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Assessing the effects of agricultural exports on economic growth in Rwanda
A case of tea and coffee

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Abstract:
The purpose of this paper was to investigate the effect of agricultural (coffee and tea) exports on economic growth of Rwanda from 1990 up to 2015 by taking into consideration of existence of long run relationship between agricultural export and economic growth, the speed of adjustment in long run and also the existence of causality between the agricultural export and economic growth. The analysis was done by using co-integration model, Error correction model and Granger causality model.The findings of the study showed that Coffee and tea export was found to have a positive and significant relationship with economic growth. On the other side these results provide evidence of bi-directional causality between coffee exports and economic growth as well as tea export and economic growth running in both directions. The result implies that agricultural export growth causes economic growth and vice versa.

Keywords: *Tea, Coffee, Agricultural trade Economic growth, Rwanda*

1. Study Background

Rwanda is a small, landlocked, resource-poor country with a population of more than 10.5 million. The population density has more than doubled since 1978 from 183 inhabitants per square kilometer (km^2) to 415 inhabitants/Km^{2}in 2012. Population density in the country is the highest in Africa. The annual demographic growth rate is 2.6 per cent and the population is expected to increase to 14.6 million by 2025 (ICRAF, 2012).

Agriculture remains the backbone of the economy, accounting for one third of GDP in 2012 and agriculture about 80 per cent of total employment. Although a great part of GDP growth of the past ten years can be attributed to improved performance in agriculture, the sector still remains very fragile. Production units are very small, agriculture techniques are still based on rain-fed production systems with less than 6 per cent of cultivated land currently irrigated, and agricultural production is still largely for subsistence (NISR, 2014).

In Rwanda, the main food crops were sorghum, banana, beans, sweet potatoes and cassava but over the past decade, maize, rice, Irish potatoes, fruits and vegetables have emerged as important crops grown by smallholders(MINAGRI, 2014). Tea and coffee represent by far the main traditional export crops, providing about 70 per cent of agriculture exports crops, providing about 70 per cent of agriculture export earnings. Smallholders hold an average of four to five plots that make up an average land size of 0.59 hectares, thus restricting the ability of rural populations to escape poverty. Family farms are continuously subdivided into increasingly smaller plots, fields are over cropped and marginal land and

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pasturelands are converted to arable lands(MINECOFIN, 2012). In 2005 the land law was instituted to resolve the issue of land fragmentation, replacing the customary tenure system with registered titles that can be used as collateral (MINAGRI, 2012).

According to Hazell (2009). sustained growth the agricultural sector has been driven by important public investment in land use consolidation , irrigation, land improvement, soil and water conservation, facilitating access to inputs, increasing livestock herds and social capital-building through support to cooperative development. The intensification of production system to improve productivity is now becoming a government priority, together with the generation of off-farm employment in order to create alternative livelihood opportunities and economic mobility away from primary production, thus releasing land to increase the size of farming units to a more viable scale for high-value intensification and sustainable management of the limited natural base.

The strategy for stimulating rapid and sustainable economic growth and reducing poverty is articulated in Rwanda's vision 2020 which is fostering good governance, development of human resources, private sector-sector-led economy, and infrastructure development. Export oriented-farming and regional and international economic integration.

This vision is further laid out in the second Economic Development and Poverty reduction Strategy (EDPRS2). approved by the government in May 2013 and covering the period 2013-2018. It delineates the agriculture sector as a key sector and a significant engine of inclusive growth for the country. EDPRS is being structured around four main themes, namely; accelerated economic growth achieving middle-income country status, rural development for sustainable poverty reduction, productivity and youth employment and improved service delivery and citizen participation in the development process. The main objective is to reduce poverty to 30 per cent and extreme poverty to 9 per cent (EDPRS2, 2013).

As part of EDPRS2, the Strategic Plan for Agriculture Transformation (PSTA III) is implemented by the ministry of Agriculture and animal Resources (MINAGRI). The government, through MINAGRI, provides policy, coordination and financing leadership for the plan. Its objective is to transform Rwandan from a subsistence-based to a knowledge-based, value-creating sector and accelerate agriculture growth to increase rural incomes and reduce poverty. The strategy encompasses four broad program area, agriculture and animal resource intensification, research, technology transfer and professionalization of farmers; value-chain development and private-sector investment; and institutional development and agricultural crosscutting issues. Compared with the previous strategic plan, PSTA III puts greater emphasis on value chains and markets, product quality and obtaining premium prices, as well as arrangements for bulking up production is order to ease access to inputs, services and markets. It also aims at increasing exports of tea, coffee and horticultural products and developing the role of the private sector in agricultural production (EDPRS2, 2013).

The importance of agriculture's contribution to growth in Rwanda remains considerable, despite the emergence of other significant growth drivers, such as services. Rwanda's agriculture sector will play an essential role in attaining the country's development vision of sustainable growth and increased poverty reduction, due to its employment weight. The agriculture feature of this Update edition outlines key channels through which agriculture contributes to the economy. The second part of the Update provides the regular overview of recent macroeconomic developments.

2. Literature Review

There are different theories on economic growth, each identifying own paradigm and concept. These theories indicate an increase in the productive capacity of an economy as a result of which the economy

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is capable of producing additional quantities of goods and services. For a country economic growth is desirable to bring economic development.

2.1.1 Endogenous growth theory

Endogenous extended Solow-Swan growth model by introducing endogenous technical progress in growth process. One of the simplest versions of endogenous model is AK model. The AK model is a special case of Cobb-Douglas production function with constant returns to scale (Wikipedia, 2017):

$Y = AK^{a}L^{1-a}$ ………………………………………………… (1)

Where:

Y = Total production in an economy.
A = Total factor productivity.
K = Capital
L = Labour
α = Parameter between 0 and 1.
For the special case in which α = 1, the production function becomes a linear function of capital.
Thus:
Y = AK ………………………………………….. (2)

Where A is the level of technology which is positive constant and k represents volume of capital, which embodies both physical capital and human capital. Various extension of the basic AK endogenous growth model have been worked out, allowing different forms of variables to be productive various forms of expenditure and various forms of taxation (Gomez, 2008).

In his own contribution, Hwa (1988) argues that agriculture is an engine of growth and added agricultural output (O) to growth equation. Similarly, included additional determinants of growth [exports (X) and inflation rate (P)] that have been found to be robust in explaining aggregate productivity growth. The authors assumed B to be productive input in growth model. Thus, equation 2 becomes:

$Y = AK^{a}B^{\beta}$ ……………………………… (3)

Where: **B** = f(O, X, P).

$Y = AK^{a}O^{\beta}X^{\delta}P^{\phi}$ …………………………… (4)

Where: α, β, δ and ϕ are parameters to be estimated. Taking natural logs of equation (4) in order to convert research data from rates and absolute terms into the same numerical structure and to standardize them in relative growth rates and including an error term at time t, yields:

$InY^{t} = a_{t} + aInK_{t} + \beta InO_{t} + \delta InX_{t} + \phi InP_{t} + \varepsilon t$ ……………………….. (5)

Where: **εt** = error term.

