 indicate that the other variables (LNKINFRAST; LNPRECIPITATION and LNTEMP) had insignificant causal relationships with LNKAGRICGDP.

Table 4. 6: Long Run Results

LNKAGRICGDP	Model 1	Model 2	Model 3	Model 4	Model 5
PEV	-0.106 (t= -2.55, p value = 0.015)*	-0.053 (t=-1.44, p value= 0.1582)	-0.051 (t=-1.407, p value= 0.1688)	-0.0507 (t=-1.338, p value =0.1909)	-0.0321 (t=-1.792, p value= 0.0838)**
SAP		-0.136 (t=-4.08, p value= 0.0003)*	-0.135 (t=-4.129,p value= 0.0002)*	-0.135 (t=-3.868, p value= 0.0005)*	-0.036 (t=-1.837, p value= 0.0768)**
LNKINFRAST			-0.025 (t=-1.333, p value =0.1918)	-0.026 (t=-1.225, p value =0.230)	0.0019 (t=0.189, p value = 0.8511)
LNPRECIPITATION				-0.017 (t=-0.169, p value =0.866)	0.0323 (t=0.667, p value = 0.5101)
LNTEMP				0.0257 (t=0.122, p value= 0.903)	-0.0282 (t=-0.282, p value = 0.7793)
LAGLNKAGRIGDP					0.829 (t=9.830, p value = 0.0000)*
Constant	9.92 (t=504.4; p value=0.000)	10.004 (t=385.36, p value =0.000)	10.150 (t= 90.25, p value =0.000)	10.195 (t=12.361, P value =0.000)	1.571 (t=1.590, p value = 0.1229)

R squared	0.161	0.442	0.472	0.472	0.8909
F statistic	6.54 (p value=0.015)	13.12 (p value= 0.0064)	9.54 (p value= 0.00018)	5.384 (p value=0.0011)	38.137 (p value =0.000)
Observations	36	36	36	36	35

*Significant at 0.05 level -2 tail

**Significant at 0.10 level -2 tail

4.4 Cointegration tests

The two step engle granger test was conducted and results presented in table 4.8. First a long run equation was run after which the residuals were generated. The residuals were then lagged. The second step was to test for stationarity of the residuals using the ADF test. Results indicated that the lagged residuals were stationary at 5% and 10% levels. This implies that the lagged residuals were stationary. This further implies that there is cointergration among the long run variables. This also implies that the variable converge to a long run equilibrium.

Table 7: Engle Granger Cointergration Test

ADF Test Statistic	-2.230841	1% Critical Value*	-2.6321
		5% Critical Value	-1.9510
		10% Critical Value	-1.6209

*MacKinnon critical values for rejection of hypothesis of a unit root.

The Johansen Cointegration test was also conducted since it is more accurate and superior to Engle granger test of Cointegration. Johansen Results at the table 4.9 indicate that the null hypothesis of at most 1 Co integration equations for the model linking was rejected at 5% (1%) significance level. The likelihood ratio statistic for the null hypothesis of the existence of at most 1 Cointegration equations was larger than the z critical vales at 5% and a 1% level. This implies that more than 1 co integrating equation exists. This further implies that all the variables in the model 4 converge to an equilibrium in the long run (i.e are co intergrated).

Table 4. 8: Johansen Cointergration Test

Sample: 1975 2010

Included observations: 34

Test assumption: Linear deterministic trend in the data

Series: LNKAGRICGDP PEV SAP LNKINFRAST LNPRECIPITATION LNTEMP

Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.764176	128.7769	94.15	103.18	None **
0.616676	79.65812	68.52	76.07	At most 1 **
0.507241	47.05634	47.21	54.46	At most 2
0.374489	22.99338	29.68	35.65	At most 3
0.185054	7.041053	15.41	20.04	At most 4
0.002453	0.083510	3.76	6.65	At most 5

