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Do coffee exports have impact on long-term economic growth of countries?

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Abstract: The present paper aims to investigate the impact of coffee exports on long-term economic growth in an open economy for 32 countries exporting coffee over the period of 1994–2013. The study applied a dynamic panel Auto-Regressive Distributive Lag (ARDL) modelling approach with estimators. All variables involved in the specified model were found to be stationary of order I (1) at a first difference. The Pooled Mean-Group (PMG) long-run results suggest the presence of a significant positive effect of coffee exports on economic growth. The empirical findings of the study suggest policy implications, promoting the coffee sector to boost the countries' economy.

Keywords: coffee exportation; coffee-exporting countries; dynamic panel Auto-Regressive Distributive Lag (ARDL); Gross Domestic Product (GDP) growth; long-run

In every nation, the export has been an important determinant of economic growth. It has been stated in Keynesian economic theory that in a short run, more exports produce more income growth through the export multiplier, referring to the amount raised on national income after an increase of one unit in domestic investment on exports (Kennedy 1966). Moreover, Adam Smith mentioned that trade increases the revenue and wealth of society by promoting country's surplus, and motivating countries to attain their highest productivity due to the market availability which pushes firms to increase their efficiency (Smith 1776). As explained by David Ricardo, the comparative advantage is the foundation of the parameters determining the countries to engage in trade. This means that when there are perfect competition and full utilisation of resources, a country has a comparative advantage in producing a good compared to another country when it is able to make it by sacrificing less of another (Ricardo 1817). This influences the nation's choice to specialise in the production of a particular good, like coffee, as studied in this case study of countries producing coffee. During international trade, the comparative advantage also stimulates the countries to increase their production and economies of scale where a large amount is produced with minimum costs.

Coffee trading has played a significant role in the aggregate changes in the economy of countries exporting coffee. The study conducted in Cameroon by Noula et al. (2013) showed that coffee exports have a positive and significant link to economic growth. Being aware of the importance of coffee export on economy of the country, most of the countries that produce coffee have started to boost its production and exports. Over the past 50 years, there has been a considerable rise in coffee production with improved quality and great variety of coffee products. The coffee-producing countries, nowadays more than 70 countries, have enjoyed benefits from higher yields and to increased volumes of sales. In trading, the rise of coffee prices depends on its quality and varieties, and there often is a higher demand for *arabica* than *robusta* variety (FAO 2015).

Since 1990, the sharp increase of coffee production, exports, and consumption have been remarkable in all worldwide coffee exporting countries (Figure 1). The data provided by the Internation-

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al Coffee Organization (ICO) show that in these countries, between 1990 and 2016, the total production of coffee increased from 93.102 million to 159.047 million of 60kg bags, with the exports changing from 73.887 million to 119.622 million of 60kg bags. Moreover, the domestic consumption increased from about 19.509 million to 49.241 million of 60kg bags in 1990 and 2016, respectively (ICO 2018). Recently, the United States Department of Agriculture (USDA) forecast the world coffee production for 2018–2019 to be 11.4 million higher than the previous year at a record 171.2 million of 60kg bags, with global consumption of 163.2 million 60kg bags. This is due to the expected increase of coffee production in the top coffee supplying countries such as Brazil, Vietnam, Mexico and Central America countries, Colombia, and Indonesia. Coffee bean exports, mostly to the United States and European Union, were forecasted to increase by 500 000 to 12.5 million of 60kg bags, drawing ending stocks lower (USDA 2018).

The economic growth in the long-run is the growth of potential output, which refers to the highest level of production that could be produced by an economy if all its resources were fully employed, including the current level of technology. Potential output can be attributed to the highest level of real GDP that can be maintained over the long term (Jones 2001). Therefore, the objective of this study is to investigate the impact of coffee exports on long-term economic growth in an open economy for the 32 coffee exporting countries over the period of 1994–2013.

METHODOLOGY AND DATA

In this study, the long-term impact of coffee exports on the economic growth of coffee-producing countries was estimated based on a generalised Cobb-Douglas production function. The study followed the empirical model applied by Awokuse (2007) for transition economies to determine the effect of exports on economic growth based on the production function. The basic formula of this function is stated as follows:

$$Y = f\left(AK, L\right) \quad (1)$$

where: Y is the output, A is the level of technology utilised, K is the capital, and L is the labour used for production.