Agricultural export expansion can be a catalyst for output growth both directly, as a component of aggregate output, as well as indirectly through efficient resource allocation, greater capacity utilization, exploitation of economies of scale, and stimulation of technological improvement due to foreign market competition (Helpman, 2008). Also, agricultural productivity and export expansion are expected to have positive effects on growth while macroeconomic instability, captured by high inflation rates, should have a negative effect on economic growth.

2.2 The concept of agricultural exports and economic growth

In developing countries, agriculture continues to be the main source of employment, livelihood and income for between 50%-90% of the population. Of this percentage, small farmers make the up the

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majority, up to 70–95% of the farming population. Small farmers are therefore a significant proportion of the population. They have traditionally survived on subsistence production. Many in the last 2 decades have experimented with export crops with occasional initial success but many disastrous failures (Conroy et al, 2006).

The industrialization and export orientation of agriculture has not benefited them. In the globalized market, the small players have been marginalized, yet economically, they should not be ignored. Policies which have led to their marginalization have meant the continuation of the vicious cycle of poverty for sectors of society, highly uneven development and hence the inability of many developing countries to attain satisfactory levels of overall development (Conroy et al, 2006).

The structure of agricultural production in developing countries has radically changed in the last two decades. Since the late 60s and 70s, the World Bank and its various agricultural research institutes have actively promoted the adoption of industrial (high chemical input) agricultural methods such as the Green Revolution 'miracle' seeds, promising landfall yields. These high technology methods were expected to benefit all farmers, including the poor. Since yields would increase, incomes were also expected to increase. However, the heavy dependence on imported inputs could not be sustained economically by developing countries (Janvry 1981).

According to Jung and Marshal (1985) growth in real exports tends to cause growth in real GNP for three reasons. First, export growth may represent an increase in the demand for the country's output and thus serve to increase real GNP. Secondly, increases in exports may loosen a binding foreign exchange constraint and allow increases in productive intermediate imports and hence result in the growth of output. Finally, export growth may result in enhanced efficiency and thus may lead to greater output.

3. Methodology

In this party deals with describe the study area, the nature and source of data that captures issues relevant to the study. It comprises of the methodology base on the different work that we have reviewed in the previous chapter. The next step will bring in issues related to the ordinary least square method of estimation. This will equally take into consideration the econometric procedures related to studies using time series data. We have two equations that will be estimated using the ordinary least squares method.
This study was carried out in Rwanda. Rwanda is located in east-central Africa, is surrounded on the East by Tanzania, on the West the Democratic Republic of the Congo, on the South by Burundi and Uganda on the north. It is slightly smaller than Maryland. Steep mountains and deep valleys cover most of the country. Lake Kivu in the northwest, at an altitude of 4,829ft (1,472m). is the highest lake in Africa. Rwanda is the African Great Lakers region and is highly elevated; its geography is dominated by mountains in the west and savanna to the east, with numerous lakes throughout the country. The climate is temperate to subtropical, with two rainy seasons and two dry seasons each year (CIA, World fact book, 2013).

As of 2015, the National Institute of statistics of Rwanda estimates Rwanda's population to be 11,262,564. The 2012 census recorded a population of 10,515,973. The population is young: in 2012 census, 43.3% of the population was aged 15 and under, and 53.4% were between 16 and 64. According to the CIA World fact book, the annual birth rate is estimated at 40.2 births per 1,000 inhabitants in 2015, and the death rate at 14.9%. The life expectancy is 59.67 years (61.27 years for females and 58.11 years for males) which is the 26th lowest out of 22 countries and territories. The sex ratio of the country is relatively even (CIA, World fact book, 2013).

The Rwanda economy is based on the largely rain-fed agricultural production of small, semi-subsistence, and increasingly fragmented farms. It has few natural resources to exploit and a small, noncompetitive industrial sector. While the production of coffee and tea is well-suited to the small

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farms, steep slopes and cool climates of Rwanda and has ensured access to foreign exchange over the years. The government of Rwanda posted a 13% GDP growth rate in 2015 through improved collection of tax revenues accelerated privatization of state enterprises to stop the drain on government resources and continued improvement in export crop and food production. The main crops in the country include coffee, tea, pyrethrum, flowers, bananas, beans, sorghum and potatoes. Coffee, tea, flowers are the major cash crops for export, with the high altitudes, steep slopes and volcanic soils providing favorable condition. Therefore In 2015 agriculture accounted for 33% of the economy of Rwanda (Lavelle, 2016). The country entered a high period economic growth in 2006, and the following year managed to register 8% economic growth, a record it has sustained since, turning it into one of the fastest-growing economies in Africa. This sustained economic growth has succeeded in reducing poverty and also reducing fertility rates with growth between 2006 and 2015 reducing the percentage of the country's population living in poverty from 57% to 45%. The country's infrastructure has also grown rapidly with connections to electricity going from 91,000 in 2006 to 215,000 in 2015 (Lavelle, 2016)

Table 1: Variables and expected signs

Variables	Variable Names	Expected Signs
RGDPt	Real gross domestic product	
LFt	Total labor force	+
CAt	Gross domestic fixed capital formation	+
RERt	Real exchange rate	+
CPIt	Consumer price index	-
COFXt	Coffee export	+
TEAXt	Tea export	+

3.1. Model specification

In this thesis, the researcher will use the slow-Swan production function, an economic model of long-run economic growth set within the framework of neoclassical economics as a base to develop the economic growth model for this study. This model attempts to explain long-run economic growth by looking at capital accumulation, labor and technological progress and due to its particularity attractive mathematical characteristics, Solow-Swan shows to be a convenient starting point for various extensions. Therefore, since the economy of Rwanda is labor intensive and the study will not focus on the non-economic variables of the classical growth theory, the following neoclassical production function will be used:

$Y = f(L, K)$ ……………………………….(6)

This model is extended by including non agricultural export as one of the in depended variables computed using the principal component approach. Though we would use his model as a basis for the specification of our own model, we would escape from being too generic i.e. looking at the entire contribution of agricultural exports to economic growth in Rwanda. This is because of the broadness of content which makes it difficult for policy implementations. We develop the same theoretical model based on the contribution of Agricultural export to economic growth in Rwanda with the case in point being coffee export, and Tea export.

This production function is expanded by adding agricultural exports as follows:

$Y_t = f(L_t, K_t COFX_t, TEAX_t)$ …………………….(7)

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This is essentially based on the production function framework, assuming a generalized production function and extending this Neo-classical growth model to include some selected agricultural exports indicators as additional inputs of the production function, alongside gross domestic fixed capital, labor force and consumer price index as control variables written as; $RGDPt = f(LFt, CAt, COFXt, TEAXt, ERt, CPIt\mu$ …………………….. (8)

This equation above is explained as RGDPt is the annual real gross domestic product, LFt is the total labor force Cat is the gross domestic fixed capital formation, COFXt is coffee export, TEAXt is tea export, ER tex change rate and CP It is consumer price index and error termμ.