*(**) denotes rejection of the hypothesis at 5%(1%) significance level

L.R. test indicates 2 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

LNKAGRICGDP	PEV	SAP	LNKINFRAST	LNPRECIPITATION	LNTEMP
1.000901	0.580591	0.013504	-0.040255	0.330614	0.874016
0.267514	0.355853	-0.053678	0.017495	-1.158341	-1.083502
0.607787	0.174368	0.176844	0.224223	0.780808	-3.969485
2.069019	0.012988	0.493667	0.025641	-0.298695	-0.078072
-1.239648	-0.081122	0.220575	0.027154	-0.674510	0.324449
-0.040733	-0.095477	0.004480	0.248670	-0.277404	0.473289

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

LNKAGRICGDP	PEV	SAP	LNKINFRAST	LNPRECIPITATION	LNTEMP	C
1.000000	0.580069	0.013492	-0.040218	0.330316	0.873229	-14.71039
	(0.13098)	(0.05257)	(0.03511)	(0.16473)	(0.50167)	
Log likelihood	132.6563					

Normalized Cointegrating Coefficients: 2 Cointegrating Equation(s)

LNKAGRICGDP	PEV	SAP	LNKINFRAST	LNPRECIPITATION	LNTEMP	C
1.000000	0.000000	0.179084	-0.121889	3.934000	4.680405	-50.34504
		(0.19328)	(0.20413)	(3.90901)	(5.33570)	
0.000000	1.000000	-0.285470	0.140794	-6.212513	-6.563320	61.43178
		(0.31127)	(0.32875)	(6.29535)	(8.59301)	
Log likelihood	148.9571					

Normalized Cointegrating Coefficients: 3 Cointegrating Equation(s)

LNKAGRICGDP	PEV	SAP	LNKINFRAST	LNPRECIPITATION	LNTEMP	C
1.000000	0.000000	0.000000	-0.538150	4.735278	13.30158	-79.31758
			(0.78007)	(6.65596)	(18.0341)	
0.000000	1.000000	0.000000	0.804338	-7.489794	-20.30594	107.6156
			(1.23509)	(10.5385)	(28.5536)	
0.000000	0.000000	1.000000	2.324388	-4.474302	-48.14027	161.7815
			(2.12699)	(18.1486)	(49.1731)	
Log likelihood	160.9886					

Normalized Cointegrating Coefficients: 4 Cointegrating Equation(s)

LNKAGRICGDP	PEV	SAP	LNKINFRAST	LNPRECIPITATION	LNTEMP	C
1.000000	0.000000	0.000000	0.000000	227.2988	115.3069	-1911.664
				(10685.7)	(5409.72)	
0.000000	1.000000	0.000000	0.000000	-340.1408	-172.7665	2846.303
				(15994.7)	(8097.46)	
0.000000	0.000000	1.000000	0.000000	-965.7742	-488.7231	8076.081
				(45430.5)	(22999.6)	
0.000000	0.000000	0.000000	1.000000	413.5713	189.5479	-3404.897
				(19384.8)	(9813.72)	
Log likelihood	168.9648					

Normalized Cointegrating Coefficients: 5 Cointegrating Equation(s)

LNKAGRICGDP	PEV	SAP	LNKINFRAST	LNPRECIPITATION	LNTEMP	C
1.000000	0.000000	0.000000	0.000000	0.000000	-0.465771	-8.496401
					(1.11710)	
0.000000	1.000000	0.000000	0.000000	0.000000	0.481203	-1.688218
					(1.92387)	
0.000000	0.000000	1.000000	0.000000	0.000000	3.185440	-10.32386
					(4.78872)	
0.000000	0.000000	0.000000	1.000000	0.000000	-21.10094	57.92584
					(5.12545)	
0.000000	0.000000	0.000000	0.000000	1.000000	0.509341	-8.372977
					(0.58698)	
Log likelihood	172.4436					

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4.5 Error correction Modelling

Since the variables in the model the determinants are cointegrated, then an error-correction model can be specified to link the short-run and the long-run relationships. Residuals from the co integrating regression are used to generate an error correction term (lagged residuals) which is then inserted into the short-run model. The specific lagged residual term is LAGRES_ECT. The estimates of the error-correction model are given in table 4.9;

Results in table 4.9 indicated that in the short run, none of the variables except the error correction term is significant. The error correction term measures the speed of adjustment to the long run equilibrium in the dynamic model. The error correction term LAGRES_ECT has the expected sign and is significantly negative (-0.242583, p value =0.0118). This result implies that there is a negative gradual adjustment (convergence) to the long run equilibrium. The coefficient of (-0.242583) indicates that 0.242% of the disequilibria in short run per capita agricultural sector GDP achieved in one period are corrected in the subsequent period.

