

Mlambo, Courage; Mukarumbwa, Peter; Megbowon, Ebenezer

Article

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*Corresponding author: Courage
 Mlambo Economics, University of Fort
 Hare, South Africa
 E-mail: mlamboc@gmail.com

Reviewing editor:
 Goodness Aye, Agricultural
 Economics, University of Agriculture,
 Makurdi Benue State, Nigeria

Additional information is available at
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GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

An investigation of the contribution of processed and unprocessed agricultural exports to economic growth in South Africa

Courage Mlambo^{1*}, Peter Mukarumbwa¹ and Ebenezer Megbowon¹

Abstract: The paper attempts to empirically test the contribution of unprocessed and processed agriculture of exports to economic growth in South Africa. The study used time series data which spanned from 1986 to 2012. A Johansen cointegration approach was used to test for cointegration after the unit root tests had shown that all variables were non-stationary at levels. Cointegration results showed that there was one cointegrating equation. Subsequently, a VECM was used as the estimation technique. The study found that processed agricultural exports have a positive relationship with economic growth whereas unprocessed agricultural exports have a negative relationship with economic growth. This shows that manufactured agricultural exports contribute significantly to economic growth. The study recommends that the South African government should promote and stimulate investment in the processed agricultural commodities sector. There should be more production and expansion in the manufacture agricultural commodities sector. Processed manufactured goods usually are sold at a much higher price and this may generate more income for South African firms.

ABOUT THE AUTHOR



Courage Mlambo

Dr Courage Mlambo research interests lie in Development Economics, Agricultural Economics, Politics and Economics in general. However, his research and publication repertoire is versatile including Economics of regulation, Monetary Economics, Labour economics, Macroeconomics, Social Justice, Politics, Banking and Finance.

PUBLIC INTEREST STATEMENT

The study attempted to compare the contribution of processed and unprocessed agricultural product exports towards South Africa's economy. The study argues that the role of the agricultural sector as a key player in building the economics of developing countries and developed countries alike cannot be understated. The African continent has been identified as the continent which could derive the uppermost benefits in agriculture development in comparison with the rest of the world. However, majority of the African countries are yet unable to tap into the potentials of the agricultural sector. Among several determinants that have been considered in the literature, the influence of the agro-processing appears to be missing as a key factor that could influence agricultural sector growth. This, therefore, called for an examination of the role of agro-processing in agricultural sector growth promotion. Results proved that the processed exports contribute positively to the South African economy.

Subjects: Agriculture & Environmental Sciences; International Economics; Development Economics

Keywords: Agro-processing; processed agricultural exports; unprocessed agricultural exports; economic growth

1. Introduction

The role of the agricultural sector as a key player in building the economics of developing countries and developed countries alike cannot be understated. There has been consensus in literature (De Janvry & Sadoulet, 2002; Machethe, 2004; Organisation for Economic Co-operation and Development (OECD), 2006; Wiggins, Kirsten, & Llambí, 2010) acknowledging the sector as imperative for boosting rural economics, reducing food prices especially staples, employment creation, increasing rural incomes, poverty reduction, supplier of resources to the industrial sector and a stimulant of growth in national output. Furthermore, the African continent has been identified as the continent which could derive the uppermost benefits in agriculture development in comparison with the rest of the world (Wiggins et al., 2010). However, majority of the African countries are yet to tap into the potentials of the agricultural sector. This is seen in the abysmal contribution of the sector to the GDP of these countries. The global climate change, poor government funding, exploration of other natural resources, have in no doubt contributed to the below performance of the agricultural sector. Despite these challenges, the sector is still considered indispensable for economic growth. Hence, the continued search for factors that could positively influence agricultural sector growth. The influence of the agro-processing appears to be one of the key factors that could influence agricultural sector growth (Mulangu, 2015; Africa Development Bank, 2018). This, therefore, calls for a re-examination of the role of agro-processing in agricultural sector growth promotion.

Agro-processing is defined as a set of technological and economic activities undertaken on agricultural products so as to transform them into more usable commodities such as food, feed, fibre, fuel or industrial raw material (Food and Agriculture Organization (FAO), 1997; Mhazo, Mvumi, Elijah Nyakudya, & Nazare, 2012). Therefore, agro-processing entails a value chain that transforms basic products from agriculture, forestry and fishery from harvest stage till they get to the final consumer in the desired form (Mhazo et al., 2012). The agro-processing industry is said to cover a broad area of postharvest activities, comprising artisanal, minimally processed and packaged agricultural raw materials, the industrial and technology-intensive processing of intermediate goods and the fabrication of final products derived from agriculture. Furthermore, the agro-processing sector is characterised by strong up- and downstream linkages (The Department of Trade and Industry (DTI), 2014 and International Trade Administration Commission, 2016). In the upstream, the sector links to primary agriculture across a wide variety of farming models and products. While on the other hand, downstream outputs from agro-processing act as both intermediate (further value is added) and final goods marketed through wholesale and retail chains. Hence, these links make it vital for possible employment creation and poverty eradication (DTI, 2014). The strong forward and backward linkages of the agro-industrial sector and its potential to generate employment opportunities hold the key to the economic development of a country. For instance, in developed countries, an estimated 14% of the total workforce is engaged in agro-processing sector directly or indirectly (Kachru, 2010; Khosla & Dhillon, 2015).

