AGRICULTURE EXPENDITURE AND ECONOMIC GROWTH IN ZIMBABWE DURING THE PRE-ECONOMIC MELTDOWN PERIOD: COINTEGRATION AND ERROR CORRECTION MODELS

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ABSTRACT

The study aims to investigate whether there is a long-run relationship between agriculture expenditure and economic growth. The paper uses time series econometric analysis to investigate the relationship between agriculture expenditure and economic growth during the period 1980-2005 (Period of macroeconomic stability in Zimbabwe). Johansen cointegration tests as well as an error correction model were used to establish the relationship between agriculture expenditure and economic growth in Zimbabwe. Johansen cointegration approach showed that a long run relationship exists between the variables. To capture the long run equilibrium and short run dynamic relationship between agriculture expenditure and gross domestic product an error correction model was adopted. The results revealed that in the long-run agriculture expenditure is a significant determinant of economic performance in Zimbabwe. Since Zimbabwe is still a developing country, therefore recommended policies for long run economic growth should be geared towards maintaining consistency in agricultural investments. Furthermore, agriculture expenditure oriented policies for long run economic growth in Zimbabwe should be maintained.

Keywords: Agriculture expenditure, Economic growth, Cointegration, Error correction model, Zimbabwe

INTRODUCTION

This paper aims to investigate the effect of agriculture expenditure on economic

growth in Zimbabwe. We also seek to investigate if there is a relationship between the two variables in the long run. Agriculture is the mainstream and back-borne of the Zimbabwean economy. Over three quarters of the Zimbabwean population derive its livelihood from agriculture and related activities (Saungweme and Matandare, 2014).

Poverty in Zimbabwe is inextricably tied up with agricultural sector performance, for two main reasons. First, as mentioned above, the agriculture sector is the backbone of Zimbabwe's economy and will continue to be so for the foreseeable future. It provides livelihoods for over seventy percent of the population. It contributes to other industries by supplying sixty percent of the raw materials required by the industrial sector (Munyoro, 2018). In addition, thirty percent of export earnings originate from agriculture sector and forestry. It is thus a key sector in determining overall economic performance, (Davies, et al. 2001). Secondly, the dualism of the sector has an important influence on the distribution of income and of the gains from economic growth (Robilliard, et al. 2002).

In broad terms, agriculture in Zimbabwe is dominated by two different systems of land tenure. On the one hand there is a commercial sector, dominated by medium-scale commercial farms. Here land is privately owned, production is for the market and farms are run as commercial profit-seeking enterprises. On the other hand, there are communal areas, in which land is collectively owned and much of the production is family-based and subsistence oriented, (IFAD, 2013). Zimbabwe's exports are predominantly agriculture commodities, minerals and low value added goods. Opportunities to process these commodities before export are unlimited. Very strong backward and forward linkages exist among the agricultural, manufacturing, mining and commercial sectors. Due to these intricate linkages economic growth patterns during the last few years have been significantly influenced by droughts. Whenever the agriculture season is good, the performance of other sectors is correspondingly good and vice versa, (Mombeshora and Wolmer, 2000).

In 2000 the government of Zimbabwe embarked on an agrarian reform program and has enabled the majority of people to acquire land and contribute meaningfully to agriculture, (Robilliard, et al. 2002). Today thousands of Zimbabweans, who were hitherto confined to peasant agriculture, are producing commercial export crops such as tobacco, cotton, perishable vegetables, cut flowers, oil seeds and wheat, (Matandare, 2017). However, the question still remains, is sustained economic growth in heavily agricultural countries dependent on development of the agriculture sector through increased expenditure? This study seeks to answer this question.

The interesting part of this study will be its emphasis on country-specific and time series analysis as opposed to most previous studies which tended to concentrate on

cross country studies, these studies failed to generalize the relationship between agriculture expenditure and economic growth and also failed to take cognizance of the unique peculiarities of each individual country. Thus this study will focus on Zimbabwe only. Although a variety of methods have been used in previous studies, most of these empirical studies used cross sectional data, logit and/or probit methods in their analysis. This was rationalized on the fact that most developing countries on which these studies were based did not have a long history of data collection and the unreliability of secondary data.

