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The impact of traditional and non-traditional agricultural exports on the economic growth of Peru: a short- and long-run analysis

This study aims to analyze and quantify the short- and long-run impact of agricultural exports—both traditional and non-traditional products—on economic growth of Peru using an annual time series data from 2000 to 2016 obtained from the Central Bank of Peru and the World Bank. Traditional agricultural exports value, non-traditional agricultural exports value, labor force and fixed capital formation value for each year of the stipulated period were used as determinant factors of the economic growth. A Vector Autoregression (VAR) Model, Augmented Dickey-Fuller (ADF) test, Johansen Co-integration test and Granger Causality test were employed for data analysis. The findings revealed that in the short run, traditional agricultural exports have had a positive but non-significant effect on economic growth while non-traditional agricultural exports have had a positive and significant effect on Gross Domestic Product (GDP). Meanwhile, both fixed capital formation and the labor force have had a significant effect on the GDP, albeit in different directions. The ADF test showed that, with the exception of traditional agricultural exports and fixed capital formation, all determinants became stationary at a level I (0). Moreover, the Co-integration result showed that there is a long-run relationship between the studied variables and a unidirectional causality in the relation between the determinant variables and economic growth.

Keywords: Peru, agricultural exports, economic growth, fixed capital formation, labor force

JEL classifications: F1, F14, F47, Q17

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Introduction

Exports as the driving engine of the economy is a widely accepted notion in the field of development economics. Exports influence and contribute to the growth and development of a national economy through a variety of channels. An increase in a country's export of goods and services can reduce unemployment, improve the balance of payments, increase foreign exchange earnings, and reduce pressure on external borrowing (Cheney and Strout, 1966). Exports enhance workers' pay, benefits, skills and productivity; they enhance corporate innovation and stability; and they benefit workers and owners of small businesses, as well as large ones (Richardson and Rindal, 1995). Furthermore, exports can be a source of learning and technological externalities for the home economy and allow domestic producers to learn from sophisticated markets abroad. An increase in exports is a conduit through which a country can foster economic growth (Mabeta, 2015).

Substantial growth of agricultural exports has been one of the outstanding characteristics of many Latin American economies since the 1990s (Damiani, 2000). Peru, a dynamic Latin American economy, has significantly expanded its role as a global food supplier in recent years. Traditionally known mostly for its exports of metals and mineral ores, the country's agriculture exports have recently grown at an average annual rate of 12.5%; its value increased from US\$ 758 million in 2000 to more than US\$ 5.78 billion in 2016 (the World Bank, 2017). Peru groups its agricultural exports into traditional and non-traditional products. Peru's traditional agricultural exports include coffee, cocoa, cotton and sugar. As international prices for these traditional agriculture exports have fallen in recent years, so has their relative importance, compared with the new, non-traditional

agricultural exports (Meade *et al.*, 2010). This decline notwithstanding, the country's non-traditional agriculture exports, which mainly include grapes, asparagus, avocado, quinoa, banana and many other fruits, have taken up the slack (Oxford Business Group, 2016). From a base of \$925m in 2000, exports of non-traditional agriculture products have grown at 10-15% per annum, surpassing US\$ 5bn in 2016 (Oxford Business Group, 2017). At a time when agriculture is becoming less important in the overall economy, the share of agriculture exports, expressed as a percentage of total GDP, rose from 1.6% in 1998 to 3.2% in 2015, driven mainly by growth in non-traditional agriculture exports (the World Bank, 2017). Peru's combination of business climate, trade preferences, low labor costs, and climatic conditions helped lay the foundation for developing a competitive and successful agricultural export industry (Meade *et al.*, 2010). In addition, the private sector has played a key role in agriculture export growth. The impressive growth in agricultural exports has been accompanied by rapid diversification of the product range and expansion of export destinations. In 2016, Peru exported 629 agricultural products to over 142 countries across the globe. The rapidly growing agriculture exports have attracted increased interest from domestic and international investors in the nation's agriculture sector (the World Bank, 2017).

Thus far, many studies have been conducted to investigate the nature and impact of relationships between agricultural exports and economic growth in developing countries across mainland Asia, Europe, and Africa. However, empirical investigation into agricultural export-led growth is lacking in the case of many Latin American nations – Peru in particular. Given the increased relevance of agriculture exports to the economic growth of Peru, the causal dynamics between the two is an empirical question worthy of further

investigation. In this paper, we try to bridge this important gap in the empirical literature by using co-integration, Granger causality, and Vector Autoregression techniques to estimate the short- and long-run contribution of agriculture commodity exports to the economic growth of Peru. These techniques are sound because of their ability to estimate the short- and long-run situation and test for the direction of causality between variables. In addition, the multivariate framework of causal investigation used in this study has an edge over some bivariate models used previously in similar studies. In so doing, the paper is structured as follows. Section 2 provides a literature review, which is followed by a methodology and data section (Section 3). Section 4 demonstrates the results of our models together with their discussion, while the last part (Section 5) concludes.