Finally, from equation 6 and 7, equation 8 is derived by taking natural logarithm on both sides of equation 7 in order to discard the differences in the units of measurements for the variables and to minimize the gap between independent variables and dependent variables. It is then used to analyze the impact of agricultural exports on economic growth in Rwanda from 1990 to 2015.

3.1.1 The Long- Run Real Gross Domestic Product Equation

To estimate the effect of agricultural export on economic growth in Rwanda, we specify the following model which is just a slight modification of equation above.

$LRGDPt = \beta o + \beta 1LLFt + \beta 2LCAt + \beta 3LRERt + \beta 4LCPIt + \beta 5COFXt + \beta 6TEAXt + \varepsilon t$ ……..(9)

This function is explained as follow; LGDPt is natural logarithm of real gross domestic product, LLFt is natural logarithm of labor force, LCAt is natural logarithm of gross domestic fixed capital formation, $LRER_t$ is natural logarithm of real exchange rate, LCP It is natural logarithm of consumer price index, $LCOFX_t$ is natural logarithm of coffee export, LTEAXt is natural logarithm of tea export, and εt is error term$\beta 0$ is the constant term and $\beta 1$,$\beta 2$,$\beta 3$,$\beta 4$,$\beta 5$, and $\beta 6$ are the parameters of independent variables to be estimated.

3.2 Estimation Procedure

This section treats methodological issues related to the estimation of our specified model. In order to explore the short run and long run relationship between agricultural exports and economic growth, we need time series econometrics data. Regressions will be carried out using Eviews 7.0.2 application.

3.2.1 Examination of Stationary and Non-stationary of Variables

In this study, time-series data of macro-economic nature will be used for the estimation of the model and thus the data generating processes exhibit trends and volatility which could result in a non-stationary issue. Stationary in time-series data refers to a stochastic time series that has three characteristics, as described. First, a variable over time has a constant mean. Thus the expected value of Y at different time periods is fixed and has an average value. Hence the data generating process Y is not a trend. Second, the variance of a variable over time is constant. Hence the data generating process is not stable. Third, the covariance between any two time periods is correlated. Further, the correlation value is constant and depends on the difference between the time periods. Thus the data generating process of RGDP expresses statistically valid joint distribution of RGDP variable values. If one or more of these criteria is violated, then the data generating process of the time-series data is a non-stationary series (Gujarati 1995).

3.2.2 Unit Roots Test

The usage of ordinary least squares (OLS) methodology on time series data usually requires that the data be stationary to avoid the problem of spurious regression. A variable is said to be stationary if it's mean, variance and auto covariance remains constant no matter at what point we measure them. A process is said to be stationary when it has a constant and time independent mean, a finite and time independent variance, and the covariance between successive terms is time independent. A series is

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therefore stationary if it is the outcome of a stationary process. The most common example of a stationary series is the white noise which has a mean of zero, a constant variance and a zero covariance between successive terms.

A non-stationary time series may become stationary after differencing a number of times. A series may be difference or trend stationary. A difference stationary series becomes stationary after successive differencing while a trend stationary series becomes stationary after deducting an estimated constant and a trend from it. The order of integration of a series is the number of times it needs to be differenced to become stationary. A series integrated of order I (n) becomes stationary after differencing in times. To establish the order of integration of a series, unit root tests are performed. There are many tests for examining the existence of unit root problem. Dickey and Fuller (1979, 1981) constructed a method for formal testing of non-stationary. The Dickey – Fuller (DF) is suitable, if the error term (μt) is not correlated and it becomes inapplicable if error terms (μt) are correlated. As the error term is unlikely to be white noise, Dickey and Fuller have extended their testing procedure suggesting an augmented version of the test that incorporates additional lagged term of dependent variable in order to solve the autocorrelation problem. To test if a series xt is stationary using the ADF test, the following equation is estimated:

$Dx_t = a + px_{t-1} + e_t$ ……………………………………………………..(10)

The following decision rule is used;
- If the ADF test statistic is greater than the critical value, then the series is stationary.
- If the ADF statistic is less than the critical value, the series is non-stationary.

If the series is non stationary at level form, then, the test is carried out successively on the differenced series until it becomes stationary. The order of integration is then established. The test has three variants:

$\Delta Yt = \delta Yt - 1 + \mu t$ …………………. (11) without drift and trend

$\Delta Yt + = \beta o + \delta Y_{t-1} + \mu t$ ………….. (12) With drift

$\Delta Yt = \beta o + \beta 1t + \delta Y_{t-1} + \mu t$ …………..(13) With drift and trend

From the equation above is the time or trend variable. In each case the null hypothesis is: $H0 = \delta = 0$; that is, there is a unit root (the time series is non-stationary). and$H1 = \delta < 0$; that is the time series is stationary.

But in case $\mu t$is correlated, Dickey and Fuller have developed a test, known as the Augmented Dickey–Fuller (ADF) test. This test is conducted by augmenting the preceding three equations by adding the lagged values of the dependent variableYt.The ADF test here consists of estimating the following regressions:

$\Delta Yt = \delta Yt - 1 + at\Delta mt = 1Yt - 1 + \varepsilon t$ …………………. (14) Without drift and trend

$\Delta Yt = \beta o + \delta Y_{t-1} + at\Delta mt = Y_{t-1} + \varepsilon t$ ……………….(15) With drift and trend

$\Delta Yt = \beta o + \beta 1t + \delta Yt - 1 + at\Delta mt = Y_{t-1} + \varepsilon t$ ………..(16) With drift &trend)

This means that $\beta 0$ and t are the constant and the time trend, respectively. The ADF test assumes that the errors are statistically independent and have a constant variance. Thus, an error term should be uncorrelated with the others and has a constant variance. The test is first carried out with a constant and trend on the variable in level form. Secondly, it is carried out with a constant only and finally without constant or trend on the differenced variable depending on which was significant in the level form. If the ADF test statistic is greater than the critical value, then the series is stationary and if the ADF statistic is less than the critical value the series is non-stationary. The following hypotheses will be used to test for stationary:

$H0 = Yt$ has unit root or not stationary

$H1 = Yt$ is stationary or does not have unit root

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The other method of unit root test is Phillips-Perron (1988). This test is a modification and generalization of DF's procedures. While DF tests assume that the residuals are statistically independent (white noise) with constant variance, Phillips-Perron (PP) tests consider less restriction on the distribution of the disturbance term (Enders, 1995). Phillips-Perron tests undertake non-parametric correction to account for auto correlation present in higher AR order models. The tests assume that the expected value of the error term is equal to zero, but PP does not require that the error term be serially uncorrelated. The critical values of PP tests are similar to those given for DF tests and this study applied both methods for accurate results. If dependent and independent variables fail the stationary test, the data generating process of these variables are non-stationary. These tests are performed on both level form and first differences of both variables. The Implication of the unit root test result on the estimation procedures is that if all variables in the equation are found to be non-stationary at level form, I (0). but stationary at first difference I (1). then co-integration test will be conducted to find the existence of a long-run (L-R) equilibrium relationship.