One drawback of some of the past studies is that the models used are based on macro-variables in the aggregate. In other words, most of the past studies have been cross sectional, cross-country and the models are generalized in nature. These methods focused their analysis mainly on the total government expenditure ignoring the role of specific types of government expenditures. This study therefore aims to use time series data and specifically analyse agriculture expenditure and how it relates to economic growth using co-integration method and furthermore the error correction model. Use of the econometrics techniques allows us to infer on the short run and long run relationship between agriculture expenditure and gross domestic product in Zimbabwe.

In general the study's objective is to seek empirically the relationship between agriculture expenditure and economic performance so as to come up with policy prescriptions to rejuvenate the Zimbabwean economy back on an upward economic growth trend.

LITERATURE REVIEW

Theoretical literature review

The Schultz high-payoff input theory

After observing years of poor results from attempts to transfer the highly productive agricultural technology of advanced nations to poor nations based on the diffusion model, Schultz (1964) pointed out that there are very few reproducible agricultural factors in technically advanced countries that are ready made for most poor communities. In general, what is available is a body of useful knowledge that has made it possible for the advanced countries to produce, for their own use, factors that are technologically superior to those employed elsewhere. This body of knowledge can be used to develop similar, and as a rule superior, new factors appropriate to the biological and other conditions that are specific to the agriculture of poor communities. This can only be possible through increased agriculture expenditure that facilitates research and development especially technology. Schultz focused on two central themes namely investments in agricultural technology development and investments in human capacity.

Kuznets' theory

Kuznets (1961) summarised the importance of agriculture expenditure to a developing nation. His contributions are perhaps more general and more measurable aspects. According to Kuznets, agriculture expenditure makes a direct contribution to growth of national product as summarised below:

Table 1: Agriculture Contributions to Growth

Contribution	Form
Foreign currency contribution	Increased agriculture exports
Product contribution	Increased food supplies
Employment contribution	Increased employment opportunities
Market contribution	Increased purchasing power as a result of increased levels of income
Factor contribution	Increased transfer of labour resources to other sectors as agriculture becomes more capital intensive

The Lewis model

The Lewis model is a structural change model that explains how labour transfers in a dual economy from areas with surplus to where it is needed and describes the process of industrialisation. For Lewis growth of the industrial sector drives economic growth. The Lewis model argues economic growth requires structural change in the economy whereby surplus labour in traditional agriculture sector with low or zero marginal product, migrate to the modern industrial sector where there is high rising marginal product. Growth means jobs for surplus rural labour. Additional workers in urban areas increase output hence incomes and profits. Hence rural-urban migration offers self-generating growth, (Lewis, 1954).

The industrial fundamentalism model

The overwhelming impact of the industrial revolution on Europe, the United States, Japan and other nations over the last two centuries, and particularly the success of the Soviet Union in industrialising after 1971, led to the development theories that made industrial development the priority task. However, development experience in India and other countries where periods of spurts of poor performance in agriculture greatly slowed national economic growth highlighted the need for more attention to the development of agriculture, (Ruttan, 1968).

Fei-Ranis model

The Fei-Ranis (1961) model demonstrates that development of the economy is through both the industrial sector as well as the agricultural sector. Initially there is transfer of surplus labour from the agricultural to the modern sector, which would facilitate an economy, to be fully commercialised. A Lewis type of an economy is

assumed where there is an advanced as well as a backward sector (dual economy). Fei and Ranis acknowledges that both the agriculture and industrial sector contributes positively to economic growth of the economy.

Neo-Classical theory: Jorgenson model

Jorgenson model is considered as the application of the neo-classical theory of growth in less developed countries. The model assumes that there is surplus labour in less developed countries but not in the sense of zero marginal productivity of agricultural labour. Like the Lewis and Fei-Ranis models, Jorgenson also assumes a dualistic economy that consists of an agriculture backward sector and an industrial modern sector. Thus to improve output we either accelerate the rate of technological process or reduce the rate of growth of population. Thus Jorgenson agrees with the fact that agriculture expenditure has a positive impact on economic growth, (Jorgenson, 1961).