In an open economy, the neoclassical growth model (1) can express the country's output production by including the total exports (*TEXP*), total imports (*IMP*), and final consumption expenditure (*FCE*). The gross domestic product (*GDP*) refers to the output, gross fixed capital formation (*GFCF*), also known as gross domestic fixed investment, stands for capital while total labour force (*TLF*) is labour used by country (i) for production of goods and services in a fixed period (t). The model can be written as follows:

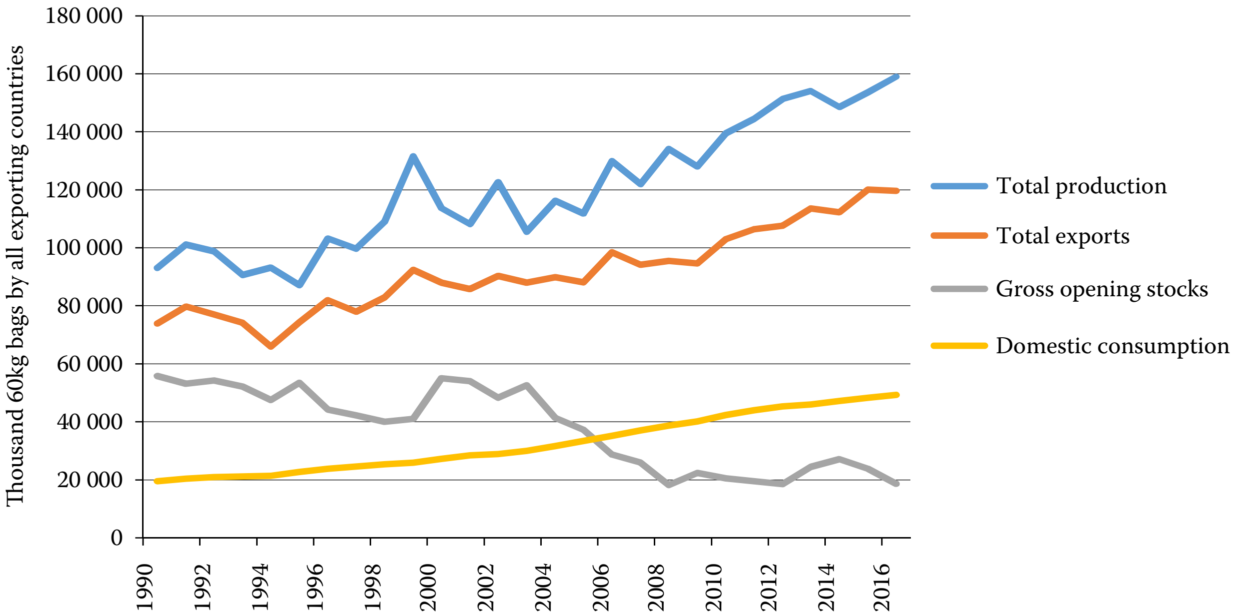

Figure 1. Change of coffee production, consumption and exportation in all exporting countries

Source: International Coffee Organization (ICO 2018)

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$$GDP_{it} = f\left(A\ GFCF,\ TLF,\ FCE,\ IMP,\ TEXP\right) \quad (2)$$

The augmented production function of Equation (2) can be expressed as follows:

$$GDP_{it} = A\ GFCF^{\beta 1}\ TLF^{\beta 2}\ FCE^{\beta 3}\ IMP^{\beta 4}\ TEXP^{\beta 5} \quad (3)$$

where: the coefficients β_1, β_2, β_3, β_4 and β_5 indicate the returns to scale associated with these five variables involved in the production and show that the rate of outputs is issued from the rate of inputs used. The natural logs (Ln) were inserted in both sides of the Equation (3) in order to exclude the differences in the units of measurements for the variables under consideration. Moreover, turning the variables into logarithmic forms is reasonable since we know that the growth rate of every series becomes the same as the derivative of its log with respect to time: $\left(\frac{d(\ln Y_t)}{dt} = \frac{d(\ln Y_t)}{dY_t} \times \frac{dY_t}{dt} = \frac{Y_t}{Y_t}\right)$.

Thereby, by holding the level of technology (A) constant as well, the Equation (3) becomes:

$$\text{Ln}GDP_{it} = \beta_0 + \beta_1 \ln GFCF_{it} + \beta_2 \ln TLF_{it} + \beta_3 \ln FCE_{it} + \beta_4 \ln IMP_{it} + \beta_5 \ln TEXP_{it} + \varepsilon_{it} \quad (4)$$

We know that the total exports of the country producing coffee in a fixed period ($TEXP_{it}$) include coffee exports ($CEXP_{it}$) and other exports ($OEXP_{it}$) of goods and services. Therefore:

$$\text{Ln}TEXP_{it} = \ln CEXP_{it} + \ln OEXP_{it} \quad (5)$$

Inserting the Equation (5) into Equation (4) results in the following:

$$\text{Ln}GDP_{it} = \beta_0 + \beta_1 \ln GFCF_{it} + \beta_2 \ln TLF_{it} + \beta_3 \ln FCE_{it} + \beta_4 \ln IMP_{it} + \beta_5 \ln CEXP_{it} + \beta_6 \ln OEXP_{it} + \varepsilon_{it} \quad (6)$$

The Equation (6) represents the final production function (model) for estimation with the coefficients β_1, β_2, β_3, β_4, β_5 and β_6 showing the returns to scale associated with the variables mentioned above for country i in time t. The ε_{it} represents the error term.