Processing of farm products increases shelf-life of produce through value-addition, offer higher income to farmers as the processed products have wide market and higher income and it also reduces waste of raw agricultural products (Chengappa, 2004). Moreover, according to the United Nations Industrial Development Organization (UNIDO) (2007), in developing countries, approximately 40–60% of manufacturing value emanates from agro-processing industries and they also constitute a major share of exports. Nonetheless, in developing countries, only about 30% of the agricultural production is processed in comparison to about 98% in developed countries. Development of the agro-processing industry can be very vital in unlocking employment opportunities as the majority of people depend on agriculture in developing countries. Equally important

economic growth of a country entails transformation from an agrarian economy to industrial (Khosla & Dhillon, 2015). Agro-processing industries must be developed first during this process of industrialisation (Khosla & Dhillon, 2015).

In the same way, it has been observed that for other developing countries such as India, agro-processing industry is still in its infancy with only 8% of the total food production being processed. In addition, only about 3% total workforce in India is employed in the agro-processing sector revealing its underdeveloped state and vast untapped potential for employment (Khosla & Dhillon, 2015). India's agro-processing is viewed as the "sunrise sector" of the economy because of its large potential for growth and socio-economic impacts on employment, income generation and exports (Grover cited in Patil et al. (2018)). Agro-processing industry triggers various multiplier effects such as the spread of industrialization in rural areas hence opening up diverse livelihood options, stable prices of agricultural commodities and various backward and forward linkages (Sharma, Pathania, & Lal, 2010). Despite, the potential economic prosperity that agro-processing can offer to rural farmers in India, commercial processing in the country has been noted to be very low. In that view, agricultural development in India is envisaged not to progress rapidly unless there is development in agro-based industries to provide a solid base to modernize agriculture and to take up surplus labour force from agriculture (Sharma et al., 2010). As such, agricultural development can also be triggered by the growth of agro-based industries in developing countries.

Another case in point is that of Zimbabwe, where the potential of agro-processing sector to contribute towards employment creation has been highlighted with specific reference to small and medium enterprises (Mhazo et al., 2012). Following this further, Watanabe, Jinji, and Kurihara (2009) examined the contribution of agro-processing industry development to poverty reduction in Thailand. Emphasis was put on farmers' income, due to the fact that the majority of the poor in Thailand are farmers. They found out that agro-processing industry development could increase farmers' income through two ways (i) creation of employment for poor farmers at factories; and (ii) the purchase of agricultural products. Therefore, they concluded that the development of the agro-processing industry in Thailand was pro-poor. On the other hand, their results tend to suggest that the contribution of the agro-processing industry decrease as the economy grows and as other manufacturing industries develop. From the foregoing, it could be deduced that the agro-processing industry plays a significant role only when an economy is in the early stages of industrialization or in a recession (Watanabe et al., 2009).

Though this may be, other scholars such as Reardon (2015) have pointed out that agro-processing conduct and transformation is still a relatively under-researched topic in developing countries. Although only recently some studies have attempted to shed some light on transformations happening in Asian countries as well as East and Southern Africa (Reardon et al., 2014; Tschirley, Reardon, Dolislager, & Snyder, 2015a). Agro-processing is a very vital topic in developing countries because of rapid urbanisation and increasing size of middle-class population. It is against this background that this study attempts to compare the contribution of processed and unprocessed agricultural products' exports towards South Africa's economy. The desire to test the contribution of processed and unprocessed agricultural exports in South Africa emanates from the fact that the government of South Africa has identified agro-processing as one of the potential engines of growth. The agro-processing industry is among the sectors identified by the Industrial Policy Action Plan (IPAP), the New Growth Path and the National Development Plan for its potential to spur growth and create jobs because of its strong backward linkage with the primary agricultural sector (Department of Agriculture, Forestry and Fisheries, 2019). South Africa's economy has had low economic growth (Madalet, 2018 and Brown, 2019) and it has displayed an average annual growth of a mere 1.1% over the past 4 years (Naude, 2018). This low growth has resulted in the economy not growing sufficiently rapidly to absorb new entrants into it and, this has caused increases in unemployment (Naude, 2018). The agro-processing sector could contribute has the power to be transformative and improve the stagnating growth in South Africa. The International Trade Administration Commission of South Africa (2016) concurs and states that the processing of agricultural products can help South Africa realise value-added growth

and support labour-intensive sectors of the economy. The paper is structured as follows: Section 2 presents stylized facts and agro-processing policies in South Africa, Section 3 presents the literature review, Section 4 presents the estimation techniques and results and Section 5 concludes the study.