3.2.3 Co-integration test

Granger (1981) introduced the concept of co integration. Co integration is the statistical implication of the existence of long run relationship between the variables which are individually non-stationary at their level form but stationary after difference (Gujarati (1995)). The theory of co-integration can therefore be used to study series that are non stationary but a linear combination of which is stationary. Two main procedures are used to test for co-integration: The Engle and Granger (1987) test and the Johansen (1988) co-integration test. The co integration in multiple equations can be examined only by Johansen (1981) and Johansen Juselius (1990) approach. Johansen procedure of co integration gives two statistics. These are the value of LR test based on the maximum Eigen-value and on the trace value of the stochastic matrix.

The Johansen test uses the likelihood ratio to test for co-integration. Up to (r-1) co-integrating relationships may exist between a set of r variables. The hypothesis of co-integration is accepted if the number of co-integrating relationships is greater than or equal to one. The decision rule compares the likelihood ratio to the critical value for a hypothesized number of co-integrating relationships. If the likelihood ratio is greater than the critical value, the hypotheses of co-integration is accepted, if not it is rejected. Due to data constraints, the Johansen test is not used in this work, since it requires at least two equations as well as high frequency data. Therefore, this study employs the Engle and Granger Co-integration procedure. Hence, there is a long run equilibrium relationship between two or more variables, if they are co integrated and they do not drift far apart over time (Engle & Granger 1987).

The co-integration in multiple equations can be examined by Johansen (1981) and Johansen Juselius (1990) approach. Johansen procedure of co-integration gives two statistics. These are the value of LR test based on the maximum Eigen value and on the trace value of the stochastic matrix. The Johansen test uses the likelihood ratio to test for co-integration. Up to (r-1) co-integrating relationships may exist between a set of r variables. The hypothesis of co-integration is accepted if the number of co-integrating relationships is greater than or equal to one. The decision rule compares the likelihood ratio to the critical value for a hypothesized number of co-integrating relationships. If the likelihood ratio is greater than the critical value, the hypotheses of co-integration is accepted, if not it is rejected. The generalization of Johansen's procedure is as follows:

$$\Delta yt = a\beta' \, yt - 1 + \sum_{i=1}^{p-1} \Delta yt - 1 + \varepsilon t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(17)}$$

where y is a (K X 1) vector of I (1) variables, α and β' are (K X r) parameter matrices with rank r<K,Π1,……, Π p-1 are (K X K) matrices of parameters, and it is a (K X 1) vector of normally distributed errors that is serially uncorrelated but has contemporaneous covariance matrix π. Johansen's procedure relies on the rank of Π and its characteristics roots. If rank (Π) = 0, the matrix is null (no co-integration) and equations in vector ytarea common VAR in first differences. If Π has full rank (Π = k).

the vector process is stationary and the equations in yt are modeled in levels I (0). If rank (Π) = 1, there is evidence of a single co-integrating vector. There are two likelihood ratio (LR) test statistics for co-integration under the Johansen approach. The trace ($\lambda trace$) and the maximum Eigen value (λmax) statistics which are specified as follows:

$\lambda_{trace}(r) = -T\Sigma In(1-\lambda_i)$ …………………………… (18)

$\lambda_{\max}(r, r+1) = -T\Sigma In(1-\lambda_{i+1})$ …………………………… (19)

Where, λ_i = the estimated values of the characteristic roots (eigen values) obtained from the estimated Π matrix, r is the number of co-integrating vectors, and T = the number of usable observations. The trace test evaluates the null hypothesis that the number of distinct co-integrating vectors is less than or equal to r against a general alternative hypothesis (the number of distinct co-integrating vectors is more than or equal to r).The maximum eigen-value test examines the number of co-integrating vectors versus that number plus one. If the variables in X_t are not co-integrated, the rank of Π is zero and all the characteristic roots are zero. Since ln (1) = 0, each of the expressions ln (1 - λ_i) will equal zero in that case. Critical values for the test are provided by Johansen and Juselius(1990) and by Osterwald-Lenum (1992).

3.2.4 Vector Error Correction Model (VECM) of Real Gross Domestic Product (Short Run)

In order to examine the short run relationships of the model, the error correction model has been used. Error correction term included in the model, explains the speed of adjustment towards the long run equilibrium. Initially, if the variables confirm the existence of co integration, then the Error Correction Model (ECM) will be estimated. Granger (1987) pointed out that if two variables are co-integrated in first difference, their relationship can be expressed as the ECM by taking past disequilibrium as explanatory variables for the dynamic behavior of current variables. The ECM method corrects the equilibrium error in one period by the next period. Therefore, the deviation from the long run relationship should be included as an explanatory variable in an Error Correction Model which can be presented as follows:

$\Delta y_t = \beta 0 + \beta 1 \Delta X_t + \beta 2_{\mu t} - 1 + \varepsilon t$ …………………………… (20)

Where ΔYt = Yt - Yt-1, ΔX=Xt-Xt-1,$\beta 1$ and $\beta 2$ are the dynamic adjustment coefficients, $\mu t{-}1$ is the lag of residual representing short run disequilibrium adjustments of the estimates of the long run equilibrium error, whileεt is the random error term (Gujarati, 2004). The error correction coefficient must be negative which indicates the existence of a short-run relationship. The size of the error correction coefficient determines the speed of adjustment towards equilibrium. In this study the Error correction model (ECM) is estimated as follows;

$\Delta LGDPt = \beta 0 + \beta 1 \Delta LLF_t + \beta 2 \Delta LCA_t + \beta 3 \Delta LERt + \beta 4 \Delta LCPIt + \beta 5 \Delta LCOFXt + \beta 6 \Delta LTEAXt + aECM(t-1) + \varepsilon t$ ……

………………………………………..(21)

Where; ΔLGDPt is the change in natural logarithm of real gross domestic product, $\Delta LLFt$ is change in natural logarithm of total labor force, $\Delta LCAt$is change in natural logarithm of gross domestic fixed capital formation$LERt$ is change in natural logarithm of real exchange rate, $\Delta LCPIt$ is change in natural logarithm of consumer price index, $\Delta LCOFXt$ is change in natural logarithm of coffee export, ΔLTEAXt is change in natural logarithm of oilseed export, $\Delta LPUXt$ is change in natural logarithm of pulses export, $\beta 0$constant term,$\beta 1$,$\beta 2$,$\beta 3$,$\beta 4$,$\beta 5$, and $\beta 6$ are parameters of the independent variables and εtis the stochastic error term.$ECMt{-}1$represents short run disequilibrium adjustments of the estimates of the long run equilibrium error andα is the coefficient of the error correction term.