Literature review

Theoretical underpinnings of exports have evolved from David Ricardo's comparative advantage in the early nineteenth century (Ricardo, 1817) to the new trade theories that emerged in the latter part of the twentieth century (e.g., Helpman and Krugman, 1985; Kunst and Marin, 1989). The classical economists, including Ricardo, have argued that international trade is the main source of economic growth and more economic gain is attained from specialization. Accordingly, welfare can be maximized if countries specialize in the production of those goods where they have a comparative advantage. The new trade theories have made progress in moving towards an understanding of inter-country differences in technological capabilities and providing a case to support government policy geared towards international competitiveness. The proponents of new trade theory assert that economies of scale will lead to cost reductions, and subsequently a bi-directional causality between export growth and economic growth (Helpman and Krugman, 1985). The theories and arguments of both classical and modern economists have contributed to the hypothesis of export-led economic growth in both developed and developing economies.

During the past few decades, the bulk of empirical research has been conducted to explore the effects of exports on economic growth (or, the export-led growth hypothesis). These studies, involving different countries, variables, and methodologies, and have come up with divergent conclusions. Some studies state that a bidirectional relationship exists between exports and economic growth; whereas the other studies state that a unidirectional relationship exists, supporting the fact that growth in exports results to economic growth. However, other studies have reported no evidence to support the export-led growth hypothesis. Rather than reporting individual studies, we highlight the divergent results. For instance, earlier studies by Chenery and Strout (1966); Kravis (1970); Balassa (1978); Tyler (1981); and Ram (1985) found positive and strong correlations between exports and economic growth, supporting the hypothesis that growth in exports has resulted in the economic growth of many developing economies. Similarly, many recent studies, such as those of Shahbaz and Moham-

mad (2014); el Alaoui (2015); Simon and Sheefeni (2016); and Bakari (2017), have also reported similar findings in the case of developing economies. Many of these studies have argued that the exports of goods and services generate foreign exchange that is required to import foreign goods by the developing economies. The increase in underlying commodities' imports, in turn, stimulates a nation's capacity to produce in the long run. Empirical evidence of export-led growth has also been confirmed in several developed and industrialized economies such as Germany, Switzerland, Canada, United Kingdom and Japan (Kugler, 1991; Henriques and Sadorsky, 1996; Boltho, 1996). Cuaresma and Wörz (2005) argue that significant positive externalities accrue to the exporting country as a result of competition in international markets, including increasing returns to scale, learning spill-overs, increased innovation, and other efficiency gains, all of which can increase the rate of economic growth. Conversely, other studies have concluded that the positive relationship between exports and economic growth did not exist in some countries during certain periods (e.g., Helleiner, 1986; Ahmad and Kwan, 1991; Onafowora and Owoye, 1998; Faridi, 2012), leading the authors to refute the export-led growth hypothesis.

A vast majority of the studies mentioned above have reported possible causality between exports and economic growth. Just a casual review of the relationship between exports and GDP would lead one to infer that the correlation between the two is positive (Feder, 1983). However, these studies have not resolved, in sufficient detail, the causality between these two variables. Moreover, few studies have implicitly assumed that export growth causes output growth without formally testing the direction of causality. Another major issue surrounding the available literature is that the original time series data used, in many cases, is not co-integrated for any meaningful inference. A non-stationary time series data set has a different mean at different points in time and its variance increases with the sample size (Yifru, 2015). Yifru (2015) reports that non-stationary data, as a rule, are unpredictable and cannot be modelled or forecasted. In order to achieve consistent and reliable results, the non-stationary data needs to be transformed into stationary data. The Johansen procedure takes care of the above shortcomings by assuming that there are multiple co-integrating vectors. Pistoresi and Rinaldi (2010) investigated the relationship between real exports and real GDP in Italy from 1863 to 2004 by using co-integration analysis and causality tests. The results revealed that the variables co-moved in the long run but the direction of causality depended on the level of economic development. In recent years, the application of co-integration techniques and error correction models for the investigation of the export-led growth hypothesis have been proposed by several economists. Representative studies that apply these methods include those of Bokosi (2015); Simon and Sheefeni (2016); and Bakari (2017).