2. Stylized facts and agro-processing policies in South Africa

2.1. Situation of agro-processing industry in South Africa

Following the Standard Industrial Classification, South Africa's agro-processing industry can also be categorised into 10 divisions as follows: food products; beverages, tobacco; textiles; Wearing apparel; Leather and leather products; Footwear; Paper and paper products; Wood and wood products; Rubber and Furniture. South Africa's agro-processing sector is estimated to contribute about 30.5% of the real value-added GDP to the manufacturing sector (Thindisa, 2014). Furthermore, an estimated 207,893 people are employed in this sector within the country (Department of Trade and Industry, 2014). This figure represents approximately 16% of the total employment number for the manufacturing sector and 2.5% of the total employment number for the entire economy (Limpopo Agro-processing Strategy, 2012). According to Department of Agriculture, Forestry and Fisheries (DAFF) (2013), there was a contraction of production in most agro-processing industry divisions of South Africa during the first quarter of 2013, due to slowed domestic economy and moderate global economic growth. During the same period, the agro-processing industry shed 2,369 formal jobs in comparison with the preceding quarter. However, formal jobs were created in the beverages and tobacco, footwear and rubber products divisions (DAFF, 2013). The average contribution of agro-processing to the output and value added of the manufacturing sector was "18.2 per cent and 19.8 per cent, respectively, during 2012–2016. Its contribution to domestic fixed investment was 15.1 per cent and to employment 18.0 per cent during the same period" (International Trade Administration Commission of South Africa, 2016).

2.2. Policy and programmes for improving agricultural production, agricultural export and agro-processing

South Africa's agro-processing industry has been recognised by National Development Plan, the Industrial Policy Action Plan (IPAP) and the New Growth Path as one of the sectors with potential to spur growth and create jobs due to its strong backward linkage with the primary agricultural sector (DAFF, 2013). However, the Industrial Policy Action Plan (IPAP (Industrial Policy Action Plan), 2013; Department of Trade and Industry, 2014) noted that the potential of agro-processing is not being fully exploited in the country. This is more pronounced in the smallholder farming sector which is confined to the informal sector mainly in primary agriculture. For this reason, enhanced participation of smallholder farmers in agro-processing activities has the potential to contribute towards national objectives such as poverty reduction and job creation. Furthermore, agro-processing is deemed to improve the sustainability and profitability of farming enterprises (Louw, Jordaan, Ndanga, & Kirsten, 2008; Mhazo et al., 2012; NGP (New Growth Path), 2010; World Bank Report, 2013). Therefore, identification of factors that limit the development of agro-processing industries particularly in rural areas of South Africa can go a long way in unlocking employment opportunities in the country's rural economy (Louw, Troskie, & Geyser, 2013). The NGP forecasts the creation of 145,000 jobs in agro-processing by 2020 by focusing on smallholder schemes in industrial products and forestry; export of wine and fruit. The framework tends to pursue existing plans for aquaculture, fisheries and agro-processing in achieving these targets. However, there is no clearly stated strategy to attain these targets.

On the other hand, the diverse subsectors that constitute South Africa's agro-processing sector present constraints that are subsector specific. For instance, the export of wine and spirit, fresh and canned fruit face constraints from the trade policy of developed countries. These include sanitary and phytosanitary standards (SPS), subsidies and tariffs. In addition, increased penetration of cheap imports into the country, particularly frozen chickens, induces stiff competition. Increased penetration of cheap imports has coincided with other challenges on the domestic

front such as cost pressures of electricity as well as other inputs. This has resulted in a margin squeeze and massive job losses and ongoing under investment in productivity (Department of Trade and Industry, 2014).

3. Literature review

3.1. Theoretical framework

Economic growth has been identified to be imperative for economic development, hence governments of developing and developed countries alike endeavour to attain sustainable economic growth. This growth, however, is experienced when there is growth in each of the sectors of the economy. Various theoretical and empirical literature have been put forward in elucidating the importance of trade on growth at the sectoral level and aggregate level, respectively. Specifically, theories of absolute advantage, comparative advantage, abundance factor endowment and new trade theories explain how trade is likely to create a value for each country that participates in international trade (Salvatore, 2011:35). The classical school of thought emphasizes this first through Adam Smith, the production through specialization in the production of a product where a country has an outright cost advantage; second through David Ricardo, the production of commodity where a country has the largest relative cost advantage, these explaining differences on labour productivity; and three through Heckscher–Ohlin, the production of commodity where a country has an abundant factor that can be used intensively. The surplus from these proposed scenarios can then be traded as export in exchange for products that cannot be made as cost-efficient (Salvatore, 2011:35).

The classical school thus promotes an unrestricted free trade among countries. The new growth theory, on the other hand, explains that economies of scale are a key factor in influencing the development of trade. Sharma et al. (2010) state that it likewise proposes that unrestricted trade and laissez-faire government intervention may be much less desirable for developing economies who find themselves unable to compete with established multi-nationals. Furthermore, relationships between international trade and output have also been postulated and empirically examined in the literature. The first postulation (export-led growth) explains that exports been a component of GDP have a direct causal effect on GDP. The second postulation, on the other hand, emphasizes that output growth promotes exports by means of enhanced productivity and reduced costs which arise from improvement in human capital and technology (Savic, Boškovic, & Micic, 2016). These literature have basically examined the export-led growth hypothesis.