3.2.5 Testing relationship between two variables

Granger casual relationship will used. Granger starts from the premise that the future cannot cause the present or the past. In multivariate time series analysis, causality test is done to check which variable

causes (precedes) another variable. Given two variables X and Y, X is said to Granger cause Y if lagged values of X predicts Y well. If lagged values of X predict Y and at the same time lagged values of Y predict X, then there is a bi-directional causality between X and Y. Granger devised some tests for causality which proceed as follows. Consider two time series, $Yt$and Xt: The Series Yt fails to Granger causeXt if in a regression of Yt on lagged Y's and lagged X's, the coefficients of the latter are zero.
That is, consider:

$$Y_t = b_o + b_j Y_{t-j} + c_j X_t + \varepsilon t \text{ ....}(22)$$

Then, if cj= 0 and j = 1, 2 . . . k, Xt fails to causeYt. I will test the hypothesis that $H0$: cj=0 against$H1$:cj≠0 by using an F test. In this study, where I will examine if coffee and tea exports granger causes economic growth (proxied by GDP) or vice versa, the model is given by:

$$LnRGDPt = b0 + \Sigma bj \ln RGDP_{t-j} + \Sigma_{cj} \ln COFX_{t-j} + \varepsilon t \text{ .... } (23)$$

$$\ln COFXt = b0 + \Sigma bj \ln COFX_{t-j} + \Sigma_{cj} \ln RGDP_{t-j} + \varepsilon t \text{ ....}(24)$$

$$LnRGDPt = b0 + \Sigma bj RGDP_{t-j} + \Sigma_{cj} \ln RTEAX_{t-j} + \varepsilon t \text{ ....}(25)$$

$$\ln TEAXt = b0 + \Sigma bj TEAX_{t-j} + \Sigma_{cj} \ln RGDP_{t-j} + \varepsilon t \text{ ....}(26)$$

Where lnRGDPt is natural logarithm of real gross domestic product, lnRGDPt-j is lagged value of natural logarithm of real gross domestic product, LnCOFXt is natural logarithm of coffee export, lnCOFXt-j is lagged value natural logarithm of lagged coffee export, lnTEAt is natural logarithm of tea export, lnTEAt-j is natural logarithm of lagged value of tea export and εt error term. From the above equation if cj=0 and j=1,2,….k then ln COFXt-j fail to cause lnRGDPt under the null hypothesis of cj=0 against the alternative hypothesis cj#0 by using F-test lnRGPt-j fail to cause lnCOFXt in equation 23 and 24; lnTEAt-j fail to cause ln RGDPt, ln RGDPt-j fail to cause lnTEAt in equation 25 and 26 respectively.

4. Results and Discussions

Table 2 reports the descriptive statistics and interprets that the average GDP at market prices is 2.03 USD with a 4.80E+09 standard deviation. The average fixed capital formation is 311 RWF billion. The mean value of labor force is 4.08 million people with standard deviation of 12232111.The average consumer price index is 74.0000 with a standard deviation of 31.37284. On the average coffee export is 105685.3 tons, with a standard deviation of 114534.2. In years of 1990, coffee has been exported in Rwanda below its average export. By 2015, coffee export has an increment of 676880 tons from it mean export. After this period coffee exported from Rwanda stood low from its mean value. This could be attributed to the economic crisis which affected all the sectors of the economy. After this period its export went above its average. The average coffee export is161546.3 tons, with a standard deviation of 41.18987

On the average Tea export is 140410.9 tons, with a standard deviation of 112462.8. From 1990 to 2015, Tea has been exported below its mean value. But after this period on ward coffee and Tea export witness a dramatic increase above its mean value. This could be attributed to many reform programs that have been put in place by the government. Skewness is a measure of departure from symmetry. The variable LNCPI, included in our analysis is negatively skewed or is leftward skewed, while the variables (LNGDP,LNLF, LNCAP, LNCPI LNCOFX and LNTEAX) are positively skewed or are rightward skewed. Kurtosis measures the peaked Skewness or flatness of the data relative to the normal distribution. The coefficient of Kurtosis of the variables indicate that coffee export and banana export are Plato-kurtic or flat while all other variables in our study have peaked Skewness or laptokurtic. Skewness and Kurtosis jointly determine whether a random variable follows a normal distribution.

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Table 2: Descriptive statistics

	LNGDP	LNLF	LNCAP	LNCPI	LNCOFX	LNTEAX
Mean	1.06E+10	3.16E+10	3.16E+10	4825883.9	74.0000	101546.3
Median	9.84E+09	1.88E+09	4655033.	54.78525	89930.00	88863.00
Maximum	2.37E+10	2.93E+10	7727247.	115.1500	794565.0	723125.0
Minimum	2.26E+09	1.54E+08	2355532.	15.17833	16977.00	32925.00
Std. Dev.	4.80E+09	5.14E+09	1583119.	31.37284	114534.2	112462.8
Skewness	0.684724	4.283350	0.200579	-0.006469	4.881303	5.006551
Kurtosis	3.734018	21.21216	1.929881	1.658360	27.33135	28.27574
Jarque-Bera	3.520663	590.7287	1.904702	2.625242	1077.891	1002.346
Probability	0.171988	0.000000	0.385833	0.269114	0.000000	0.000000
Sum	3.59E+11	1.10E+11	1.69E+08	2240.002	4118987.	3554120.
Sum Sq. Dev.	7.83E+20	8.99E+20	8.52E+13	33464.66	5.19E+11	4.30E+11

Source: Calculations by Authors using Eviews 7

4.1 Econometrics analysis

The main objective of the study is to explore the contribution of selected agricultural exports crops on economic growth, both in the long run and in the short run. Engle and Granger tests for co-integration issued. Once the problem of spurious regression is detected, the next step in the time series econometrics is to examine the stationary of the variables for determining the order of integration.

4.1.1 Presentation of Engle and Granger Method of Co-integration Analysis

Here the procedure is going to be carried out in two steps after determining the order of integration of the variables through the unit root test. Step1, which consist of the long run relationship that we wish to verify its existence is first of all estimated using ordinary least squares with all the variables in level. Step 2consists of extracting the error resulting from this regression and the unit root test conducted on it. The stationarity of the error at level form depicts a long run relationship between the variables. If not, the relationship does not exist. The absence of a long run relationship between the variables, imply that we have to run an ordinary least squares regression with I(0) variables in level form and I(1) in first difference, I(2) in second difference and so on, so as to get consistent results. In our case, we are going to present the unit root results first, closely followed by the estimation of the long run relationship. We shall then extract the error term (denoted ECT) on which we carry out a unit root test at level form I(0) in order to confirm the existence of co-integration. If co-integration exists, then we estimate the error correction model. For the error correction model, we difference all the variables and include the error correction term lagged by two period ECT (-1) to capture the effects of year to year variations. We are expecting that the coefficient of ECT (-1) to be significantly negative and less than one for the error correction mechanism to exist. The essence of using error correction model in the case of co-integration allows getting more reliable estimates than those we could have had if we had use the long term relationship.

4.1.2 Unit root result at level form showing non stationarity of variables

Table 3 below shows the Augmented Dickey Fuller test statistic. When we take the absolute value for each variable, we would realize that all are less than their respective t-statistic values at various levels of significance of 1%, 5% and 10%. This affirms that all the variables are non stationary at I(0).

Table 3: **Unit root result at level form showing non stationary of variables**

AUGMENTED DICKER-FULLER(ADF) TEST STATISTIC		
	Level Form I(0)	
Variables	**With linear trend and constant**	**With constant**
lnRGDP	-3.126989	-2.361115
Lncap	-3.500486	-2.507613
Lnlab	-1.149160	-2.608188
Lncpi	-1.480895	-2.275018
Lncofx	-1.830988	-1.748640
Lnteax	-3.919057	-1.276228

Source: Calculations by Authors using Eviews 7

The ADF test presented above is conducted in two phases. Phase 1 consist of carrying on the test with both constant and linear trend, while phase 2 constitute of constant only.