The results also indicate that in the short run, SAPs have the expected negative sign although it is insignificant. All other variables were not short run determinants of per capita GDP.

Table 4. 9: Error Correction Model/Short run model

Dependent Variable: DLNKAGRICGDP

Method: Least Squares

Date: 11/16/12 Time: 20:29

Sample(adjusted): 1977 2010

Included observations: 34 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLAGLNKAGRICGDP	0.099633	0.165783	0.600984	0.5531
DLNKINFRAST	0.024651	0.024794	0.994213	0.3293
DLNPRECIPITATION	0.056412	0.033349	1.691594	0.1027
DLNTEMP	-0.029292	0.067036	-0.436965	0.6657
PEV	-0.026716	0.016271	-1.641955	0.1126
SAP	-0.013471	0.016047	-0.839479	0.4089
LAGRES_ECT	-0.242583	0.089552	-2.708854	0.0118
C	0.012593	0.012622	0.997706	0.3276

R-squared	0.441453	Mean dependent var	-0.003916
Adjusted R-squared	0.291076	S.D. dependent var	0.044031
S.E. of regression	0.037073	Akaike info criterion	-3.549541
Sum squared resid	0.035734	Schwarz criterion	-3.190397
Log likelihood	68.34220	F-statistic	2.935627
Durbin-Watson stat	2.162940	Prob(F-statistic)	0.020997

CHAPTER FIVE: CONCLUSION AND POLICY RECOMMENDATION

The gradual rise in temperature may have been responsible for the decline in per capita agricultural GDP. The Jarque-Bera test statistic tested the null hypothesis that the distribution of the variables was not significantly different from a normal distribution. The test reveals that KAGRICGD, KCAPITAL, PRECIPITATION and TEMP were normally distributed as the reported p values were more than the critical p value of 0.05. High p values indicate that there is a very high probability that the distribution of the data is normal. The results indicate SAP, PEV and KINFRAST are not normally distributed as the reported p values are less than the critical p values. However, the natural log of KINFRAST is normally distributed.

Bivariate correlation results presented indicate that there is a very strong and significantly positive correlation between SAP and per capita Capital (lncapital) ($r=0.828$, p value <0.05). This implies that the two variables could be multi correlated. Results from variance Inflation factor (VIF) indicate that lnkcapital introduces serious multicollinearity and it may be wise to drop it from the regression model.

The test results of the unit roots indicated that all variables are non stationary (i.e. presence of unit roots) at 1%, 5% and 10% levels of significance. This calls for first differencing of the non stationary variables. It is clear from the results that all the variables become stationary (unit root disappears) on first differencing.

The two step engle granger test results indicated that the lagged residuals were stationary at 5% and 10% levels. This implies that the lagged residuals were stationary. This further implies that there is cointergration among the long run variables. This also implies that the variable converge to a long run equilibrium. The Johansen Cointegration test indicated that the null hypothesis of at most 1 Co integration equations for the model linking was rejected at 5% (1%) significance level. The likelihood ratio statistic for the null hypothesis of the existence of at most 1 Cointegration equations was larger than the z critical vales at 5% and a 1% level. This implies that more than 1 co integrating equation exists. This further implies that all the variables in the model 4 converge to an equilibrium in the long run (i.e are co intergrated).

Results in indicated that the R squared of the regression between LNKAGRICGDP and PEV had an R squared of 16.1%. The Rsquared improved to 44.2% once the SAP dummy was introduced. The r squared increased marginally from 44.2% to 47.2% upon the introduction of

LNKINFRAST. There was no observed change in R squared when LNPRECIPITATATION and LNTEMP were introduced. The introduction of the LAGLNAGRICGDP significantly improved the R squared from 47.2% to 89.09%. In all models, the f statistic indicated that the independent variables were good joint predictors of LNKAGRICGDP.