On the processed exports side, there is a well-established trade-innovation macroeconomic framework that offers at least two mainstream theoretical models to account for a relationship between R&D/innovation and exporting (with the causation running from the former to the latter) (Harris & Moffat, 2011). Usually, little distinction is made between R&D and innovation—the most common assumption being that innovation inputs (R&D) lead to new product and process outputs. Neo-endowment models concentrate on specialisation and thus three competitive advantages on the basis of factor endowments, such as materials, skilled/unskilled labour, capital and technology (Davis cited in Sikharulidze and Kikutadze (2017)).

3.2. Empirical review

This section presents different studies that were conducted, methods employed, the countries where the research was done and the results obtained. Several studies tend to support the opinion that agro-processing can improve rural economies of developing countries.

Louw et al. (2013) conducted a study intended to identify factors that constrain the development of agro-processing in rural areas of South Africa's small wheat milling and baking industries. They used primary data that was obtained by means of structured questionnaire and they conducted 15 interviews with different small wheat-milling and baking firms. Findings of the study tend to suggest that small wheat milling and baking industries face comparatively high barriers to entry. These barriers include the ability to uphold a well-maintained infrastructure; to acquire the

required capital to start operations; to acquire marketing-management knowledge; to acquire knowledge of the wheat-milling and baking industries; to establish a market; and to have the necessary cash flow. However, it is noteworthy that the study employed a qualitative rather than an empirical approach.

Sharma et al. (2010), studied the structure and extent of value addition in different agro-processing units in Himachal Pradesh in India. The study employed the breakeven analysis and the financial viability ratios. Primary data on different aspects of agro-processing which were collected through a survey for the year 2006–07 from selected processing units were used. The study revealed a direct relationship between size of the firm and number of its backward and forward linkages. Likewise, Khosla and Dhillon (2015) examine the growth and prospects of agro-processing industries in Punjab state in the same country. They used secondary data obtained from various sources for the years 1990–91, 2001–02 and 2011–12. The empirical framework used tends to suggest that the development of agro-processing industries can stimulate industrial growth in Punjab state.

Watanabe et al. (2009) examined the development of the agro-processing industry's contribution to poverty reduction in Thailand. The analysis was done using the input–output table published by Thailand's National Economic and Social Development Board (NESDB). Secondary data spanning from the period between the late 1980s and 2000 were used. Findings of the study showed that the development of the agro-processing industry in Thailand could improve farmers' income, hence it was deemed to be pro-poor.

Savic et al. (2016) analysed the agriculture and the food industry as dominant sectors of the Serbian agro-industrial complex. They employed the correlation analysis and the comparative method using secondary data from different sources in the year 2012. The research results showed that new EU member states adapt the structure of their agriculture more efficiently to the new demands of development, resulting in the agro-industry creating a greater added value which influences overall economic development.

From the above, it can be concluded that most of the studies on agro-processing have been conducted at micro-level with only a few studies focusing on agro-processing at macro-level. There are flagship examples where studies which focus on agro-processing and its contribution to agricultural growth were conducted. This, therefore, necessitates the investigation of the contribution of processed and unprocessed products to agricultural growth in South Africa.

4. Methodology

4.1. Model specification

This study adopts Anwar, Farooqi, Ghulam, and Khan (2015) model. Anwar et al. (2015) did an analysis of the role of the agriculture sector share in GDP in Pakistan. The study chose Anwar et al. (2015) because their study was done in an “emerging market economy” (Ume-Farwa, 2016; Mangi, 2019). South Africa is also an emerging market economy. Since both countries are emerging market economies, they share common economic characteristics that make them similar enough for the experiences to be compared. The economic circumstances for emerging market economies have more or less been the same. For instance, these emerging market economies have experienced robust and sustained productivity growth in the agricultural sector since the 1970s, with technological change and agricultural research (alongside macroeconomic stability and institutional reforms) playing important roles (Fan & Breska, 2019). This is why this study chose to adopt a model that was used for an emerging market economy. The study shall include both processed and unprocessed agricultural exports. This was not done in Anwar et al. (2015) study. This study shall adopt their model with modifications. Subsequently, the study had the following model:

$$GDP = f(WI, UP, P, GE) \quad (i)$$

The empirical model to be used in the study can be estimated as follows:

$$GDP_t = \beta_0 + \beta_1 WI_t + \beta_2 UP_t + \beta_3 P_t + \beta_4 GE_t + \varepsilon_{it} \quad (ii)$$

where GDP (economic growth) is a function of WI (World Income), UP (Unprocessed agricultural exports), P (Processed agricultural exports) and GE (Government expenditure).

4.2. Data sources

This study makes use of secondary data. Information and statistics were sourced from the South African Reserve Bank publications and Quantec. The study used annual data that spanned from 1986 to 2015. Data for 30 years are used in this study due to the accessibility of the data.