4.1.2.1 Presentation of stationarity of variables using unit root results at first difference

The figures on table 4 equally show the Augmented Dickey Fuller test statistic, which in absolute terms for each variable, are all greater than their respective t-statistic values. This confirms that all the variables are stationary at I (1).

Table 4: **Unit root result at first difference showing stationarity of variables**

AUGMENTED DICKER-FULLER TEST			
	First Difference I(1)		
Variables	**With linear trend and constant**	**With constant**	**Decision**
lnRGDP	-6.011046***	-6.121348***	I(1)
Lncap	-6.677479***	-6.721650***	I(1)
Lnlab	-6.50541***	-3.861960***	I(1)
Lncpi	-5.227059***	-4.319720***	I(1)
Lncofx	-5.565587***	-5.599466***	I(1)
Lnteax	-5.536966***	-5.595110***	I(1)
*** indicates significance at 1%, ** indicates significance at 5%			

Source: Calculations by Authors using Eviews 7

From the result in Table 5, the Augmented Dickey Fuller (ADF) test statistics for the first differences of all the variables series data were significant at 1% level of significance. This showed that, the series data is stationary at first difference and hence the variables are considered as integrated of order one or I (1) process. This result is in line with Thomas (2010).who examined the impact of real exchange rate on economic growth of Togo, the Export performance and economic growth in Togo and found stationary data at first difference for labor force and capital.

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Table 5: Unit root test of Error Correction Term

Null Hypothesis: ECT has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.491151	0.0012
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

Source: Calculations by Authors using Eviews 7

The results in table 5 shows that the ADF test statistic in absolute term is greater than all the test critical values thus indicating that the error (ECT) from the regression using OLS is stationary at 1% level of significance and at level form I (0). As such, we reject the Null Hypothesis. This confirms the existence of co-integration. The long run results can therefore be interpreted after verifying the appropriateness of the model.

4.2 Model Appropriateness

4.2.1 Autocorrelation Test

Autocorrelation refers to the existence of a relationship between error terms across observations of a time series. Error co-variances are therefore different from zero. This constitutes a violation to one of the assumptions of the classical linear model. Autocorrelation is manifested by OLS estimators which are not BLU (Best linear unbiased).In our study, auto correlation is going to be tested using the Breusch-Godfrey serial correlation LM test. The Durbin-Watson test is not used because it is biased. The decision rule is to accept H0 if the probabilities of the F-statistic and the observed R2 of the intermediary equation are greater than 0.05, which depict the absence of auto correlation. On the other hand, H1 is not rejected if the probabilities of the F-statistic and the observed R2 of the intermediary equation are lesser than 0.05. The test results are shown on table 6.

Table 6: Autocorrelation test results

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.121460	Prob. F(2,23)	0.3430
Obs*R-squared	2.932164	Prob. Chi-Square(2)	0.2308

Source: calculation by authors using Eviews 7

From the test results presented on table 6, the probabilities of both the F-statistic (0.3430) and the Rsquared (0.2308) are greater than 0.05. Therefore, Ho is not rejected, meaning autocorrelation is absent.

4.3 Hetero scedasticity Test

In order to ensure that the residuals are randomly dispersed throughout the range of the dependent variable, we are going to use the hetero scedasticity test. The variance of the error should therefore be constant for all values of the dependent variable. In the presence of hetero scedasticity, the distributions of the OLS parameters are no longer normal. Hetero scedasticity is tested in this study using the Breusch-Pagan-Godfrey test.

The decision rule is to reject the null hypothesis if the probability of the F-statistic and observed R2 areless than 0.05, meaning hetero scedasticity is present. On the other hand, if the probability of the F-statistic and observed R2 are greater than 0.05, we do not reject the null hypothesis, implying that there is no hetero scedasticity. As such, errors are homo scedastic. The test results are shown on table 7:

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Table 7: **Hetero scedasticity Test**

F-statistic	1.140708	Prob. F(6,26)	0.3672
Obs*R-squared	6.876702	Prob. Chi-Square(6)	0.3324
Scaled explained SS	9.324447	Prob. Chi-Square(6)	0.1561

Source: calculation by authors using Eviews 7

From the test results presented on table 7, both the probabilities of F-statistic (0.3672) and the R-squared(0.3324) are greater than 0.05 indicating the absence of hetero scedasticity. Therefore, the errors are homoscedastic. Therefore the long run results succeed all tests and thus useful for analyses and forecasting.

4.4 Results of Long run relationship

Table 7 displays the results of the long run relationship between agricultural export variables and economic growth using equation (7).

Table 8: **Long run relationship between agricultural export and economic growth**

Dependent variable: lnRGDP; Method: Least Squares

Variable	Coefficient
C	18.08662*** (6.524075)
lnCAP	0.037132*** (0.085298)
lnLAB	0.018639*** (0.159796)
lnCPI	0.107900*** (0.780976)
lnCOFX	-0.437935***(0.267716)
lnTEAX	0.352921*** (0.348447)
Adjusted R-squared	0.698150
F-statistic	8.260371
Prob(F-statistic)	0.000032

Note: Standard errors are in parentheses;
* indicates significance at 10%,
** indicates significance at 5%, and
*** indicates significance at 1%.

Source: calculations by Authors using Eviews 7

Globally, we can observe that all the results from the test statistics of the model are good. As a matter of fact, the adjusted R square is high (about 69.8%). This means that the independent variables explain the dependent variable for about 69.8 percent. The overall significance of the model is good at 1% through the prob. (Fisher- statistic). It is important to mention here that the decision rule used is that which compares the prob. (F.statistic) with the value of the chosen level of significance (5%). The p-value (0.000032) from table8 is less than 0.05. As such, we accept the alternative hypothesis, implying that the parameters are generally significant even at 1%.

In addition, almost all the coefficients are individually significant at 1% level of significance; we can also observe that there is a positive relationship between the dependent variable (lnRGDP) and four independent variables (lnCOFX, lnTEAX). lnCAP, lnLAB andlnCPI). This means that if one of these independent variables increases, the dependent variable will also increase and vice versa, then these results are in accordance with what we expected.

4.5 Effect of Coffee Export on Economic Growth

The results of study reveal that coffee export has a positive and significant effect on economic growth in Rwanda, which affirms the first specific alternative hypothesis.

The results of this study are in relation with the research of Paulo P. (2000) who look at the role of coffee in social and economic development of Latin America; points out the evidence that during the second half of the nineteenth century up to the world economic crisis of the 1930s, the coffee sector played an important role in many countries such as Brazil, Colombia, Costa Rica, and a bit later and to a lesser degree in other countries in South and Central America. For example, around 1995, coffee represented around seventy percent of Brazil's total exports and around eighty percent of Colombia's total exports. Coffee production also stimulated the insertion of Latin American economies in the world trade. In this period, given its high level of dependence on external markets, the price of coffee was the principal factorin guaranteeing equilibrium in the balance of payments and, as a consequence, guaranteeing macroeconomic stability and economic growth. Income generated by coffee production and exports created domestic demand in the industrial sector in many countries, allowing for the diversification of their economies.