Although previous studies depict a positive relationship between total exports and economic growth, it is reasonable to question whether the same holds for all the primary exports. However, research into the relationship between primary exports such as agricultural exports and economic

growth has not been given serious attention until recently. Some economists (e.g. Verter, 2015; Verter and Becvarova, 2014) argue that rising agricultural exports play a pivotal role in economic growth, particularly in developing economies. Despite its long-recognized role in development processes, empirical research on agricultural export-led economic growth has been, to some extent, left behind. Earlier studies in this direction include that of Johnston and Mellor (1961) who cite several important roles for agriculture in the development process. Some of the recent studies, including those of Dawson (2005); Aurangzeb (2006); Sanjuán-López and Dawson, (2010); Gilbert *et al.* (2013); and Hyunsoo (2015), support the export-led growth hypothesis for some agricultural commodities in developing countries. Conversely, the studies of Marshall *et al.* (1991) and Faridi (2012) found no evidence of export-led growth in the developing countries they investigated. Mucavele (2013) argues that, in general, agriculture's performance and its contribution to a nation's economic development has traditionally been undervalued because its linkages (forward and backward) with other sectors of the economy, including the value added by these linkages, do not appear in the basic statistics of many developing countries. Another major issue is that of "adding up" caused by low price elasticity of demand for agriculture commodities, which can result in lower export revenue as volume exported increases and the average price of the commodities decreases (Hallam *et al.*, 2004).

On the whole, it seems evident that many studies have investigated relationships between agricultural exports and economic growth in developing countries across mainland Asia, Europe, and Africa, though empirical investigation on the agricultural export-led growth is lacking in many Latin American nations and Peru in particular – the gap which aims to be filled by this paper

Methodology

This research was fundamentally analytical and descriptive as it embraced the use of secondary data to determine the effect of traditional and non-traditional agricultural exports on economic growth in Peru, in both the short- and the long run. For the analytical test, econometric modeling of the annual time series data was used. For the descriptive analysis, the description of the regression of the Solow model was used.

For the current research, we needed the annual time series data that covered the period between 2000-2016 including, data on Gross Domestic Product (GDP), data on the traditional agricultural exports, non-traditional agricultural exports, labor force and on the fixed capital formation value. The data for this research was obtained, as it was mentioned from secondary resources, especially from the Peruvian Central Bank of Reserve (PCBR), PCBR Annual Reports, from the National Bureau of Statistics, from the Ministry of Labor in Peru and from the World Bank Indicators.

In order to examine the contribution of traditional and non-traditional agricultural exports to economic growth (a supply-side perspective), it is necessary to consider the neoclassical growth model developed by Solow (1956), which

includes the capital and the labor force as main variables of the production function. The model is specified by the following equation:

$$Y_t = f(L_t, K_t) \quad (1)$$

In order to fulfil the main objective, that is, to describe how agricultural exports affect economic growth, it is necessary to incorporate both traditional and non-traditional agricultural exports in equation (1).

$$Y_t = f(L_t, K_t, Y_t, ATX_t, ANTX_t) \quad (2)$$

To discard the differences in the measurement units, we applied the natural logarithm on both sides of the equation 2 as follows:

$$\begin{aligned} LGDP_t = & \beta_0 + \beta_1 LATX_t + \beta_2 LANTX_t + \\ & + \beta_3 LFKF_t + \beta_4 LLF_t + \beta_5 LGDP(-1) + e_t \end{aligned} \quad (3)$$

where:

$LGDP$ = Natural logarithm of the Gross Domestic Product in million dollars.

$LATX$ = Natural logarithm of traditional agricultural exports in million dollars.

$LANTX$ = Natural logarithm of non-traditional agricultural exports in million dollars.

$LFKF$ = Natural logarithm of fixed capital formation in million dollars.

LLF = Natural logarithm of labor force.

$LGDP(-1)$ = Natural logarithm of one year lagged Gross Domestic Product.

e_t = Error term.

β_0 = Constant term.

$\beta_1 - \beta_5$ = Parameters of explanatory variables estimated in the model.

Estimation procedures

For the short run analysis, we used the Vector Autoregression (VAR) Model, enforced for the Unit Root Test and the Causality Test; and for the long run analysis, we used the Co-integration Test.