In this study, the sample included 32 coffee exporting countries over the period of 20 years. This study falls into the category of the dynamic panel-data (640 observations) where the numbers of cross-sectional observations (N) and time-series observations (T) are both large. Here, the study relied on Mean Group (MG) estimator proposed by Pesaran and Smith (1995) and Pooled Mean-Group (PMG) estimator suggested by Pesaran et al. (1997) which are used to estimate non-stationary dynamic heterogeneous panels where N and T are large. The MG model allows the slope coefficients, the intercepts, and error variances to differ across the groups. As this estimator does not impose any restrictions, all coefficients in the long-run and short-run are different and heterogeneous.

On the other hand, the PMG estimator allows short-run coefficients including the intercepts, error variances, and the speed of adjustment to the long-term equilibrium values to be different across the groups while keeping the long-run coefficients to be homogeneous across groups. When pooling long-term elasticities to be equal across all panels, the estimates become efficient and consistent. However, this happens when the restrictions are true. When the PMG model is heterogeneous (in the case when the hypothesis of slope homogeneity is not accepted), its estimates become inconsistent (Blackburne and Frank 2007). This is to mention that the size of T and N must be relatively large for avoiding the bias in the average estimators and overcome the issue of heterogeneity.

The Dynamic Fixed Effects (DFE) is another estimator used to estimate these types of panels. It keeps the coefficients of the co-integrating vector to be the same across all panels and equalises the speed of adjustment coefficient and short-run coefficients (Blackburne and Frank 2007). However, when the sample size is small, the DFE modes are subject to simultaneous equation bias caused by the endogeneity existing between the lagged dependent variable and error term (Baltagi et al. 2000). After running these three models, the selection of the best is necessary. This is performed through Hausman test to check the significant difference between them.

As the main objective of this study was to analyse the long-term relationship between the variables, the bound test for cointegration was performed. Johansen (1995) states that the long-term relationship is expected to occur only when there is cointegration among the variables with the same order of integration. However, the Auto-Regressive Distributive Lag (ARDL) panel model approach, developed by Pesaran et al. (1999), is applied when variables are integrated of order zero, I (0), and/or integrated of order one, I (1).

An ARDL (p, q, … , q_k) of dynamic panel (for this case study) has the following general form:

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$$\text{Ln}GDP_{it} = \beta_{0t} + \beta_{1t}\ln GFCF_{it} + \beta_{2t}\ln TLF_{it} + \beta_{3t}\ln FCE_{it} + \beta_{4t}\ln IMP_{it} + \beta_{5t}\ln CEXP_{it} + \beta_{6t}\ln OEXP_{it} + \mu_{it} + \varepsilon_{it} \quad (8)$$

$$\text{Ln}GDP_{it} = \phi_{10i}\ln GFCF_{it} + \phi_{11i}\ln GFCF_{i,t-1} + \phi_{20i}\ln TLF_{it} + \phi_{21i}\ln TLF_{i,t-1} + \phi_{30i}\ln FCE_{it} + \phi_{31i}\ln FCE_{i,t-1} + \phi_{40i}\ln IMP_{it} + \\ + \phi_{41i}\ln IMP_{i,t-1} + \phi_{50i}\ln CEXP_{it} + \phi_{51i}\ln CEXP_{i,t-1} + \phi_{60i}\ln OEXP_{it} + \phi_{61i}\ln OEXP_{i,t-1} + \psi_i \ln GDP_{i,t-1}\mu_i + \varepsilon_{it} \quad (9)$$

$$\Delta\text{Ln}GDP_{it} = \pi_i(\ln GDP_{i,t-1} - \beta_{0i} - \beta_{1i}\ln GFCF_{it} - \beta_{2i}\ln TLF_{it} - \beta_{3i}\ln FCE_{it} - \beta_{4i}\ln IMP_{it} - \beta_{5i}\ln CEXP_{it} - \beta_{6i}\ln OEXP_{it}) + \\ + \phi_{11i}\Delta\ln GFCF_{it} + \phi_{21i}\Delta\ln TLF_{it} + \phi_{31i}\Delta\ln FCE_{it} + \phi_{41i}\Delta\ln IMP_{it} + \phi_{51i}\Delta\ln CEXP_{it} + \phi_{61i}\Delta\ln OEXP_{it} + \varepsilon_{it} \quad (10)$$

$$Y_{it} = \sum_{j=1}^{p}\psi_{ij}Y_{i,t-j} + \sum_{j=0}^{q}\phi_{ij}X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (7)$$

where: $i = 1, 2, 3, \dots, N$ refers to the number of countries; $t = 1, 2, 3, \dots, T$ is the number of years; X_{it} is a vector ($k \times 1$) of independent variables; ϕ_{ij} refers to the coefficient vectors ($k \times 1$); ψ_{ij} are scalars; μ_i stands for country-specific effect; and ε_{it} is error term. For each country (i), the model (7) will fit the data when the number of years (T) is large.

