ANALYSING THE CAUSAL RELATIONSHIP BETWEEN AGRICULTURAL VALUE ADDITION AND ECONOMIC GROWTH IN NAMIBIA

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ABSTRACT

This paper examined the causal relationship between agriculture value added and economic growth in Namibia. The study was based on annual data covering the period 1980 to 2015, utilizing the techniques of unit root, cointegration and pairwise Granger causality. The results of the Granger causality test showed a unidirectional causal relationship running from agricultural value added to economic growth and not vice versa.

Keywords: Economic growth, agriculture, value added.

INTRODUCTION

Namibia is an arid country in southern Africa with a total land area of 824 268 km2. The country consists of poorly vegetated areas dominant in southern and western regions, the Namib Desert in the west along the Atlantic Ocean, the Kalahari Desert in the southeast, extensive savannah and woodlands in the central and north-eastern areas, and subtropical forests in the north-eastern regions. Five perennial rivers are found along the borders with neighbouring countries. Average annual rainfall varies from less than 20 mm on the Atlantic coast to 600 mm in the northeast. Only eight percent of the country receives more than 500 mm in average annually. Most rain falls during the summer and drought is a common phenomenon throughout the country. Low and variable rainfall and the inherently poor soils are major obstacles to optimum agriculture production (FAO 2017).

FAO (2017) report states that despite agriculture being a minimal contributor to Gross Domestic Product (GDP), the sector remains central to the lives of the majority of the population. Directly or indirectly, it supports over 70 percent of the country's population. The agricultural sector can be divided into two distinct sub-sectors: the capital intensive, relatively well developed and export oriented commercial sub-sector; and the subsistence-based, high-labour, low-technology communal sub-sector.

The interrelation between agriculture and economic growth is a topic that has been broadly discussed. Alston and Pardey (2014) argues that low productivity level and a slow growth of the agricultural sector in developing countries are regarded as the main instigators for low incomes and slow economic growth. In addition, there is extensive evidence for a positive link between increases in agricultural productivity and economic growth (Gollin, 2010; Self and Grabowski, 2007). More so, various influential development reports have also indicated that agricultural sector has greatly contributed towards improving economic growth and fighting poverty (World Bank, 2008 and 1981).

Gollin (2010) and Tiffin and Irz (2006) also reasoned that the underlying relationship between agriculture and economic development is subject to debate. The importance of increases in agricultural productivity as precondition for economic growth in some literature has also been emphasized. In particular, most developing countries the agricultural sector make up a larger share of the workforce and takes up roughly 25% of the value added in the economy. Hence, improvement in agricultural productivity causes significant aggregate effects and will therefore also influence the general economic growth within a country (Gollin, 2010; Diao, Hazell, & Thurlow, (2010). (Hwa, 1988) suggested that it is also possible that (non-agricultural) economic growth positively affects agricultural productivity since this is to a large extent reliant on technology and inputs from other economic segments. Therefore, agriculture might also benefit from wider processes of economic growth.

However, given the importance of agricultural value addition to economic activities as highlighted in literature, there is a need to investigate this relationship in the Namibian context.

LITERATURE REVIEW

Diverseness among nations in their physical endowment and historical contexts prevent any commonly applicable definition of agriculture in economic growth. However certain roles of agriculture seem to have higher degree of generality because of special features that represent the agriculture sector in the course of economic development.

Ahmad (2001) examined the output growth in input growth and total factor productivity including technological change and technical efficiency. The study used 34 district level data of Punjab including the year of (1991 to 1999).Crop area in acres not irrigated, crop area irrigated, total fertilizer, rainfall in inches, short term loan by ADBP, Long term loan by ADBP used as variables. Data from Agricultural statistics, Agricultural development Bank of Pakistan, and Punjab development statistics were taken. Fixed effect techniques, OLS estimation, and Random effect techniques were used to estimate the data. Results indicated that negative growth rates in technical efficiency and total factor productivity is positively related with farm size. It was suggested that to save the economy from instability in output prices needs active participation of the trading corporation of Pakistan and protected farmers from dealers and seeds companies which are selling's uncertified seed and substandard products.

Timmer (2002) used a panel of 65 developing countries over 1960–1985 to show a positive correlation between growth in agricultural GDP and its lagged values and nonagricultural GDP growth. He suggested that this relationship can be explained by ''first-order'' effects of agricultural growth on lower food prices, labor migration, and capital flows from agriculture, as well as ''second order'' effects, such as improved nutritional intake, which improves workers' productivity.