Unit root test

A variable is considered as stationary if it has a constant mean, variance and autocovariance at any measured point. A non-stationary time series may become stationary after differencing a number of times. If the series is not stationary at the base level, it will be stationary after successive differencing. 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 n times. In this study the stationary test was carried out using the Augmented Dickey-Fuller (ADF) test, which was formulated by Dickey and Fuller (1979, 1981). The decision rule states the series is stationary if the ADF test statistic is greater than the critical value, while it is not stationary if the

test statistic is less than the critical value. The general ADF Test form is represented by the following regression:

$$\Delta Y_t = \alpha_0 + \alpha_1 \cdot Y_{t-1} + \Sigma \alpha \cdot \Delta Y_{t-1} + e_t; \quad (4)$$

it includes only the drift

$$\Delta Y_t = \alpha_0 + \alpha_1 \cdot Y_{t-1} + \Sigma \alpha \cdot \Delta Y_{t-1} + \delta_t + e_t; \quad (5)$$

it includes the drift and linear time trend

where:

Y = time series of specified variable

t = time trend

Δ = first differencing operator $\Delta Y_{t-1} = Y_t - Y_{t-1}$

α_0 = constant term

N = optimum lags' number

e_t = random error term

Johansen co-integration test

The test was developed in 1989-1990 by Johansen and Juselius (Johansen, 1991) is necessary to determine the existence of a long run equilibrium (stationary) relationship between the dependent and the explanatory variables. The co-integration of two (or more) time series suggests that, there is a long run or equilibrium relationship between them. It determines the number of co-integrated vectors in a model that is based on the method of two likelihood ratio test statistic; the Maximal Eigenvalue Test and the Trace Statistic Test. The null hypothesis is the non-existence of co-integration between the variables, which will be rejected when the test statistic is greater than the critical value, indicating that there exists a co-integration in the long run.

Pairwise Granger causality test

To examine the significant causality relationship of agricultural exports, fixed capital formation and the labor force with economic growth in Peru, we performed a Granger Causality Test (Granger, 1969). The independent variable is considered as a Granger-cause variable of Y , if the y_t (the variable Y in the current period) is conditional on the past values of the variable $X(x_{t-1}, x_{t-2}, x_{t-3} \dots x_0)$.

Focusing on the total traditional agricultural exports, the total non-traditional agricultural exports, the fixed capital formation and the labor force as the engines of the economic growth, we are interested in the bidirectional causal relation between them to provide evidence of those independent variables as causes of the economic growth between 2000 and 2016. Therefore, we considered the following hypotheses:

For the case of $LGDP$ (Logarithm Gross Domestic Product) and $LANTX$ (Logarithm of traditional agricultural exports):

- $LANTX$ does not Granger Cause $LGDP$
- $LGDP$ does not Granger Cause $LANTX$

For the case of $LGDP$ (Logarithm Gross Domestic Product) and the $LANTX$ (Logarithm of non-traditional agricultural exports):

- $LANTX$ does not Granger Cause $LGDP$
- $LGDP$ does not Granger Cause $LANTX$

For the case of $LGDP$ (Logarithm Gross Domestic Product) and the $LFKF$ (Logarithm of Fixed Capital Formation):

- $LFKF$ does not Granger Cause $LGDP$
- $LGDP$ does not Granger Cause $LFKF$

For the case of $LGDP$ (Logarithm Gross Domestic Product) and the LLF (Logarithm of Labor Force):

- LLF does not Granger Cause $LGDP$
- $LGDP$ does not Granger Cause LLF

Vector Autoregression (VAR) Model

The Vector Autoregression is frequently used for analyzing the dynamic impact of random disturbances on the system of variables. The VAR Model approach treats each endogenous variable in the system as a function of lagged values of all endogenous variables in the system. This model is also a dynamic system of equations, which examines the impacts of interactions between economic variables. The model is represented by the following:

$$Y_t = \alpha + \Sigma \alpha_i \cdot \Delta Y_{t-1} + e_t \quad (6)$$

When this equation is extended, the model will be:

$$Y_t = \alpha + \alpha_1 \cdot Y_{t-1} + \alpha_2 \cdot Y_{t-2} + \alpha_3 \cdot Y_{t-3} + \dots + \alpha_k \cdot Y_{t-k} + e_t \quad (7)$$

where:

Y_t = vector of endogenous variables at time t

α_i ($i = 1, 2, \dots, k$) = ($n \times n$) coefficient matrices that describe the relationship between endogenous and exogenous variables

e_t = vector of residuals or random disturbances

The above equation will change with the inclusion of the lag operator (L):

$$Y_t = \alpha \cdot (L) \cdot Y_{t-1} + e_t \quad (8)$$

where:

Y_t = vector of endogenous variables at time t

α_i ($i = 1, 2, \dots, k$) = ($n \times n$) coefficient matrices that describe the relationship between endogenous and exogenous variables

$\alpha \cdot (L)$ = matrix of coefficients.

e_t = vector of residuals or random disturbances

Results and discussion

Before the comprehensive econometric analysis, a brief interpretation of statistical analysis is necessary. The definitions and summary of the statistics of those variables are provided in Table 1, which reported that the average of the GDP growth was US\$ 122,819.20 million with US\$ 58,684.71 as the standard deviation. In the case of the traditional agricultural exports, the average was US\$ 639.96 million and the

standard deviation was US\$ 392.92. For the case of non-traditional agricultural exports, it had an average value of US\$ 2,066.84 million and a deviation standard of US\$ 1,458.64. It also showed that the fixed capital formation had a mean value of US\$ 27,203.35 and a deviation standard of US\$ 15,932.23. Finally, the labor force had a mean value of 15.19 and a deviation standard of 1.92.

As regards skewness, the GDP and the FKF presented an approximately symmetric distribution, while the ATX, the ANTX and the LF showed a moderately skewed distribution.

The Augmented Dickey-Fuller test was also used, performed on all variables (gross domestic product, traditional agricultural exports, non-traditional agricultural exports, fixed capital formation and labor force). The results of Augmented Dickey-Fuller test for showing the existence of unit root of once differenced data have been represented in Table 2.

The reported result in Table 2 confirmed the stationary test of the variables at the level form I (0) for the LGDP, LANTX and for the LLF. In the case of LATX and LFKF, those variables showed stationary at the level form I (1). According to this, the null hypothesis of non-stationary could be rejected at 5% and 10% critical value level, confirming that the ADF test statistics were greater than the critical value, which also could be understood as the P-value was significant at the level form I (0) because it is less than 0.05. Since the null hypothesis was rejected for all the variables at a convenient significant level, the variables did not have a unit root at levels. Therefore, we can conclude that the variables data were stationary at the level of order one I (1). Those stationary tests supported the econometric model of the equation (6).

Table 3 presents the result of the Johansen Co-integration Test in the Trace Statistic and in the Maximum Eigen Test statistics. Both test statistics revealed that there were four co-integrating equations. This was because at the null

hypothesis of co-integration rank ($r=0$) the max-eigenvalue of 48.0754 was greater than the 5% critical value of 33.46. The trace statistics also indicated 4 co-integrating equation since trace value of 112.784 was greater than the 5% critical value of 68.52. The evidence of co-integration in the study indicated that traditional agricultural exports, non-traditional agricultural exports, fixed capital formation and labor force are long-run determinants of economic growth in Peru. The result of the Johansen statistics, therefore, rejects the null hypothesis of no co-integration among the variables.

The same long-run relationship between agricultural exports, gross fixed capital formation and economic growth was found in the study made by Gbaise *et al.* (2013), in Nigeria; and confirmed by Ijirshar (2015); by Ouma *et al.* (2016), in Kenya, Uganda and Rwanda; by Fakhre and Godwin (2016), in Tanzania and by Simasiku and Sheefeni (2017), in Namibia.

As to Granger causality, the following relationships were analysed: the causal relationship between the LATX (Logarithm of traditional agricultural exports) and the LGDP (Logarithm Gross Domestic Product); the causal relationship between the LANTX (Logarithm of non-traditional agricultural exports) and the LGDP (Logarithm Gross Domestic Product); the causal relationship between the LFKF (Logarithm of Fixed Capital Formation) and the LGDP (Logarithm Gross Domestic Product); and the causal relationship between the LLF (Logarithm of Labor Force) and the LGDP (Logarithm Gross Domestic Product). Table 4 shows that value of the Granger Causality Test, considering the probability value of 5%.

The result for the causal relationship between LATX (Logarithm of agricultural exports) and the LGDP (Logarithm Gross Domestic Product) showed it was unidirectional, while the LATX didn't have an influence on the LGDP, though the LGDP had an influence on the LATX. According to Abrar ul Haq (2015), in a study made in Pakistan, the reason of this result was because the exportation of those products were in a raw material more than value-added product, and a higher gross domestic product increased the investment in the sector as in other sectors. The same result was made for Ouma *et al.* (2016) in Uganda, Tanzania and Burundi.