Results in model 1 and Model 5 indicated that PEV had a negative and significant relationship with LNKAGRICGDP (-0.106, p value 0.015; -0.0321, p value= 0.0838). This implies that an increase in PEV by one unit leads to a decrease in LNKAGRICGDP by 0.106 and 0.0838 units respectively. Results in model 2, 3, 4 and 5) indicated that SAP had a negative and significant relationship with LNKAGRICGDP (-0.136, p value=0.0003; -0.135, p value=0.0002; -0.135, p value= 0.0005; -0.036, p value=0.0768). This implies that the introduction in sap by one unit leads to a decrease in LNKAGRICGDP by 0.136, 0.135, 0.135, 0.036 units respectively. Results in model 5 indicated that the lagged per capita income had a positive and significant relationship with LNKAGRICGDP (0.829, p value = 0.0000). This implies that an increase in the previous year per capita agricultural GDP by one unit leads to an increase in the current year per capital agricultural GDP by 0.829 units. Results in indicate that the other variables (LNKINFRAST; LNPRECIPITATION and LNTEMP) had insignificant causal relationships with LNKAGRICGDP.

Error correction modeling results indicated that in the short run, none of the variables except the error correction term is significant. The error correction term measures the speed of adjustment to the long run equilibrium in the dynamic model. The error correction term LAGRES_ECT has the expected sign and is significantly negative (-0.242583, p value =0.0118). This result implies that there is a negative gradual adjustment (convergence) to the long run equilibrium. The coefficient of (-0.242583) indicates that 0.242% of the disequilibria in short run per capita agricultural sector GDP achieved in one period are corrected in the subsequent period. The results also indicate that in the short run, SAPs have the expected negative sign although it is insignificant. All other variables were not short run determinants of per capita GDP.

5.0 DISCUSSION CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

It was possible to conclude from the study that structural adjustment programme (SAPs) had a negative and significant long run effect on per capita agriculture GDP. The results are in line with the school of though that advocates against structural adjustments programs. According to this school of thought, SAPs will be harmful to economies.

The study also concluded that the lagged per capital agricultural performance has a positive and significant effect on the per capita agricultural performance. Hence, above average per capita performance in year t-1 leads to better per capita agricultural performance in the current year.

The results also led to the conclusion that the long run per capita agricultural growth may be linked to the short run growth by an error correction term of -0.242583 which indicates that 0.242% of the disequilibria in short run per capita agricultural sector GDP achieved in one period are corrected in the subsequent period.

The results also concludes that weather indicators (temperature and precipitation), and per capita infrastructure did not have a significant effect on the short run and long run per capita Agricultural GDP.

5.2 Policy Recommendations

The study recommends that policy response should be encouraged to reduce or counteract the effect of Structural adjustment programmes on the per capita agriculture. Various policy options are available;

For instance, some harmful policies need to be eliminated such as the removal of subsidies. Subsidies are important in lowering the cost of production and also encouraging economies of scale. Specific subsidies that need to be re-introduced include; subsidies on fertilizers, seeds and other agricultural inputs.

Another suggested policy option would be to enhance the adaption of privatized agricultural institutions. The government should put in place structures that facilitate the resilience of privatized enterprises in the wake of highly competitive environments. The government can do this by ensuring that qualified leaders who are transformational in nature is appointed to top positions of privatized institutions. A good example is the NEW KCC, the Agricultural Finance Bank and the Kenya Meat Commission. Transformational leaders would be able to guide the privatized institutions during turbulent and competitive economic times.

Another measure is the encouragement of value addition in primary agricultural products. This will ensure that they will be competitive in the world market. In addition, the value added products will be more responsive to price related structural adjustment programmes.

The government should address the terms of trade.

5.3 Areas of further research

The study recommends that future studies should focus on specific crops. For instance, studies may be done on the effect of structural adjustment program's on the maize production, rice production, cash crop production such as tea, coffee and Miraa.

Another area of study would be to investigate the impact of SAPs on the livestock productivity in Kenya. In addition, the studies may also concentrate on specific livestock products such as milk,

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