Therefore, the long-run of Equation (6) can be written according to the general form in Equation (7) as follows in Equation (8).

For an ARDL ($p, q, \dots, q_k$) model, the lag structure is essential. In case of data limitation, when the time dimension is short so that it cannot overextend the lags, a common lag structure can be imposed across groups as shown in Demetriades and Law (2004). Taking lag one, for instance, the ARDL (1, 1, 1, 1, 1, 1, 1) dynamic panel specification of Equation (8) is written as follows in Equation (9).

In Equation (9), when the variables are of order 1 and cointegrated, the error term becomes integrated of order 0, I (0) for all countries i in the dynamic panel. Performing the parameterisation of Equations (8) and (9) into error correction, we get Equation (10).

In Equation (10),

$$\pi_i = -(1-\psi_i); \beta_{0i} = \frac{\mu_i}{1-\psi_i}; \beta_{1i} = \frac{\phi_{10i}+\phi_{11i}}{1-\psi_i};$$

and $\beta_{2i} = \frac{\phi_{20i}+\phi_{21i}}{1-\psi_i}$, other coefficients ($\beta_{3i}$, β_{4i}, β_{5i}, β_{6i}) follow the same formula for calculation.

The π_i is the error-correcting speed of adjustment parameter, and it has a negative value when the variables manifest a return to long-term equilibrium. If $\pi_i = 0$, it confirms no evidence of a long-term relationship. The β_{1i}, β_{2i}, β_{3i}, β_{4i}, β_{5i}, β_{6i} are the long-run coefficients associated with the six explanation variables. The coefficient β_{0i} adjusts the cointegration relationship to have a nonzero mean. The Equation (10) is estimated based on maximum likelihood method developed by Pesaran et al. (1999) since it is nonlinear in the parameters.

The study was conducted on 32 coffee exporting world countries based on the availability of data. The data such as gross domestic product (*GDP* in constant 2010 USD), gross fixed capital formation (*GFCF* in constant 2010 USD), total exports (*TEXP* in constant 2010 USD), total imports (*IMP* in constant 2010 USD), final consumption expenditure (*FCE* in constant 2010 USD), total labour force (*TLF* in million people) were collected from World Bank (2017). The data on coffee export ($CEXP_{it}$ in USD) were provided by Food and Agricultural Organization (FAO 2015). The data on other exports ($OEXP_{it}$ in USD) were computed from available data. The list of selected countries is shown in Table S1; Table S1 in electronic supplementary material (ESM); for the supplementary material see the electronic version. Stata software (version 13.1) was used during data analysis.

RESULTS AND DISCUSSION

Unit root testing

Before applying the ARDL approach to cointegration, unit roots of all the series were tested. According to Pesaran et al. (1999), the model is applied only when the variables of interest are integrated on order I (0) and/or I (1). The study applied two types of panel unit root tests: i) Im-Pesaran-Shin and ii) Fisher-type unit roots tests, to check if none of the variables is over I (1) order of integration. The Table 1 provides the results of unit root tests which show that most variables of the study are non-stationary at the level or order I(0)of integration. At first difference, all of the variables became stationary of order I (1). As it was found that no variable is stationary at I (2) or beyond this order of integration, the study allowed

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Table 1. Unit root test results

Variable name (in logarithms)	Variable (abbreviation)	Level		First difference	
		Im-Pesaran-Shin	Fisher type (ADF based)	Im-Pesaran-Shin	Fisher type (ADF based)
Gross domestic products	Ln*GDP*	0.9418	–0.3633	–6.0173***	9.5712***
Gross fixed capital formation	Ln*GFCF*	–0.6905	0.8893	–7.7456***	14.3422***
Total labour forces	Ln*TLF*	–0.1471	8.1439***	–3.4580***	10.5510***
Total imports	Ln*IMP*	–0.9063	1.8786*	–9.6928***	21.0387***
Final consumption expenditure	Ln*FCE*	1.5921	–0.9872	–7.4095***	14.8261***
Coffee export value	Ln*CEXP*	0.9283	–0.8558	–5.0238***	8.2069***
Other export value	Ln*OEXP*	–0.4036	1.1346	–7.0433***	12.3102***

*, ** and *** denote rejection of the null hypothesis at the 5, 1 and 0.1% levels, respectively; Im-Pesaran-Shin unit root tests (H_0: all panels contain unit roots); Fisher type based on ADF (Augmented Dickey-Fuller) unit root tests (H_0: all panels contain unit roots)

Source: authors' estimation

to apply the ARDL bounds approach in investigating the long-term relationship between variables.