For the case of the LANTX (Logarithm of non-traditional agricultural exports) and the LGDP (Logarithm Gross Domestic Product), it was demonstrated that there was also a unidirectional causal relationship between them, where the non-traditional agricultural exports Granger caused the gross domestic product. The same result was presented for

Table 1: Summary statistics of variables, 2000-2016.

Variable	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis
GDP	122,819	120,550	201,217	51,744	58,684	0.14	1.42
ATX	640	634	1,689	207	393	1.00	3.94
ANTX	2,067	1,828	4,667	394	1,459	0.52	1.92
FKF	27,203	26,749	50,899	9,165	15,932	0.21	1.45
LF	15	16	18	12	2	-0.50	1.96

Source: researcher's compilation from Stata 13.0

Table 2: Unit root test for order of integration of variables (ADF).

Variables		Critical values		Result
		5%		
LGDP	At level	-2.078	-1.812	Stationary
	First difference	-1.865	-1.860	Stationary
LATX	At level	-1.655	-1.812	Non-stationary
	First difference	-1.870	-1.860	Stationary
LANTX	At level	-2.260	-1.782	Stationary
	First difference	-2.445	-1.812	Stationary
LFKF	At level	-1.487	-1.782	Non-stationary
	First difference	-2.349	-1.812	Stationary
LLF	At level	-8.807	-1.761	Stationary
	First difference	-3.393	-1.782	Stationary

Source: researcher's compilation from Stata 13.0

Table 3: Johansen Cointegration Trace and Maximum Eigenvvalue Test results.

Hypothesized No. of CE(S)	Trace Test		Maximum Eigen Test	
	Max-Eigen Statistic	0.05 Critical Value	Trace Statistic	0.05 Critical Value
None	48.075	33.460	112.784	68.520
At most 1	29.328	27.070	64.709	47.210
At most 2	19.150	20.970	35.381	29.680
At most 3	14.225	14.070	16.231	15.410
At most 4	2.007*	3.760	2.007*	3.760

* Shows that it has a value significance at 5%.

Source: researcher's compilation from Stata 13.0

Odetola and Etumnu (2013) in a study in Nigeria. The same result was made for Bulagi *et al.* (2014) in South Africa, for Fakhre and Godwin (2016) in Tanzanian, and for Ouma *et al.* (2016) in Rwanda.

This analysis also showed that the Gross Domestic Product Granger caused the Fixed Capital Formation, but this variable didn't have any influence on the gross domestic product. It is analyzed in Malaysia for Albiman and Suleiman (2016), who demonstrated that the economic growth Granger caused the domestic investment and not otherwise.

Finally, about the causal relationship between the LLF (Logarithm of Labor Force) and the LGDP (Logarithm Gross Domestic Product), there exists a unidirectional causal relationship between those variables. The labor force Granger caused the gross domestic product, but it didn't have any influence in the labor force.

Going further, Table 5 presents the result of the Vector Autoregression Model, which reveals the relationship between the dependent and independent variables in a short long term.

The result of the regression equation (3) is shown in Table 5. It indicates that this function best fit the model with significant effects on the GDP, having 99.85% as the R2. This result implied that independent variables explained 99.9 % of the total variation in the GDP in the short long run. The Probability of F-statistic was 0.0000 that indicated the significance, which implied that the parameters were significant at 5% even at 1%. The Breusch-Godfrey Correlation LM Test was used to test the existence or not of autocorrelation, having as a null hypothesis the no autocorrelation against the alternative hypothesis of autocorrelation. In this particular case, the value was 0.4822 that implied the no rejection of the null hypothesis. So, the estimated model is free from autocorrelation.

For the case of testing the existence of residuals normality, the Jarque-Bera test was used. It had as a null hypothesis that the residuals are normally distributed against the alternative hypothesis, which was the residuals are not normally distributed. In this case, the result was 0.3037, which implied the no rejection of the null hypothesis and it showed the normal distribution of the residuals.

According to this result, there was a partial elasticity of the Traditional Agricultural Exports (LATX), which had a value of 0.06. This meant an increase of 1% in the Traditional Agricultural Exports would result in 0.06% increase in the Gross Domestic Product (LGDP). In addition, this result had a significance at 10%. This result was also showed in

Table 4: Pairwise Granger causality test results.