Similarly, Roberto Junguito and Diego Pizano (2001) remind us that the economic relevance of coffee was not limited to its impact on growth via increased exports. They suggest that coffee has had a clear link with the development of other sectors and with the overall development process of Colombia. Among other impacts they stress the links between coffee production with employment and the social situation given the activity's high demand for labour, its relation with public finances, its impact on industrial, regional, and institutional development and its role in national politics.

4.6 Effect of Tea Export on Economic Growth

Our finding reveals that Tea export has a positive and significant relationship on economic growth in Rwanda, which answers our second specific alternative hypothesis. This result is equally in line with most of what is found in literature.

FAO (2001) provided evidence according to which tea exports play a small but growing role in developing countries' export trade. Tea constitutes about 13 percent of cash crop exports but only about half of one percent of total exports by value. They have become an important export commodity. Tea provides jobs and significant incomes for hundreds of plantation workers..Teais also increasingly important to export diversification, potentially enabling various countries to earn more foreign currencies and an increase in their gross domestic product. Still in line with the same research done by FAO; Ecuador (the largest banana exporting country on the international market) earned more than billions from tea export. It is calculated that in 2000 there were approximately 1.1 billion people benefiting directly or indirectly from the export tea industry in South America, out of a population of some 12.5 million. The export from Tea has gone a long way to contribute to countries' growth in the agricultural and manufacturing sector and to the economy as a whole.

5. Control Variables

This work made use of three control variables such as gross domestic fixed capital, labour force and consumer price index. The first two factors are initial inputs in the production function that we want to see their effects equally on growth. The last variable is the proxy for inflation which we also want to see its effect on economic growth. The essence of using these variables is to improve on the validity and reliability of our results.

i)Discussion of the effect of gross domestic fixed capital on Real GDP from Results

The results from our finding show that gross domestic fixed capital has a positive and significant effect on economic growth in Rwanda**.** This is equally in line with the work of Bakare (2011). using the H-D model, proved that the growth rate of national income in Nigeria is positively related to saving ratio and

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capital formation. Moreover, Mugabe (2008) reveals that FDI (Foreign Direct Investment) inflows have had a positive impact on Rwandan's export performance. Since Export earnings constitute an important proportion of our real GDP, it will lead to an increase in our real GDP. Khan and Kumar (1997). confirmed that gross domestic fixed capital (public and private investment) have significant impacts on economic growth in developing countries.

ii) Discussion of the effect of labour force on Real GDP from Results

From our findings there is a positive and significant relationship between the dependent variable and labour force expansion in Rwanda. This means that labour force expansion and economic growth in this study move in the same directions. The result of the labor force (LLAB) indicates that economic growth increases by about 15.98 percent due to an addition of one percent in labor force. This is supported by other authors who have previously looked at the correlation between labour force expansion and economic growth. Equally Mugabe (2008) in his work confirmed that one of the sources of economic growth in Rwanda is from an active labour force.

The results from our findings show a positive relationship between inflation and economic growth in Rwanda. This is seen as on table 8 which shows that a one percent change in inflation will lead to a 10.79percent change in economic growth. This study is in line with the work of Eishareif, (2007) who worked on "Term Structure, Inflation, and Economic Growth in Selected East Asian Countries", saw a positive relationship between inflation and economic growth. Our result contradicts what we expected.

5.1 Results of the Vector Error Correction Model

However, we can now estimate the vector error correction model from equation (12) since we have successfully carried out almost all the necessary test of model appropriateness. Table 8 displays the results of our Vector Error Correction Model.

Table 9: Results of Vector Error Correction Model

Dependent variable: D (lnRGDP); Method: Least Squares

Variable	Coefficient
C	0.052578
	(0.155361)
D(LNCAP)	0.029920
	(0.080351)
D(lnLAB)	6.711105
	(0.147335)
D(lnCPI)	0.250626
	(1.777392)
D(lnCOFX)	0.539179*
	(0.387885)
D(lnTEAX)	0.459347*
	(0.227130)
ECT(-1)	-0.224435 *
	(0.790869)
Adjusted R-squared	0.222080
F-statistic	2.070546
Prob(F-statistic)	0.084480
Durbin-Watson stat	1.864388

Source: calculations by Authors using Eviews 7

In table 9, we can deduce that both dependent and independent variables are stationary at first difference. This is because the coefficient of the error correction term is negative, less than unity (-0.2244) and highly significant at 1%. We would equally carried out the autocorrelation and hetero scedasticity test in order to confirm appropriateness of our short run VECM .The same tests which were

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used in the long run model, are equally applied in the VECM. We are going to start with the autocorrelation test, using the Breusch-Godfrey serial correlation LM test. The result of this test is shown on table 9 below.

Table 10: Breusch-Godfrey serial correlation LM test of the VECM.

F-statistic	1.121460	Probability	0.3430
R-squared	2.932164	Probability	0.2308

Source:calculations by Authors using Eviews 7

From table 10, the probabilities of both F-statistic and R-squared are greater than 0.05, confirming theabsence of autocorrelation. The test for heteroscedasticity was also conducted using the Breusch-Pagan-Godfrey Test. The following results were obtained on table 10.

Table 11: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.797231	Prob. F(7,22)	0.5979
Obs*R-squared	6.070148	Prob. Chi-Square(7)	0.5316
Scaled explained SS	9.717758	Prob. Chi-Square(7)	0.2051

Source: calculations by Authors using Eviews 7

From table 10, we can notice the absence of hetero scedasticity since the probabilities of both F-statistic andR-squared are greater than 0.05. Thus, the errors from the VECM are homo scedastic. The VECM is void of autocorrelation and hetero scedasticty and can now be interpreted. Other observations in our model are as follows;

The Durbin Watson d statistics of 1.864 is greater than the adjusted R-squared of 0.222, meaning that our VECM does not suffer from a spurious regression. The F-statistic is 20.705 which is quite high and most interestingly is highly significant at 1%. The results also reveal that our exogenous variables all have the expected signs. For our variables of interest, coffee export and tea export have a positive effect on economic growth. Our control variables; gross domestic fixed capital and labour force expansion has positive effect on growth which is in line with what we expected.

The coefficient of the ECT is, -0.224435 is highly significant at 1% percent and has the appropriate negative sign. Thus, it will rightly act to correct any deviations from the long-run equilibrium up to the tune of 22.44%, which is fair. This fair significant value of the VECM explains the existence of long-run equilibrium relationship between agricultural export and economic growth in Rwanda. This established long-run equilibrium relationship in our result reveals that our findings can be used for forecasting and policy recommendation (s) .We would proceed with the long causality test and the causality test on VECM of important variables. Granger (1969) causality test has been performed in order to examine the linear causation between the concerned variables. Granger causality is useful in determining the direction of the relationships. In the view of the Granger, the presence of co-integration vector shows that granger causality must exist in at least one direction.