4.3. Estimation techniques

4.3.1. Descriptive statistics and unit root tests

The descriptive study of data involves describing the characteristics of the sample data, not drawing conclusions about the population. The study used five variables and the summary of the series is presented in Table 1.

Table 1 reports that all series exhibit negative skewness which indicates that the series have an asymmetric distribution with a longer left tail except for the LGE variable which has a positive skewness. Moreover, most observations of the series take a value centered at the left side of the mean (possibly including the median). Every variable has a relatively low kurtosis compared to the normal value which is three and an insignificant “Jarque-Bera” test statistics which strongly suggest a non-rejection of normality.

The Phillips–Perron test was used to test for unit root. The Phillips–Perron test was chosen over the commonly used unit root tests such as the Dickey–Fuller tests and the Augmented Dickey–Fuller (Arltová & Fedorova, 2016) because it has more power than these two tests. The University of Bath (2019) states that one advantage of the PP tests over the ADF tests is that the PP tests are robust to general forms of heteroskedasticity in the error term. In Arltová and Fedorova (2016), the Phillips–Perron test represents the most common alternative to the ADF test and its main advantage is that it is a non-parametric test. Thus, it is not necessary to specify the model and lagged parameter in the test regression.

The Phillip–Perron was performed and it showed that all variables were non-stationary at levels and they become stationary after being differenced once except for the World Income variable

Table 1. Descriptive statistics

Mean	LGDP 10.04308	LP 8.773115	LGE 8.344252	LUP 8.473050	LWI 9.010218
Median	10.17017	8.952655	8.228043	8.625362	8.888741
Maximum	11.15974	10.56737	9.745781	9.951925	10.78934
Minimum	8.293800	6.776393	6.725034	6.670259	6.593045
Std. Dev.	0.816780	1.132412	0.816076	0.985335	1.302659
Skewness	−0.439304	−0.068713	0.098488	−0.288352	−0.052431
Kurtosis	2.258012	1.761257	2.168333	1.924165	1.613352
Jarque-Bera	1.653124	1.941711	0.913086	1.862511	2.417236
Probability	0.437551	0.378759	0.633470	0.394059	0.298610
Sum	301.2924	263.1934	250.3275	254.1915	270.3065
Sum Sq. Dev.	19.34676	37.18836	19.31340	28.15567	49.21071
Observations	30	30	30	30	30

Source: Primary data computed from Eviews8.

Table 2. Lag length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-14.81883	NA	2.99e-06	1.468062	1.708031	1.539417
1	78.13996	144.6026	2.02e-08	-3.565923	-2.126104	-3.137790
2	109.1766	36.78413	1.60e-08	-4.013079	-1.373411	-3.228168
3	191.6115	67.16919*	4.30e-10*	-8.267517*	-4.428000*	-7.125827*

Source: Primary data computed from Eviews 8.

* shows the chosen lag length.

which became stationary after second differencing. The presence of unit root in the variables could be a sign that there is integration amongst the variables. The next procedure shall be to test the presence of cointegration amongst the variables.

4.3.2. Lag selection criteria

Before performing the cointegration test, the number of lags to include in the model must be determined (Emerson, 2007). In this regard, a lag order selection criterion was performed and it came up with the following results that are displayed in Table 2.

As shown in Table 2, the LR, FPE, HQ AIC and SC criteria suggest the use of three lags. Thus, subsequent analyses were based on VAR with 2 (3-1) lags.

4.3.3. Cointegration

The next stage in the examination of statistical properties of the series was a test for cointegration among the endogenous variables in the VAR system in equation (i). This was implemented in E-Views using procedures from Johansen (1992, 1995) system-based techniques. In testing for the number of cointegrating vectors among economic time series, Johansen's (1992, 1995) system approach is to estimate the Π matrix in an unrestricted form, and then test whether we can reject the restrictions implied by the reduced rank of Π (E-Views, 2009). The software provides procedures for conducting both a maximum Eigenvalue and trace statistic-based cointegration tests, which were employed in this study. The main difference between the two test statistics is that the Trace test is a joint test where the null hypothesis is that the number of cointegrating vectors is less than or equal to r , against a general alternative that there are more than r (University of Bath, 2019bb). Whereas the maximum Eigenvalue test conducts separate tests on the individual eigenvalues, where the null hypothesis is that the number of cointegrating vectors is r , against an alternative of $(r+1)$. Results are shown in Table 3.

Both the Trace and Maximum Eigen tests indicate that there is at least one cointegrating relationship in this model. The cointegration test has proved that the variables are cointegrated, and as a result of this, the VEC model can be done. Thus, we estimate VECMs restricted on one cointegrating vector.

It is essential to consider results from both tests for robustness purposes. Results from Table 3 can be presented graphically by plotting graphs of cointegrating variables as shown in Figure 1. One cointegrating vector in our VAR model realised from Table 3 is confirmed by the cointegrating graph (Figure 1).