Pooled Mean Group, Mean Group, and Dynamic Fixed Effects results

In this study, the long-term and short-term relationships between the variables under consideration and economic growth were computed. The results were found by incorporating the heterogeneous panel regression into the error correction model through the application of the autoregressive distributed lag ARDL (p, q) with three estimators (models). The results of these estimators, namely Pooled Mean Group (PMG), the Mean Group (MG), and the Dynamic Fixed Effects (DFE), are reported in Tables 2–4, respectively. The best efficient estimator was chosen using a Hausman test (Table 5).

The results of PMG (Table 2) indicate that all variables have, in the long-run, a positive, highly significant effect on economic growth. The PMG also proves the error correction term to be negative (significant at 5% level), a sign which was expected when variables display a return to long-run equilibrium.

The MG estimator (Table 3) shows different results than those from PMG. In the long-term relationship, there are some variables, such as gross fixed capital formation (*GFCF*), final consumption expenditure (*FCE*), and other export value (*OEXP*), which corroborate significantly the positive impact like their PMG estimates. However, variables such as total labour forces (*TLF*) and coffee export value (*CEXP*) have a negative and non-significant effect on economic growth. Considering the error-correction term coefficient, the MG provides significant estimate coefficient, with the expected negative value, but its magnitude is exceeding one unit. Its magnitude value (π_i = –1.06) acquaints us that 106% of the disturbance is corrected from long-run equilibrium by the following year.

Finally, the DFE model produces the same results as PMG. The speed of adjustment estimate from DFE model is reliable and significant, just like shown by PMG, but stronger in magnitude (compare π_i = –0.23 from DFE and π_i = –0.15 from PMG). The reliable value of the speed of adjustment (π_i) must be between 0 and –1. Remember that when π_i = 0, long-term relationship would be absent.

Selection of efficient estimator: Hausman test

To find the efficient model fitting panel data of this study for providing reliable results, the Hausman test (Table 5) was performed.

First, the Hausman test of PMG versus MG was run, and then the test of best-chosen estimator was performed versus the DFE. In Hausman test, the null hypothesis is that the difference in coefficients is not systematic. When the probability value calculated by Hausman test is more than 5%, the PMG is accepted as the best estimator. In contrast, the MG is chosen as the best model when the probability value is less than 5% (Baum et al. 2003). The Hausman test resulted in value of 1.28, and it is a chi-squared distribution (^{2}-distribution) with the probability value of 0.9727. Here, the study concludes that the PMG estimator

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Table 2. Pooled Mean Group (PMG) results

Variable name (in logarithms)	Variable (abbreviation)	Coefficient	Standard error	z
Long-run effects (LR)				
Gross fixed capital formation	Ln*GFCF*	0.0658064***	0.0033660	19.55
Total labour forces	Ln*TLF*	0.1814581***	0.0240522	07.54
Total imports	Ln*IMP*	0.0298060***	0.0065156	04.57
Final consumption expenditure	Ln*FCE*	0.5096935***	0.0201350	25.31
Coffee export value	Ln*CEXP*	0.0217441***	0.0013143	16.54
Other export value	Ln*OEXP*	0.1729704***	0.0050483	34.26
Error correction term (speed of adjustment)	*ECT*	–0.1464281**	0.0580059	–2.52
Short-run effects (SR)				
Gross fixed capital formation	ΔLn*GFCF*	0.0907825***	0.0140174	6.48
Total labour forces	ΔLn*TLF*	–0.6309202*	0.3586257	–1.76
Total imports	ΔLn*IMP*	–0.0669539***	0.0168301	–3.98
Final consumption expenditure	ΔLn*FCE*	0.3915634***	0.0486093	8.06
Coffee export value	ΔLn*CEXP*	–0.0001648	0.0018386	–0.09
Other export value	ΔLn*OEXP*	0.1204683***	0.0244353	4.93
Intercept	–cons	0.4068108***	0.1431761	2.84

*, **and ***denote significance at 10, 5 and 1% levels, respectively; independent variable – logarithm of gross domestic product (Ln*GDP*); number of countries – 32; period 1994–2013; *z* refers to *z*-score or standard score for measuring standard deviations from the mean