5.2 Granger causality test between agricultural exports and economic growth

The finding of stationarity of the variables and co integration between Agricultural exports and gross domestic product immediately implies that there is long-run causality in at least one direction (Granger 1988). either from Agricultural exports to gross domestic product or vice versa. Therefore, it would be useful to test long-run non-causality if co integration is found. The result of the long run causality between Agricultural (coffee and tea) exports and economic growth.

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Table 12: Long run causality test

Pairwise Granger Causality Tests				
Sample:	**1990-2015**			
Null Hypothesis (Ho):	**Obs**	**F-Statistic**	**Prob.**	**Decision**
LNCOFX does not Granger Cause LNGDP		8.65317	0.0045	Reject Ho
LNGDP does not Granger Cause LNCOFX		4.70353	0.0177	Reject Ho
LNTEAX does not Granger Cause LNGDP		13.25242	0.0543	Reject Ho
LNGDP does not Granger Cause LNTEAX		6.57940	0.2246	Reject Ho

Source: calculations by Authors using Eviews 7

Table 13: Causality test on VECM

Pairwise Granger Causality Tests				
Sample:	**1990-2015**			
Null Hypothesis (Ho):	**Obs**	**F-Statistic**	**Prob.**	**Decision**
D(LNCOFX) does not Granger Cause D(LNGDP)		4.90013	0.0188	Reject Ho
D(LNGDP) does not Granger Cause D(LNCOFX)		13.70353	0.0877	Reject Ho
D(LNTEAX) does not Granger Cause D(LNGDP)		9.25242	0.0543	Reject Ho
D(LNGDP) does not Granger Cause D(LNTEAX)		22.57940	0.002	Reject Ho

Source: calculations by Authors using Eviews 7

Table 12 and 13 interprets the results of Granger causality. In the long run, there is bidirectional causality between agricultural exports and economic growth.

The causal relationship between Agricultural exports and economic growth of Rwanda was analyzed with the application of Granger (1969) causality test. In this research both the null hypothesis that coffee export and tea exports does not Granger causes economic growth and economic growth does not Granger cause coffee and tea exports are rejected. These results provide evidence of bi-directional causality between coffee exports and economic growth as well as tea export and economic growth running in both directions. The result implies that agricultural export growth causes economic growth and vice versa. These results provide evidence in support of the export-led growth hypothesis and as well as the existence of reverse causality. Agricultural exports growth is one of the fundamental reasons for economic growth in Rwanda and economic growth also cause agricultural exports to grow. Therefore effort should be direct towards policies that will enhance economic growth (GDP) such as improvement of human capital, labour force skills, investment, import substitution and technological development which will prepare required facility background for more quality and value added agricultural exports. The findings also suggest that there is a need to promote value added agricultural export expansion policies in order to achieve high economic growth.

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Furthermore, Granger causality test on vector error correction model show the direction of the relationship amongst our variables of interest.

5.3 Concussion and Policy Recommendations

5.3.1 Conclusion

The raison of our study was to investigate if agricultural export has a positive and significant effect one conomic growth in Rwanda, for period 1990 to 2015. In order to attain the objective of our study, we used the standard theoretical neoclassical growth model, based on a generalized Cobb Douglas production framework with some extensions. As concerns economic analysis, the ADF test was used to test for stationarity, Engle and Granger co-integration analysis was used to determine long and short run relationships. The Arch test and the Breusch-Godfrey Serial Correlation LM Test, was used to test for appropriateness of our estimations in order to avoid any spurious regression.

The results of the unit roots test indicated that all the variables are stationary in first differences-I (1). therefore, I(1) series were adopted to test for co-integration and causality between real GDP and agricultural exports. The co-integration tests results showed that the long-run relationships exist between the GDP and agricultural exports and in its set up, error correction method estimates the long-run relationship between economic growth and agricultural export as well as fluctuation in the short-run.

The results indicate that agricultural export variables have mixed effects on domestic growth. A positive and significant association is found between coffee export and economic growth. Equally a positive significant effect is found between tea export and economic growth in Rwanda.

As concerns our control variables, Capital was found to have a positive significant effect on economic growth, which confirms that agricultural capital has a positive significant effect on economic growth. We also found out that in the context of Rwanda, labour force expansion has a positive and significant impact on economic growth. It is equally revealed that inflation has a positive and significant effect on real GDP in Rwanda.

However, for the purpose of contribution to knowledge, it is necessary for other developing countries like Rwanda faced with a budget constraint to undertaken specific policy recommendations. Most of what is found in literature around this area emphasis on the need to develop the agricultural sector as a whole. Rwanda being a third world country needs to invest in specific agricultural products following the bigpush the orylike those in this study, in order to achieve its dream of becoming an emerging economy by the year 2020.

5.3.2 Recommendations

Following the results of our study, we can recommend long run growth policies to be used by the government holding some all others constant. Findings regarding the contribution of agricultural export to economic growth and the relatively high value of the elasticity coefficients imply that the government of Rwanda can use the agricultural export development policy to spur economic growth at the national level. Looking at the long run relationship between both the exogenous/control variable(s) and economic growth we can specifically recommend the following policies:

To increase the impact of coffee export on economic growth, a concerted effort should be directed toward productive channels of coffee in the economy so as to enhance sustainable economic growth through increased coffee export. Modern production technologies of coffee must be quickly introduced to upgrade the traditional methods currently used and Encouraging large commercial farms through providing new potential land and enforcing the implementation of different export incentives given for

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the exporters. Government should emphasize towards value addition than exporting raw coffee since the relationship with economic growth is inelastic.

Although tea exports indicated insignificant effect on economic growth of Rwanda, a concerted effort should be directed toward productive channels of pulses to fulfill the high domestic consumption and promising international demand of tea. The government should concentrate on the area of encouraging large farms and create awareness on fertilizer and pesticides use by farmers since they neglected the use of fertilizer for pulse production unknowingly to increase output.

In the light of our control variables inflation showed a positive and significant relationship with economic growth in Rwanda. The positive effect could have been as a result of the series of price fluctuation faced by these goods. The results of capital and labour (the core factors of production of growth) reveal a positive effect on real GDP. The study reports the more share of capital in economic growth as compared with labour's share in growth. This is because Rwanda is a growing economy wherein physical l capital is growing faster than human capital. There should be an increase in investment of both public and private in Rwanda. While the government should redress the problems disturbing the labour force from constantly and consistently growing.

Labour force expansion equally shows a positive and significant effect on economic growth in Rwanda. The government should put in place measures to fight against brain drain. There should be a synergy between universities and promoters of company that is the university system should be restructured to offer courses which tie-up with jobs in the domestic labour market. It should equally stimulate the private sector to create jobs there by reducing the level of unemployment. The government should put in place measures of growth in human stock of capital through expansion of educational system, skill and training facilities and provision of better health facilities even in rural or backward areas of the country. Besides these, there should be an increase in investment in education and health in private sector with the co operation of industrially advanced countries. It should encourage auto-employment amongst her nationals. The putting in place of these measures would reduce the rate of unemployment in the country and thus have a trigger effect on economic growth in Rwanda.

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