Empirical literature review

Chebbi and Lachaal (2007) examined the agricultural sector role into the economic growth and its interactions with the other sectors using time-series co-integration techniques. They used annual data from 1961 to 2005 to estimate a VAR model that included GDP indices of five sectors in Tunisian economy. Empirical results from this study indicated that in the long-run all economic sectors tend to move together (co-integrate). But, in the short-run, the agricultural sector seems to have a limited role as a driving force for the growth of the other sectors of the economy. In addition, the study concluded that growth of the agricultural output may not be conducive directly to non-agricultural economic sector in the short-run.

Fatuase, et al. (2016) employed autoregressive distributed lag (ARDL) model to describe the relationship that exists among economic growth, agriculture and health expenditures in Nigeria using time series data of 32 years' period (1982 – 2012). The result showed that there exists a long-run equilibrium relationship between economic growth and government expenditures on agriculture and health in Nigeria. It was therefore recommended that government should increase expenditure on agriculture so as to increase economic growth.

In a paper titled Agricultural Budgetary Allocation and Economic Growth in Nigeria: Implications for Agricultural Transformation in Nigeria, Oyinbo, Zakari and Rekwot (2013) investigated the link between agricultural budgetary allocation and economic growth in Nigeria from an econometric perspective. The results of the analysis show that the relationship between agricultural budgetary allocation and economic growth in Nigeria is positive but not significant in the long run, while the relationship is positive and significant only for the two-year lagged value of agricultural budgetary allocation.

This implies that there is a need for a significant increase in budgetary allocations to agriculture in order to ensure that the agricultural sector plays a pivotal role in the national transformation of Nigeria.

Asiedu and Adelegan (1991) undertook a study for Nigeria to test the relationship between agriculture expenditure and economic growth. Asiedu and Adelegan's results showed that all the independent variables were significant in explaining economic performance of the Nigerian economy. Agriculture expenditure was found to be the most significant factor and the increased agriculture output was realised because of the newly acquired technology that was made possible by expanding agriculture expenditure.

Ayunku and Etale (2015) examined the effect of agriculture spending on economic growth in Nigeria over a period from 1977 to 2010 with particular focus on sectional expenditure analysis. The study used Johansen Cointegration and followed by Error Correction Model (ECM) tests. The empirical results indicate that RGDP was particular influenced by changes in AGR, INF, INT and EXR, these variables as they stand contributes or promotes economic growth in Nigeria.

While the significance of agriculture expenditure varies across studies using the production function approach, these studies have found in general that increased expenditure on the agriculture sector, especially for improving land quality, developing infrastructure, research, education and extension services and technology are the most important factors in explaining growth in agricultural productivity and output. The above literature reveals that agriculture expenditure is an important determinant of economic growth. Some of the reviewed literatures cited that agriculture expenditure is a powerful engine for economic growth. In contrast, other empirical analysis has concluded that too much increased public spending by the government crowds out private investment and eventually retards economic growth especially in the long run. This paper seeks to try and obtain a better empirical insight into this argument, which begins by considering the methodology that would be used for this paper.

METHODOLOGY

Methodological Framework

Although, the impact of agriculture expenditure on economic growth is far from being conclusive, there seems to be some consensus as to the core determinants of growth. Agriculture is seen as the "engine of growth" in developing countries and empirical literature insists that there is a sturdy long-term impact of agriculture on growth. In the long run, any increase in agriculture expenditure enables higher investment and consumption and thus relates directly and immediately to economic growth. Other factors that play a crucial role in the growth performance of

a country include exports, money supply and government expenditure, (Anderson and Jordan, 1968), as shown below:

$gdp = f(e, ms, exp)$……..….(1)

The model used in this study is an extension of the work based on both the theoretical and empirical literature and specifically to meet the requirements of a developing country like Zimbabwe.