Source: authors' estimates

Table 3. Mean Group (MG) results

Variable name (in logarithms)	Variable (abbreviation)	Coefficient	Standard error	z
Long-run effects (LR)				
Gross fixed capital formation	Ln*GFCF*	0.2494113***	0.0739079	3.37
Total labour forces	Ln*TLF*	–0.1802345	0.2325142	–0.78
Total imports	Ln*IMP*	–0.2638295**	0.1242119	–2.12
Final consumption expenditure	Ln*FCE*	0.5741746***	0.0912127	6.29
Coffee export value	Ln*CEXP*	–0.0074184	0.0179028	–0.41
Other export value	Ln*OEXP*	0.3716148***	0.1337670	2.78
Error correction (speed of adjustment)	*ECT*	–1.0631350***	0.0918418	–11.58
Short-run effects (SR)				
Gross fixed capital formation	ΔLn*GFCF*	–0.0192376	0.0198512	–0.97
Total labour forces	ΔLn*TLF*	–0.8222612	0.8871733	–0.93
Total imports	ΔLn*IMP*	0.0257529	0.0219517	1.17
Final consumption expenditure	ΔLn*FCE*	–0.1677111**	0.0708351	–2.37
Coffee export value	ΔLn*CEXP*	0.0004030	0.0025732	0.16
Other export value	ΔLn*OEXP*	–0.0457260***	0.0172457	–2.65
Intercept	–cons	2.5479820**	1.0065340	2.53

*, **and ***denote significance at 10, 5 and 1% levels, respectively; independent variable – logarithm of gross domestic product (Ln*GDP*); number of countries – 32; period 1994–2013; *z* refers to *z*-score or standard score for measuring standard deviations from the mean

Source: authors' estimates

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Table 4: Dynamic Fixed Effects (DFE) results

Variable name (in logarithms)	Variable (abbreviation)	Coefficient	Standard error	*z*
Long-run effects (LR)				
Gross fixed capital formation	Ln*GFCF*	0.0333724	0.0228039	1.46
Total labour forces	Ln*TLF*	0.1085344	0.0774064	1.40
Total imports	Ln*IMP*	–0.0502858*	0.0284532	–1.77
Final consumption expenditure	Ln*FCE*	0.7840693***	0.0604211	12.98
Coffee export value	Ln*CEXP*	–0.0150508**	0.0070012	–2.15
Other export value	Ln*OEXP*	0.1437763***	0.0253687	5.67
Error correction (speed of adjustment)	*ECT*	–0.2345431***	0.0232696	–10.08
Short-run effects (SR)				
Gross fixed capital formation	ΔLn*GFCF*	0.0312008***	0.0055155	5.66
Total labour forces	ΔLn*TLF*	–0.1779678**	0.0872282	–2.04
Total imports	ΔLn*IMP*	–0.0143428*	0.0081460	–1.76
Final consumption expenditure	ΔLn*FCE*	0.1250500***	0.0264789	4.72
Coffee export value	ΔLn*CEXP*	0.0044843**	0.0019752	2.27
Other export value	ΔLn*OEXP*	0.0493368***	0.0096165	5.13
Intercept	–cons	0.2811590	0.1740706	1.62

*, ** and *** denote significance at 10, 5, and 1% and levels, respectively; independent variable – logarithms of gross domestic product (Ln*GDP*); number of countries – 32; period 1994–2013; *z* refers to *z*-score or standard score for measuring standard deviations from the mean

Source: authors' estimates

is the efficient estimator under the null hypothesis. The Hausman test result of PMG versus DFE is 0.01, and its associated probability value (1.0) suggests to choose PMG as the best estimator under the null hypothesis.

Table 5. Hausman test for efficient estimator

Coefficient	Ln*GFCF*	Ln*TLF*	Ln*IMP*	Ln*FCE*	Ln*CEXP*	Ln*OEXP*
Hausman test 1: Mean Group (MG) versus Pooled Mean Group (PMG)						
MG	0.2494113	–0.1802345	–0.2638295	0.5741746	–0.0074184	0.3716148
PMG	0.0658064	0.1814581	0.029806	0.5096935	0.0217441	0.1729704
Difference	0.1836049	–0.3616926	–0.2936355	0.0644811	–0.0291625	0.1986444
Standard error	0.3868006	1.216683	0.650061	0.4769592	0.0936894	0.7000845
chi2 (6) = 1.28*						
Probability > chi2 = 0.9729						
Hausman Test 2: Pooled Mean Group (PMG) versus Dynamic Fixed Effects (DFE)						
PMG	0.0658064	0.1814581	0.029806	0.5096935	0.0217441	0.1729704
DFE	0.0333724	0.1085344	–0.0502858	0.7840693	–0.0150508	0.1437763
Difference	0.0324339	0.0729237	0.0800918	–0.2743758	0.0367949	0.0291941
Standard error	1.0662060	7.6201040	2.0641580	6.379133	0.4163607	1.5992610
chi2 (6) = 0.01**						
Probability > chi2 = 1.0000						