Bravo-Ortega and Lederman (2005) used panel data approach covering the period 1960–2000 to estimate the effect of agricultural growth on the overall growth rate. The results showed that an increase in agricultural GDP boosts nonagricultural GDP in developing countries, whereas a reverse similarity exists for developed countries.

Gardner (2005) studied the relationship between agriculture value addition and per capita economic growth in 85 countries for the period 1960 – 2001 using regression analysis, the results showed that growth of agricultural value added is independent of per capita economic growth of those who work in agricultural sector.

Aurangzeb (2006) researched on the link between economic growth and exports in Pakistan based on the analytical framework developed by (Feder, 1983). He tested the pertinence of the hypothesis that the economic growth increased as exports expanded by using time series from 1973 to 2005.The study found that export sector had significantly higher social marginal productivities and as such an export oriented and outward looking approach was needed for high rates of economic growth in Pakistan.

Francis, Osaretin and Troy (2007) worked on agricultural export variation and economic growth in Caribbean countries. They made use of co-integration and error-correction models to explore the contributory link between agricultural export variation and economic growth in eight selected Caribbean countries. Data for the period 1961 to 2000 were used for the estimation. The results indicated that agricultural export variation results economic growth in Barbados and Belize in short run, while Belize, Costa Rica, Haiti, and Jamaica show the same results in the long run. In addition, Non-causality exists in Trinidad and Tobago. The distinct absence of bi-directional causality seems in any of the countries in either the short or long run. The results indicate that the export-growth linkage holds in the face of an outward oriented trade strategy in some Caribbean countries.

Awokuse (2009) analyzed the vital synergy between agriculture productivity and economic growth using time series analysis of fifteen developing and transition economies in Africa, Latin America and Asia. He used real export, agriculture value added per worker, real GDP per capita, population as proxy for labor and gross capital formation per worker as proxy for capital as the economics variables. Data from the World Bank development indicators and international monetary were used for the period of 1971 to 2006. He used auto regressive distributed lag model and co integration to find out the empirical relationship among variables. The results indicated that agriculture is an important factor for economic growth like an engine for economic development.
Awan (2012) employed the Tornqvist- Theil index number methodology for the period of 1971 to 2006 to analyze the growth of agriculture sector and total factor productivity of agriculture growth in Pakistan. Categories of data were collected from the various issues of Economic Survey of Pakistan and various issues of agriculture statistics of Pakistan. The results showed that during the 70s decade total factor productivity growth rate was low and during the past six years 2001 to 2006 of the study total factor productivity was at his highest at 2.86 percent.

Zahir Faridi (2012), investigated the impact of agricultural exports to economic growth in Pakistan by estimating the link between gross domestic product (GDP) and agricultural and non-agricultural exports by using Johansen co-integration technique for the period 1972 – 2008. The results indicated that agricultural exports have negative on economic growth while agricultural exports elasticity have been 0.58. Furthermore he noted that there is bidirectional causality in agricultural exports and real GDP.
Matahir and Tuyon (2013), analysed the relationship between agriculture sector and economic growth in Malaysia throughout historical economic policy adjustments spanning from 1970 to 2010. They used also used Johansen Juselius (1990), cointegration test which indicated that agriculture and economic growth be moving together in the long run. They also studied the direction of causality between agriculture output and economic growth within the vector error- correction model (VECM) and found that both agriculture and economic growth have no causality direction at least in the short run but there exist a bi-directional causality movement in the long run.

Awan (2014) examined key factors of agriculture productivity growth and their impact on economy growth in the selected seven economies and compared their experience with seven advanced countries. Share of employment in agriculture, labor productivity in agriculture, the intermediate inputs ratio and aggregate labor productivity were used as economic variables. A time series data were collected from the total economy database and conference board. A two sector model methodology was used to measure the economic behavior of variables. The results show that due to low agriculture productivity in the emerging economies and the income gap between emerging and advanced countries have negative effects on the economic growth in the selected developing economies.

Awan and Vashma (2014) examined the major factors of agricultural sector and mutual relationship between agriculture economic development and GDP and how agriculture helped in economic development for the period 1980 - 2012. Gross domestic product and agriculture growth were taken as economic variables. World Bank Meta data of Pakistan were taken and Co integration and vector error correction model was used as econometric technique for measuring the variable relationship. The results indicated that there exists numerically significant and positive link between agriculture growth and GDP growth.