Null hypothesis	F-statistic	Prob.
LATX does not Granger Cause LGDP	0.005	0.945
LGDP does not Granger Cause LATV	5.503	0.028
LANTX does not Granger Cause LGDP	4.246	0.046
LGDP does not Granger Cause LANTX	0.934	0.425
LFKF does not Granger Cause LGDP	3.336	0.091
LGDP does not Granger Cause LFKF	4.673	0.049
LLF does not Granger Cause LGDP	14.183	0.002
LGDP does not Granger Cause LLF	0.003	0.956

Source: researcher's compilation from Stata 13.0

other studies made in Kenya by Ouma *et al.* (2016), in 34 developing countries by Mehrara and Baghbanpour (2016) and in Namibia by Simasiku and Sheefeni (2017). Those showed that the agricultural exports had a positive but low impact in the GDP. In those studies, the significance of the result was explained by the production techniques of individual families with low income, who produced in small scale and sold the products in a raw state.

The coefficient of the Non-Traditional Agricultural Exports (LANTX) was also significant at 10% in the short-run. An increase of 1% in the Non-Traditional Agricultural Exports (LANTX) resulted in an increase in the economic growth (LGDP) by 0.14%. This result was compatible with other studies of Sanjuán-López and Dawson (2010) and of Simasiku and Sheefeni (2017), who explained the result of the high statistical significance was related to the value of added products and the high prices relation in the world market.

About the control variables such as the Fixed Capital Formation (LFKF), it had a positive and insignificant impact on the economic growth in Peru at significance level of 1%. The result implied that an increase of 1% in fixed capital formation should produce an increase of 0.36% in gross domestic product (LGDP). According to Noula *et al.* (2013) for Cameroon, to Kanu and Ozurumba (2014) for Nigeria, to Albiman and Suleiman (2016) for Malaysia, to Bakari (2017) for Gabon and to Simasiku and Sheefeni (2017) for Namibia, in the short run, the positive impact on the increase of domestic investment had to support the economic growth more.

In the case of the Labor Force (LLF), it had a positive, but insignificant impact on the economic growth of Peru. When there was an increase of 1% in the labor force, it produced an increase of 0.31% in the gross domestic product (LGDP). The same relationship was found in Cameroon by Noula (2013) and in Ethiopia by Yifru (2015). In addition, in common with that study result, the labor force was reported as making a greater contribution to economic growth as compared with fixed capital formation. This situation can be explained in terms of much of the population having agriculture production as their principal labor, which is converted gradually into human capital, which is considered to be the primary source of the country's economic growth.

Table 5: Short-run dynamic of factors that affect the economic growth.

Variable	Coefficient	Std. Error	t-Statistic	P-value
D(LATX)	0.056	0.032	1.790	0.100*
D(LANTX)	0.136	0.086	1.580	0.100*
D(LFKF)	0.359	0.082	4.370	0.000***
D(LLF)	0.311	0.481	0.650	0.500
D(LGDP-1)	0.189	0.115	1.640	0.100*
Constant	3.626	1.090	3.330	0.000***
R-squared	0.999			
Prob (F-statistics)	0.000			
Breusch-Godfrey LM Test	0.482			
Jarque-Bera (Prob)	0.304			

Note: *,*** mean significance at 10% and 1%, respectively.

Source: researcher's compilation from Stata 13.0

Finally, where the lagged GDP is concerned, it had a positive impact on economic growth in Peru and it is significant at 10%. When the lagged GDP increased by 1%, it implied an increase of 0.12% of the economic growth (LGDP). This result was according to the multiplier-accelerator interaction, which implied that the previous period GDP increased the investment level of the country that led to increase the GDP in the current period.

We are aware that our study has a number of limitations. First of all, the study assessed the contribution and impact of agricultural exports on economic growth in Peru by using yearly agricultural exports data from 2000-2016. It did not cover earlier periods because of the absence of a complete data set. The study used only officially available data and did not regard any unofficial flows of agricultural products to other countries. Furthermore, our analysis was limited to the volume of total agricultural exports and did not examine their competitiveness on the international market. Moreover, issues concerning the impact of non-agricultural exports on economic growth were not discussed. Future research should address these limitations to come up with a more reliable estimations of the impact of agricultural exports on the economic growth of Peru. More importantly, to evaluate the true contributions' of agriculture exports to the economic growth, future research should take into account the externalities and its forward and backward linkages with service, manufacturing and the trade sector.