It can be observed from the graph that over the period 1986 to 2012, the deviations of GDP from equilibrium were stationary. An error correction model can be specified from the results of the analysis. The VECM approach was preferred instead of the ARDL approach because the unit root results have shown that the World Income variable became stationary second differencing. Frimpong and Oteng-Abayie (2006) and Lee (2012) argue that the ARDL procedure will crash in

Table 3. Cointegration results

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.760836	71.98201	69.81889	0.0333
At most 1	0.413888	31.92506	47.85613	0.6163
At most 2	0.357701	16.96621	29.79707	0.6426
At most 3	0.129238	4.570574	15.49471	0.8526
At most 4	0.024542	0.695754	3.841466	0.4042

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.760836	40.05695	33.87687	0.0081
At most 1	0.413888	14.95886	27.58434	0.7515
At most 2	0.357701	12.39563	21.13162	0.5091
At most 3	0.129238	3.874819	14.26460	0.8723
At most 4	0.024542	0.695754	3.841466	0.4042

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Source: Primary data computed from Eviews 8.

the presence of I(2) series. This is further supported by Belloumi (2014) the presence of variables integrated of order two, we cannot interpret the values of F statistics provided by Pesaran (ARDL). However, in order to ensure the robustness of the VECM results, the VECM approach was supplemented by the Fully Modified Ordinary Least Squares (FMOLS). The FMOLS method produces reliable estimates for a small sample size and provides a check for the robustness of the results (Bashier & Siam, 2014). This technique modifies least squares to account for serial correlation effects and test for the endogeneity in the regressors that results from the existence of Co-integrating Relationships (Kalim & Shahbaz, 2008).

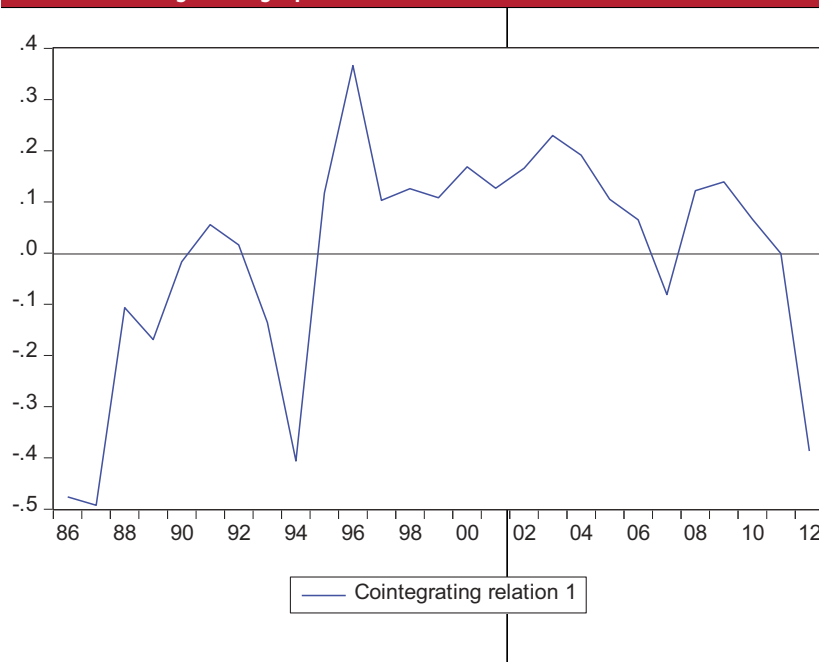
4.3.4. Cointegrating equation normalised on GDP

On the basis of evidence from various diagnostic and specification tests, the final specification of the statistical model in Equation (i) was finally estimated as a Vector Error Correction (VEC) model, with one CE imposed, up to two lags allowed for each of the endogenous variables in the VAR and with constant (no trend) allowed in the CE. Results from the long-run model are presented in Table 5.

The estimation results are shown in Table 4. The study shall report the results that were obtained from the VECM. The FMOLS was used to test the robustness and also to corroborate the VECM results. It should also be that the results of both tests are similar except for the LUP variable which showed a negative sign under VECM and it was insignificant under the FMOLS model.

Results show that, in the long run, processed agricultural exports (LP) have a positive¹ relationship with GDP. This is consistent with empirical and economic theory. Theoretically, it has been argued that a change in export rates could change output. Results are also consistent

Table 4. Cointegration graph



Source: Primary data computed from Eviews 8.