Even though these empirical investigations establish a relationship between agriculture and GDP growth, they do not imply connection in either way. The relationship observed could be false if both sectors have been growing independently of each other or as a result of a common third factor. Some authors have as a result, criticized studies that argue that there is a causal effect of agricultural growth on economic growth. The aim of this paper is to analyze the causal relationship between agricultural value addition and economic growth in Namibia.

METHODOLOGY

In analyzing the causal relationship between agricultural value added and economic growth in Namibia, this study adapts the approach used by Matahir and Tuyon (2013) and modifies it to suit the study. This study will ascertain the existence of such a relationship by implementing the following three-step procedure.

The first step is to test for unit root and determine the order of integration for two variables by employing tests devised by Augmented Dickey - Fuller (ADF). This is necessitated due to the fact that most time series data exhibit a trend over time and usually contains unit root (non-stationary). The state of being non-stationary implies that the mean, variance and covariance are not constant over time. Hence, any results accrue to such data will be spurious or nonsensical, whereby the relationship between variables may appear statistically significant, though there is no meaningful relationship among the variables.

The second step would be to test for cointegration in order to ascertain if there is any long-run relationship among the variables. It gives an indication as to whether the variables will converge in the long run to some sort of equilibrium. This study employs the Johansen cointegration test in order to determine if there are any cointegrated equations. Since this will be done in the vector autoregressive (VAR) framework, the first step uses first difference as shown below:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + ... + A_n Y_{t-n} + \varepsilon_t \quad ...1$$

whereas Y_t is lag length n $(p \times 1)$ vector endogenous variable, then first difference changes below:

$$\Delta Y_t = \sum_{j=1}^{n=1} \pi_j \Delta Y_{t-j} + \pi Y_{t-n} + \varepsilon_t$$

…2

whereas π_j is a short term adjusting coefficient to explain short-term relationship, π is long term shock vector that includes long term information that tips off on the existence long term equilibrium relationship. Moreover rank of π decides the number of cointegrated vector. π has three hybrids:

(a) $rank(\pi) = n$, then π is full rank, meaning all the variables are stationary series in the regression (Y_t)

(b) $rank(\pi) = 0$, then π is null rank, meaning variables do not exhibit cointegrated relationship.

(c) $0 < rank(\pi) = r < n$, then some of variables exist r cointegrated vector.

The Johansen cointegration approach uses rank of π to distinguish the number of cointegrated vector and examine rank of vector in testing how many of non-zero of characteristic roots exist in the vector. There are two statistic processes for cointegration.

(i) Trace test:

$H_0 : rank(\pi) \le r$(at most r integrated vector)

$H_1 : rank(\pi) > r$(at least r+1 integrated vector)

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i)$$

T is sample size, $\hat{\lambda}_i$ is estimated of characteristic root. If test statistic rejects H_0 that means variables exist at least r+1 long term cointegrated relationship.

(ii) Maximum eigenvalue test:

$H_0 : rank(\pi) \le r$(at most r integrated vector)

$H_1 : rank(\pi) > r$(at least r+1 integrated vector)

$$\lambda_{\max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1})$$

If test statistics does not reject H_0 that means variables have r cointegrated vector. This method starts testing from variables that do not have any cointegrative relationship which is r=0. Then test has added the number of cointegrative item to a point of no rejecting H_0 that means variables have r cointegrated vector.

The third step is Granger-causality. The presence of a long-run relationship would imply that there is causality at least in one direction too. That is if there is cointegration there should be Granger-causality in at least one direction. In general different hypotheses are assumed and usually unsure about variables' cause and effect relationship. To cater for this Granger (1969) developed model based on lead and lag relations in forecasting. Granger causality test is considered a useful technique for determining whether one time series is good for forecasting the other. There are different situations under which Granger causality test can be applied. These include;

(a) A simple bivariate Granger causality where there are two variables and their lags.