Model specification

A production function as mentioned is constructed as to suit the Zimbabwean environment. Most studies which have worked on related areas have applied the ordinary least squares. This study is going to apply an error correction model so as to try and obtain valid inferences on the long run equilibrium and short run dynamic relationships between the variables. Ram (1986) and Asiedu (1991) suggested a general empirical model of agriculture expenditure on developing economy's economic growth can be put as captured by the following production-type function of the implicit form hereby tuned to the specific requirements of the Zimbabwean economy:

*GDP** = *0b +1b *AGRICEXP** +2b *EXPO** +3b*MSS** +4b*GVTEXP** +5b*SUBS** +6b*DD**+m……...……(I)

Where: *GDP* is the Gross Domestic Product, *AGRICEXP* is agricultural expenditure, *EXPO* is agriculture exports, *MSS* is money supply, *GVTEXP* represents total government expenditure, *SUBS* is subsidies to the agriculture sector from the central bank, *DD* is the dummy for drought and μ is the stochastic error term. The variables with asterisks are the transformed logged variables, that is each of the above variables is in logarithms captured by *. Logarithms help to solve the problem of heteroscedasticity and coefficients obtained in the estimated results can be readily read as elasticities.0b,,,,, and6b are the coefficients to be estimated, all else remain as defined above.

Estimations to be done

Agriculture expenditure is the main explanatory variable of interest. In order for the impact of agriculture expenditure on economic growth to be sustainable, we will check the time series statistics of the included variables. The data will be tested for unit root (non-stationary) by using the Augmented Dickey Fuller (ADF) and Phillips-Perron tests. If the results reveal that the variables are integrated of the same order, cointegration tests will be done. If any variables are cointegrated an error correction model will be undertaken so as to determine if there is any long run relationship.

Sources of Data

This study uses annual time series data covering the period 1980 to 2005.The choice of the period is informed by the developments in the Zimbabwean economy and consideration of the period before the economic meltdown, hyperinflation, severe expenditure cuts and huge public debts. All the data used in the equation is available during the period. The study is based on secondary data, obtained from World Bank development indicators. Eviews 8.0 econometric package was used for the estimations.

Estimations and interpretation of Results

Before an estimation of the model is done, it is important to consider the underlying properties of the processes that generate the variables. In this study we first test for stationarity of variables to avoid estimating spurious relationships. Spurious regression is whereby results suggest statistically significant long run relationships when in fact all we have is evidence of contemporaneous correlations rather than meaningful causal relations. When non-stationary time series are used in a regression model one may obtain apparently significant relationships from unrelated variables, (Granger and Newbold, 1974).

Testing for Stationarity

Testing for stationarity involved the use of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The results of the two tests are summarized in Tables 2 and 3 below. All the tests were run at a 5% and 10% level of significance. The trend and intercept were found to be significant therefore included in the estimations. Thus, the ADF results are generally reported as those from the tests that were run on one lag. The PP test was run on two truncation lags as suggested by Newey-West (1998). The only exceptions are the ADF test results for agriculture subsidies, which were run on two lags and confirm stationarity while in their levels. Therefore the ADF and PP tests unambiguously call for us to reject the null- hypothesis of a unit root for all the variables in levels except for agriculture subsidies.

Table 2 : Unit root test statistics of variables in levels

Variable	ADF (Lags)	PP	S/N-S
Gdp	2.173 (1)	0.703	Non-Stationary
Agricexp	1.944 (1)	2.437	Non-Stationary
Mss	2.006 (1)	0.241	Non-Stationary
Govtexp	0.699 (1)	1.095	Non-Stationary
Expo	1.172 (1)	0.311	Non-Stationary
Subs	2.567 (2)	7.801	Stationary
Critical values 5%	3.612	3.603	
Critical values 10%	3.242	3.237	

cointegrating relationship implies that the regression of non-stationary series in their levels will yield meaningful, not spurious results (Johansen, 2000).