*PMG is more efficient estimator than MG under null hypothesis (H_0); **PMG is more efficient estimator than DFE under null hypothesis (H_0); Ln – logarithms; *GFCF* – gross fixed capital formation; *TLF* – total labour forces; *IMP* – total imports; *FCE* – final consumption expenditure; *CEXP* – coffee export value; *OEXP* – other export value

Source: authors' estimates

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The results from PMG are shown in Table 2; the study also found the coefficient of error correction term (ECT) to be fairly negative and significant ($p < 0.05$) with the value of –0.1464281. It implies that the system corrects its previous-period disequilibrium (policy deviation, crisis, risk) at a speed of 15% annually to reach the steady-state. Bannerjee et al. (1998) report that when the error correction term is highly significant, the long-term relationship is more stable. This fair significant value of ECT confirms the existing long-run equilibrium relationship between coffee export and economic growth. It argues that economic growth reacts to disequilibrium in coffee export: economic growth increases in response to positive deviations from the long-run equilibrium in coffee export, while it decreases in response to negative deviations from the long-run equilibrium.

The long-term impact of gross fixed capital formation (*GFCF*) on economic growth was positive and significant at 1% level. This finding is supported by the Harrod-Domar model, a classical Keynesian model of economic growth developed by Harrod (1939) and Domar (1946). The model states that more investment (capital formation) results in the accumulation of capital, which in turn generates economic growth. The more a country saves and invests, the greater is its GDP growth. The results of PMG also show that labour force (*TLF*) has a positive long-term significant effect on economic growth. The same results were found by Boztosun et al. (2016) in Turkey for the period of 1961–2011. It can be seen through these results that in coffee-producing countries, a 1% increase in total labour force induces their GDP to get an increase of 0.181% in the long-run. As shown in Table S1, most coffee producers are developing countries; Table S1 in electronic supplementary material (ESM); for the supplementary material see the electronic version. These countries have large populations which have been expected to increase in the period of 2010–2030 and provide more labour force (Bloom and McKenna 2015). Following Mankiw et al. (1992) model, these developing countries can improve their economy through human capital investment. This refers to increase in the labour force skills and knowledge for raising national income, as Breton (2013) shows that schooling boosts the educated workers' marginal productivity, and in return these workers enhance the marginal productivity of other workers and physical capital.

The impact of total imports (*IMP*) on economic growth is positive (significant at 1% level) for the long-term period. Its effects show that a 1% expansion in imports leads to the increase of economic growth by 0.03%. Similar result was reported by Kim et al. (2007), showing that imports had significant positive effects on productivity growth in Korea in the period of 1980–2003. Final consumption expenditure (*FCE*), also called government expenditure or gross national expenditure, has a positive significant long-term impact on economic growth as well; similar results found by Suanin (2015).

As shown in Table 2, the study can also lead to a deduction that the long-run effects of coffee exports (*CEXP*) and other exports (*OEXP*) on GDP are positive (significant at $p < 0.01$): 1% increase in coffee exports and other exports result in a 0.0217% and 0.173% increases in GDP, respectively. These results confirm the hypothesis of this study stated before that there is a long-term positive relationship between coffee exports and economic growth in coffee-producing countries. Equally, using the Engle and Granger test, and the Johansen cointegration test, Noula et al. (2013) found a positive and significant long-term relationship between coffee exports and economic growth in Cameroon in the period of 1975–2009. For exports other than coffee, the studies by Fatemah and Qayyum (2018) showed their positive impact on the country's economic growth in the long-term period.

CONCLUSION

The results from the ARDL approach to cointegration with PMG estimator confirmed that all the variables have a long-term positive, highly significant impact on economic growth. Like other exports, the long-term effect of coffee exports on economic growth was positive and significant. In the long-run, a 1% increase in coffee exports results in a 0.0217% increase in GDP. This confirms that the countries producing coffee can boost their economy by increasing the quantity and quality of coffee exports. As these countries have high comparative advantage in coffee production, they should implement policies stimulating the coffee sector by considering other determinants of economic growth in an open economy and placing them in the direction of coffee production. They should empower the labour force involved in the coffee sector, increase gross fixed capital formation in this sector, and boost the imports of inputs used in coffee production and exportation such as good fertilisers, and equipment used in harvesting and post-harvest handling. These countries should participate in international coffee competitions and events such as World Coffee Events

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(WCE) to stimulate the promotion of coffee quality. Moreover, being a member of the International Coffee Organization (ICO), the main intergovernmental organisation for coffee, gathering exporting and importing governments to address the challenges found in the worldwide coffee sector, would be useful for the purposes of advocacy and international cooperation.