(b) A multivariate Granger causality where more than two variables are considered and it is most applicable where more than one variable can influence the results.
(c) Granger causality can also be tested in a Vector Autoregressive (VAR) framework where a multivariate model is extended to test for simultaneity of all included variables.
Granger used twin factors of VAR to find variables' causal relationship. The VAR can be considered as a means of conducting causality tests, or more specifically Granger causality tests. It assumes two series X_t and Y_t that define those messages set.

$$X_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} X_{t-1} + \sum_{i=1}^{k} \alpha_{2i} Y_{t-1} + \varepsilon_{1t}$$

…3

$$Y_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} X_{t-1} + \sum_{i=1}^{k} \beta_{2i} Y_{t-1} + \varepsilon_{2t}$$

…4

To determine the variables' relationship the following test are conducted on the coefficients.
(i) $\alpha_{2i} \neq 0$ *and* $\alpha_{1i} = 0$: meaning Y lead X or X lag Y.
(ii) $\beta_{1i} \neq 0$ *and* $\beta_{2i} = 0$: meaning X lead Y or Y lag X.
(iii) $\alpha_{2i} = 0$ *and* $\beta_{1i} = 0$: meaning both variables are independent.
(iv) $\alpha_{2i} \neq 0$ *and* $\beta_{1i} \neq 0$: meaning both variables are interactive each other and have feedback relationship.
However, this study uses a simple bivariate Granger causality where there are two variables and their lags.

Data and Data Sources

This study used annual time-series data covering the period 1980-2015. The variables included are AV: Agriculture value added, in percentage and RY: Output, in percentage. The data series for both variables were obtained from the World Bank's website.

EMPIRICAL FINDINGS

Unit Root Test

The Augmented Dickey-Fuller (ADF) test was used to investigate the univariate characteristics of the variables as well as to ascertain the order of integration. Table 1, reports the results of the ADF unit root tests. The results show that all variables are stationary in levels. That is to say, the variables are integrated of order zero.

Table 1: Unit root tests: ADF in levels and first difference

Variable	**Model Specification**	**ADF**	**ADF**	**Order of Integration**
		Levels	**First Difference**	
RY_t	Intercept	-4.271**	-8.558**	0
	Intercept and trend	-5.047**	-8.422**	0
AV_t	Intercept	-6.114**	-7.513**	0
	Intercept and trend	-6.471**	-7.445**	0

Source: author's compilation and values obtained from Eviews
*Notes: (a) ** means the rejection of the null hypothesis at 5%*

Testing for Cointegration

Upon establishing the order of integration of the variables, it was then appropriate to test for the presence of the long-run relationship better known as cointegration, among the variables. In this regard, the Johansen cointegration test based on trace and Maximum Eigen values test statistic was conducted. The results of the Johansen cointegration test show a presence of cointegration in all cases as it is supported by both test statistics as reported in table 2.

Table 2: The Johansen co-integration test based on trace and maximal Eigen value

Maximum Eigen Test				Trace Test			
H_0: rank = r	H_a: rank = r	Statistic	95% Critical Value	H_0: rank = r	H_a: rank = r	Statistic	95% Critical Value
r = 0	r =1	15.919	14.265**	r = 0	r >=1	26.224	15.495**
r <=1	r = 2	10.305	3.841**	r <= 1	r >= 2	10.305	3.841**

Source: author's compilation and values obtained from Eviews
Note: Both Max-Eigen value and Trace tests indicates 2 cointegrating equations at the 0.05 level (**).

Pairwise Granger Causality

The final step is to test for causality among the variables. It follows that, the presence of a long-run relationship as it was found in the previous section would imply that there is causality at least in one direction too.

Table 3: Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
AV does not Granger Cause RY	33	2.58523	0.0933
RY does not Granger Cause AV		1.25994	0.2993

Table 3 presents the result of Granger causality. The findings revealed that the null hypothesis that agricultural value added does not Granger cause real output was rejected. This is due to the fact that the probability value of 0.09 is less than 0.10, which is the level of significance. Thus, agricultural value added does Granger cause real output, though not vice versa.

CONCLUSION

This study examined the causal relationship between agriculture value added and economic growth in Namibia. This was done with the purpose of establishing which of the variables can help predict the other. The study was based on annual data covering the period 1980 to 2015, utilizing the techniques of unit root, cointegration and pairwise Granger causality. The results of the unit root test reveal that all the variables are integrated of order zero. The results of the cointegration showed a long-run relationship among the variables. The results of the Granger causality test showed a unidirectional causal relationship running from agricultural value added to economic growth and not vice versa. The study recommends that Namibia should continue advocating for values addition to enhance economic growth.

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