Table 5. Long-run results

Variable	VECM	FMOLS
LP	-0.399889	0.3143**
	<i>0.10542</i>	<i>0.1457</i>
	(-3.79345)	(2.1575)
LGE	-0.613350	5.269***
	<i>0.04835</i>	<i>0.5948</i>
	(-12.6857)	(8.8579)
LWI	-0.009587	3.781***
	<i>0.05108</i>	<i>0.5849</i>
	(-0.18768)	(6.4652)
LUP	0.257797	-1.97
	<i>0.09128</i>	<i>1.92</i>
	(2.82433)	-(1.026)

Note: Figure in parentheses are t statistics, in italics are standard errors and * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

with empirical literature. Levin and Raut (1997) explored the effect of primary commodity and manufactured exports on economic growth. The study concluded that manufacturing exports were the main source of economic growth and the exports of primary products had a negligible effect. A similar conclusion was reached by Crespo-Cuaresma & Worz (2005) and Wang, Wu, and Gao (2010). Although little has been done on this subject in South Africa, evidence on the ground supports the findings of this study. For instance, the International Trade Administration Commission of South Africa (2016) and Department of Trade and Industry (2019) stated that amid the fall in mineral commodity prices, the processing of agricultural products has been helping South Africa realise value-added growth and support labour-intensive sectors of the economy. Furthermore, the agro-processing sector is helping South Africa break out of

commodity dependence (International Trade Administration Commission of South Africa, 2016). Furthermore, the PMG (2015) stated that the agro-processing sector has been displayed the highest growth and employment multipliers compared to other sectors of the South African economy.

Results also show that government expenditure has a positive relationship with GDP. This is consistent with the Keynesian theory which argues that government intervention in the economy is necessary. In the 1930s, John Maynard Keynes argued that government spending-particularly increases in government spending-boosted growth by injecting purchasing power into the economy. Keynes postulated that causality runs from public expenditure to income, to Keynes, public expenditure is an exogenous factor which can be used as a policy instrument to influence economic growth (Al-Fawwaz, 2013).

Results also show that there is a weak positive relationship between world income (LWI) and GDP. This was expected because an increase in world income might lead to a demand for South African exports. This will then increase the GDP for South Africa. However, this relationship is insignificant.

Furthermore, results show that there is a negative relationship between unprocessed exports and GDP. This is surprising because, intuitively, since exports are a component of GDP, increasing exports necessarily increases GDP, *ceteris paribus* (Gilbert, Linyong, & Divine, 2013). This is also inconsistent with both economic theory and empirical literature. The classical economists like Adam Smith and David Ricardo have argued that international trade is the main source of economic growth and more economic gain is attained from specialization. According to the export-led growth hypothesis, exports being the major source of economic growth have many theoretical justifications. Ohlan (2013). Ohlan (2013) showed, in India, agricultural products export Granger causes the growth in the GDP of agriculture, which supports the export-led growth hypothesis.

However, the results are, partially, consistent with De Pin̄eres and Cantavella-Jorda' (2007) who showed that the relationship between GDP and exports is existent in some countries. Faridi (2012) also showed that agricultural exports have a negative and significant effect on economic growth. The negative relationship may be caused by the changes occurred after 1994 when South Africa was under apartheid. During the apartheid period, commercial farmers benefited from import protection, state subsidies, guaranteed prices and access to productive technology, and after 1994, all these disappeared and agricultural productions concentrated on low value and less labour-intensive field crops (Dube, Nair, Nkhonjera, & Tempia, 2018). The fact that the exports showed a negative relationship with GDP supports the need to have agro-processing. Growth of the agro-processing industry stimulates agricultural growth by creating new output markets and increasing farmers' incomes, which enables investment in land and inputs to improve productivity (African Center for Economic Transformation, 2017). Evidence of error correction is shown by the results in Table 5.

In Table 5, the coefficient of D (GDP) of -0.2406 shows that the speed of adjustment is approximately 24%. This means that if there is a deviation from equilibrium, only 24% is corrected in 1 year as the variable moves towards restoring equilibrium. This means that there is no strong pressure on economic growth to restore long-run equilibrium whenever there is a disturbance. The results also show that, in the short run, processed agricultural exports have a negative relationship with GDP. This is surprising because processed exports are supposed to contribute towards GDP. Growth of the agro-processing industry stimulates agricultural growth by creating new output markets and increasing farmers' incomes, which enables investment in land and inputs to improve productivity (African Center for Economic Transformation, 2017). However, the results from the study are much clearer when they are combined with the results from the variance decomposition in Table 6. In the first two periods, the contribution of unprocessed exports to GDP is very insignificant. This may represent the short run where there would be a negative but marginal

Table 6. Error correction model results

Variable	Coefficient	Standard error	t-statistic
DLGDP	−0.240625	0.08151	−2.95200
LP	−0.148549	0.07146	−2.07885
LUP	−0.006974	0.09778	−0.07132
LWI	0.291318	0.06805	4.28082
LGE	−0.155254	0.08464	−1.83437

Source: Primary data computed from Eviews 8.

relationship between processed exports and GDP. As time moves (long run) the contribution of unprocessed agricultural exports becomes larger and it also contributes positively to GDP as shown in Table 4.

Results also show that World income has a positive relationship with GDP. This is a reasonable outcome. When world income increases, we expect spending to increase. This may boost South African exports. During the period of economic crisis, economies struggle and this may have ripple effects to other economies. But when economies are performing well, there would be more global trade and investment and this boosts the GDP of countries that are open to foreign investment and trade. This notion is supported by Dube et al. (2018) who state that, in South Africa, increased demand following the growth in world incomes contributed to increased investments in agriculture after the global financial crisis.