However, as noted above, for integration to exist the non-stationary series must be integrated of the same (higher) order. By testing for and establishing cointegration, we verify the assumption made in above that the necessary condition {of all variables being I(1)} was indeed established.

Because the Engle Granger two-step model has been criticized for ignoring other cointegrating relationships between regressors, testing for cointegration involved in this paper used the Johansen procedure due to its simplicity.

Table 4: Johansen technique results

Series: LGDP LAGRICEXP LEXPO LGVTEXP LMSS				
Lags interval: 1 to 1				
	Likelihood	5 Percent	1 Percent	Hypothesized
Eigenvalue	Ratio	Critical Value	Critical Value	No. of CE(s)
0.902750	90.87615	68.52	76.07	None **
0.555712	54.94479	47.21	49.46	At most 1**
0.309444	15.47400	29.68	35.65	At most 2
0.195737	6.587799	15.41	20.04	At most 3
0.055088	1.359917	3.76	6.65	At most 4

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

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

The likelihood ratio is greater than the critical value in the first two rows. This shows that the hypothesis of no cointegration is rejected suggesting that there exists a long run relationship among the variables in question, thus also suggesting that we can formulate an error correction model (ECM), which would reveal the short run dynamics of the model.

The ECM is the preferred method for estimation when two or more integrated series are statistically related since the ECM can be formally derived from the properties of integrated time series (Davidson and Mackinnon, 1993), thus we adopt it in this study.

The Error Correction Model (ECM)

The existence of cointegration among variables suggests that there is a long-run economic relationship among variables, implying that it is most efficient to apply an ECM, (DiNardo and Johnston, 1997). A linear functional form ECM model is used. This type of model involves lagged values of dependent variable. The error

correction representation of the model, which incorporates both long run and short run information, is as follows:

$$\Delta gdp_t = \alpha_0 + \alpha_1 agricexp + \alpha_2 expo + \alpha_3 mss + \alpha_4 gvtexp + \sum_{i=1}^{n} \theta_i \Delta gdp_{t-i} + \sum_{i=1}^{n} \phi_i \Delta agricexp_{t-i} +$$

$$\sum_{i=1}^{n} \varphi_i \Delta expo_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta mss_{t-i} + \sum_{i=1}^{n} \lambda_i \Delta gvtexp_{t-i} + \varepsilon_t$$

In the above equation the short run dynamics of the model are represented by the variables with summation signs. Long run information is represented by the first part with (alpha's). The model includes lagged values of dependent variable as explanatory variable.

Table 5 : Error correction model results

Dependent Variable: DLGDP				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.478029	1.441664	-2.164854**	0.0469
DLAGRICEXP	0.568648	0.191429	2.970546**	0.0079
DLEXPO	1.378621	0.912731	1.510435	0.1517
DLMSS	-0.442527	0.208596	-2.121456**	0.0466
DLGVTEXP	0.204163	0.064396	3.170427*	0.0048
DLAGRICEXP(-1)	2.712740	1.341620	2.021989**	0.0614
DLEXPO(-1)	3.989790	1.938446	2.058242**	0.0574
DLMSS(-1)	-0.331612	0.144319	-2.297760**	0.0325
DLGVTEXP(-1)	1.004901	0.405418	2.478676**	0.0256
ECM(-1)	0.314322	0.309464	1.985114**	0.0657
R-squared	0.948532	Mean dependent var		11.26485
Adjusted R-squared	0.917651	S.D. dependent var		2.462466
S.E. of regression	0.119359	Akaike info criterion		-1.124193
Sum squared resid	0.213698	Schwarz criterion		-0.636642
Log likelihood	24.05241	F-statistic		1133.347
Durbin-Watson stat	2.057425	Prob(F-statistic)		0.000000

*, ** significant at 5% and 10% significance level respectively.