REFERENCES

Awokuse T.O. (2007): Causality between exports, imports, and economic growth: Evidence from transition economies. Economics Letters, 94: 389–395.

Baltagi B.H., Griffin J.M., Xiong W. (2000): To pool or not to pool: Homogeneous versus heterogeneous estimators applied to cigarette demand. Review of Economics and Statistics, 82: 117–126.

Banerjee A., Dolado J., Mestre R. (1998): Error-correction mechanism tests for cointegration in a single-equation framework. Journal of Time Series Analysis, 19: 267–283.

Baum C.F., Schaffer M.E., Stillman S. (2003): Instrumental variables and GMM: Estimation and testing. Stata Journal, 3: 1–31.

Blackburne E.F., Frank M.W. (2007): Estimation of nonstationary heterogeneous panels. The Stata Journal, 7: 197–208.

Bloom E.D., McKenna J.M. (2015): Population, Labour Force and Unemployment: Implications for the Creation of (Decent) Jobs, 1990–2030. UNDP Human Development Report Office, New York.

Boztosun D., Aksoylu S., Ulucak Z.S. (2016): The role of human capital in economic growth. Economics World, 4: 101–110.

Breton T.R. (2013): The role of education in economic growth: Theory, history and current returns. Educational Research, 55: 121.

Demetriades P., Law S.H. (2004): Finance, institutions and economic growth. International Journal of Finance and Economics, 11: 245–260.

Domar E.D. (1946): Capital expension, rate of growth, and employment. Econometrica, 14: 137–147.

FAO (2015): FAO Statistical Coffee Pocketbook. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

Fatemah A., Qayyum A. (2018): Modeling the Impact of Exports on the Economic Growth of Pakistan. Munich Personal RePEc Archive (MPRA). Available at https://mpra.ub.uni-muenchen.de/83929/ (accessed May 15, 2018).

Harrod R.F. (1939): An essay in dynamic theory. The Economic Journal, 49: 14–33.

International Coffee Organization (ICO) (2018): Historical Data on the Global Coffee Trade. Available at http://www.ico.org/new_historical.asp?section=Statistics (accessed Jan 10, 2018).

Johansen S. (1995): Likelihood-Based Inference in Cointegrated Vector Autoregressive Models. Oxford University Press.

Jones C.I. (2001): Was an industrial revolution inevitable? Economic growth over the very long run. Advances in Macroeconomics, 1: 2.

Kennedy C. (1966): Keynesian theory in open economy. Social and Economic Studies, 15: 1–21.

Kim S., Lim H., Park D. (2007): Could imports be beneficial for economic growth? Some evidence from Republic of Korea. ERD Working Paper No. 1036. Asian Development Bank, ADB Avenue, Mandaluyong, Philippines.

Mankiw N.G., Romer D., Weil D.N. (1992): A contribution to the empirics of economic growth. The Quarterly Journal of Economics, 107: 407–437.

Noula A.G., Sama G.L., Gwah M.D. (2013): Impact of agricultural export on economic growth in Cameroon: Case of banana, coffee and cocoa. International Journal of Business and Management Review, 1: 44–71.

Pesaran M.H., Shin Y., Smith R.P. (1997): Estimating long-run relationships in dynamic heterogeneous panels. DAE Working Papers. Amalgamated Series, 9721.

Pesaran M.H., Shin Y., Smith R.P. (1999): Pooled mean group estimation of dynamic heterogeneous panels. Journal of the American Statistical Association, 94: 621–634.

Pesaran M.H., Smith R.P. (1995): Estimating long-run relationships from dynamic heterogeneous panels. Journal of Econometrics, 68: 79–113.

Ricardo D. (1817): On the Principles of Political Economy and Taxation. Batoche Books. Kitchener, Ontario,Canada.

Smith A. (1776): An Inquiry into the Nature and Causes of the Wealth of Nations (Cannan ed.). University of London at the London School of Economics Ed., London, UK.

Suanin W. (2015): The impact of government expenditure on economic growth in Thailand. In: Proceedings International Conference on Trends in Economics, Humanities and Management (ICTEHM'15), Singapore, March 27–28, 2015.

USDA (2018): Coffee: World Markets and Trade. Foreign Agricultural Service. United States Department of Agriculture (USDA), Office of Global Analysis, Washington D.C., USA.

World Bank (2017):World Bank Open Data. Available at https://data.worldbank.org (accessed January 10, 2018).

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