4.3.5. Variance decomposition

Variance decomposition analysis provides a means of determining the relative importance of shocks in explaining variations in the variable of interest. In the context of this study, it therefore provides a way of determining the relative importance of shocks to each of the variables in the model. All the results are presented in Table 6.

Table shows that GDP explains approximately 92 per cent of its variation, while all its determinants explain the other 8%. After a period of four years, GDP explains approximately 53 per cent of its own variation, while its determinants explain the remaining 47% per cent. The results also show that in the short run the contribution of processed exports is marginal. This may be the reason why the short run VECM analysis showed a negative relationship. However, as time moves into the long run, the rewards of investing in processed agricultural exports are reaped. This is in line with the long run VECM results where the processed agricultural exports were seen to be having a positive relationship with GDP. The influence of the LWI increase to about 18 per cent making it the largest component that explains much of the changes in GDP. LP explains the second largest component (13%) of the 47 per cent variation in GDP that is explained by its determinants. As time moves, GE becomes the largest component explaining the variations in GDP. This is consistent with the Keynesian theory. Keynes postulated that causality runs from public expenditure to income, to Keynes, public expenditure is an exogenous factor which can be used as a policy instrument to influence economic growth (Al-Fawwaz, 2013).

4.3.6. Diagnostic checks

The VAR model was subjected to rigorous diagnostic tests. Diagnostic checks are crucial in this analysis because if there is a problem in the residuals from the estimation of the model, it will be an indication that the model is not efficient such that parameter estimates from such a model may be biased. Results from the different diagnostic tests carried are presented in Table 7.

Table 7. Variance decomposition

Period	S.E.	LGDP	LGE	LP	LUP	LWI
1	0.065580	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.097077	92.69896	5.980190	0.976634	0.299425	0.044790
3	0.106118	77.99203	5.065709	5.228020	3.785374	7.928872
4	0.130685	53.71251	8.662237	12.97431	6.386545	18.26440
5	0.144706	45.35711	11.44574	15.93657	7.334404	19.92617
6	0.152821	40.91844	14.10467	17.92159	7.396498	19.65880
7	0.166323	35.62415	25.51004	15.65474	6.268707	16.94236
8	0.175101	33.47212	30.63589	14.80118	5.762928	15.32788
9	0.182394	30.95393	32.07545	16.83881	5.369772	14.76203
10	0.191901	27.96332	34.68470	17.90638	4.950451	14.49516

Source: Primary data computed from Eviews 8.

Table 8. Diagnostic tests

Test	Null Hypothesis	Chi-square	Probability
Lagrange Multiplier (LM)	No serial correlation	32.59	0.1414
White (CH-sq)	No conditional heteroskedasticity	0.935	0.762
Jarque-Bera (JB)	There is a normal distribution	10.671 ²	0.621

Source: Primary data computed from Eviews 8.

In Table 7, the LM results suggest that we cannot reject the null hypothesis of no serial correlation. The probability (0.1414) is greater than 0.05, and as a result, the null hypothesis of no heteroskedasticity or no misspecification will thus not be rejected. Therefore, the model does not suffer from any misspecifications hence can be relied on. The null hypothesis for the Jarque-Bera test states that there is a normal distribution. The results obtained for this particular test show a Jarque-Bera probability of 0.621. The null hypothesis was only going to be rejected if the probability was less than 5%. In this case, probability is greater, therefore we fail to reject the null hypothesis of a normal distribution. The model does not suffer from heteroscedasticity as shown by the 0.762 probability from the White test. Results show that the model is robust.

5. Policy implications and recommendations

The paper attempts to empirically test the relationship between the contribution of unprocessed and processed agriculture of exports to economic growth. The study used time series data which spanned from 1986 to 2012. The study found that processed agricultural exports have a positive relationship with economic growth whereas unprocessed agricultural exports have a negative relationship with economic growth. This shows that manufactured agricultural exports contribute significantly to economic growth.

The study recommends that the South African government should promote and stimulate investment in the processed agricultural commodities sector. There should be more production and expansion in the manufacture agricultural commodities sector. Processed manufactured goods usually are sold at a much higher price and this may generate more income for South African firms. There should industries which turn raw agricultural goods into high-value manufactured goods. Furthermore, the processed agricultural sector has much longer chain and involves a number of processes which require manpower. Each stage in the

manufacturing process requires different skills and expertise. This then creates employment opportunities. The development of agro-manufacturing industries will maximize the socio-economic benefits from the agricultural sector in terms of economic growth, employment and consequently poverty reduction.

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Author details

Courage Mlambo¹
 E-mail: mlamboct@gmail.com
 Peter Mukarumbwa¹
 E-mail: peerta@gmail.com
 Ebenezer Megbowon¹
 E-mail: ebenezymeg@yahoo.com

¹ Department of Economics, University of Fort Hare, Alice, South Africa.

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Notes

1. The long-run coefficients interpretation in a VECM is interpreted by taking the opposite of the sign of the estimated coefficients.
2. JB statistic.

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