	F-Statistic	Probability
ARCH LM test	1.106	0.219
Normality – Jarque-Bera test	0.698	0.834
Ramsey RESET test	0.542	0.822
Breusch-Godfrey Correlation LM test	0.816	0.484

The results of the error correction model have been quite consistent with theory. The R-squared, which shows the correlation between the independent and the dependent variables, is 0.917651. The estimated model was tested for normality, serial correlation, autoregressive conditional heteroscedasticity and specification. Diagnostics shows that the model is well specified, residuals are normally

distributed, homoscedastic and serially uncorrelated. Therefore, from the diagnostics, the model appears to be reasonably good.

Gross domestic product has been highly responsive to expansionary agriculture expenditure policies in Zimbabwe. The coefficient of agriculture expenditure shows that a 1% increase in agriculture expenditure leads to about 0.57 percent increase in gross domestic product. In addition to this, agriculture expenditure (lagged) also has an even greater positive impact of about 2.71 percent on gross domestic product for every 1% increase.

Both the coefficients of agriculture expenditure and lagged agriculture expenditure are statistically significant at the 10% significance with a positive impact. Thus in the long run agriculture expenditure becomes an important determinant of economic growth.

The findings of the current study lend support to studies done elsewhere on the positive relationship and impact between agriculture expenditure and economic growth in developing countries, (Ebere, et al, 2012; Oynibo, et al, 2013, Selvaraj, 1993; Ayunku, et al, 2015 and Fatuase, et al. 2016). Barro and Sala (1992) also support the results of this study when they concluded that productive agriculture expenditures have a significant impact on economic performance

Current agricultural exports are not significant in determining economic growth, however lagged agricultural exports have a huge positive impact on gross domestic product and are significant at 10% level of significance. These results support are in tandem with Simasikau and Sheefeni, 2017; Ali Shah and Adeel Farooq, (2015), Sayet and Mabrouki, (2014), Abrar ul Haq, (2015) and Sanjuan-Lopez and Dawson, (2010).

The coefficient of money supply carries a negative sign and is significant at 10% significance level. Lagged money supply coefficient also carries a negative sign and is significant at 10% level of significance. These results support both theoretical and empirical literature.

Government expenditure also has a positive impact on gross domestic product as shown by the positive coefficient which is significant at 5% level of significance. Lagged government expenditure coefficient also carries a positive sign and is significant at 10% significance level.

This shows the importance of total government expenditure in determining economic gross domestic product in the long run in Zimbabwe

CONCLUSION

As one of the objectives of the study, the study shows the effects of agriculture expenditure on economic performance and concludes that there is indeed a positive relationship between agriculture expenditure and economic performance in Zimbabwe. This is supported by the estimated results of this study, which have been highlighted above.

The estimated results tally very well with the literature reviewed and provide strong support for the study hypothesis that agriculture expenditure has a positive relationship with economic growth and is a significant variable in determining economic performance in Zimbabwe. This positive relationship is because Zimbabwe is a developing country thus is still very much dependent on the primary agriculture sector.

The error correction term coefficient {ecm (-1)} is statistically significant and is less than one, showing that gross domestic product will eventually converge to their equilibrium level in the long run which is consistent with Asiedu and Adelegan (1991) results. The speed of adjustment of gross domestic product in the long run is about 31.4%, which shows that there is a long run relationship between the variables thus confirming the acceptance of our second hypothesis that agriculture expenditure has a long run relationship with economic performance.

A value of 0.314 for the ecm coefficient implies that the speed of adjustment towards the equilibrium is relatively low and suggests that errors are not fully corrected within a year.

These results thus imply that there is scope for further growth in Zimbabwe through exploitation of the agriculture sector. Therefore focus on agriculture expenditure oriented policies for long run economic growth in Zimbabwe should be maintained. Policies should be geared towards maintaining consistency in agricultural investments through agriculture expenditure. Although investments in the agriculture sector take time to yield results, they however in the long run results in a positive impact on economic growth which is very important for a developing nation like Zimbabwe.

This minimizes the deleterious effects on the agriculture sector, especially effects of drought and the less competitiveness of agricultural products on the international market. Thus, broader policies, which focus on influencing economic growth using agriculture expenditure, should be pursued, as they yield a positive impact on economic performance.

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