Conclusion and policy implications

Agriculture is fundamental to Peru's socioeconomic development and has remained an important source of foreign exchange earnings. Despite its substantial contribution to the total exports during the last few decades, it is astonishing that there has rarely been an empirical study on the impact of agricultural exports to the national economy. Therefore, the overarching goal was to investigate the contribution and impact of agricultural exports – both traditional and non-traditional – on the economic growth of Peru in the short and the long run. The empirical analysis was done on the basis of annual time series data from the period 2000-2016, applying Vector Autoregression modeling and various estimation procedures such as ADF test, Co-integration test, and Granger Causality test.

The ADF Test used to determine the stationarity of the data showed that with the exception of traditional agricultural exports and fixed capital formation, all variables achieved stationary at level I (0) implying the regression model used for the short run analysis avoided spurious results. In the case of the short run analysis, the results revealed a positive relationship between the traditional agricultural exports and the economic growth; and between the non-traditional agricultural exports and the economic growth. It also showed that the significance of non-traditional agricultural exports was stronger than that of traditional agricultural exports on the economic growth of Peru in the short-run. Likewise, the Co-integration test result revealed a long-run relationship between the traditional agricultural exports, non-traditional exports and economic

growth of Peru. Finally, the Granger Causality test revealed a unidirectional causality relationship between both traditional and non-traditional agricultural exports and the GDP. However, in the first case, the GDP Granger caused the traditional agricultural exports while in the second case, it was the non-traditional agricultural products that Granger caused the GDP. These results are far from surprising as the last decade witnessed a steady decline in the dollar values of many of the traditional agricultural export crops, highlighting the risks of depending upon traditional agricultural exports as a source of foreign exchange earnings. Unlike the traditional agricultural exports, the volume and the price of many non-traditional agricultural exports grew steadily during the last decade resulting in a much stronger positive correlation of non-traditional agricultural exports with economic growth of Peru. As concerns our explanatory variables, the results showed that the labor positively contributed to economic growth, which can be explained by the transformation of the labor force through quality education and skill-based training. We also found that fixed capital formation contributed positively to the GDP, which was expected a priori.

The insights from the study lends general support to the agriculture export-led growth hypothesis for Peru. In particular, there is a strong empirical evidence of a positive relationship between non-traditional agricultural exports and economic growth at the macroeconomic level in both short-run and long-run. As export earnings from traditional agricultural products has stalled, much attention is needed in the non-traditional agricultural sector. However, some challenges still persist. In particular, improving productivity throughout agriculture sector and diversifying economic activities towards higher value-added production and exports are two major challenges for the medium- to long-term sustainability of Peru's growth and development. Institutional development such as phytosanitary controls, significant competition in regional markets, insufficient export infrastructure, and the great distance between Peru and its major trading partners create additional challenges. While the agriculture export of the country has seen notable growth and diversification in recent years due to enforcement of public policies that support innovation and technology transfer in the sector, to make better use of this source of growth requires continued institutional and policy reforms. In the light of the findings and the challenges, our study has the following policy implications:

- The agriculture sector should be prioritized in terms of increased budget allocation which will in turn raise agricultural GDP and promote export diversification.
- Since the non-traditional agricultural commodities such as avocado and grapes exhibit high-income elasticities, the production and export of non-traditional agricultural commodities needs to be prioritized over the traditional ones.
- In the case of traditional agricultural commodities, government should emphasize adding value rather than exporting the raw commodity since their price elasticity of demand is low. Farmers should also be trained in the mechanisms of adding value to their products before they go to the market.

- To encourage smallholders to actively engage in agriculture production and minimize the associated risks, government should provide schemes such as crop insurance, technical assistance on pest control and improve the access to credit.
- Government should incentivize all producers through grants, subsidies, tax breaks, and low rates of corporation tax.
- Good standards of education are essential to ensure that the workforce is of a sufficiently high caliber to deliver products of the standard and quality required by destination buyers. Labor laws must also meet international standards and expectations.
- The government should improve the marketing of agricultural products continuously, not only by promoting these products in the international market, but also in the internal market to cover the existing and growing local demand.
- While Peru's performance ranks high overall within the region, Peru lags far behind in the technological sphere as compared to several industrialized nations. Therefore, there is a need for technology diffusion from the more technologically advanced countries to improve productivity in the agriculture sector.
- Many of the successful smallholder schemes, in a wide range of traditional and non-traditional commodities, have been initiated and led by the private sector of the country. Therefore, more financial assistance should be provided by governments and/or donor agencies to support those initiatives, such as revolving credit funds, extension advice, training, and building of cold stores which are currently financed by the private sector.
- The government should play a more proactive role in fostering innovation to develop new competitive advantages, overcome bottlenecks and alleviate constraints that hinder the growth of agriculture exports.

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