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LONG RUN RELATIONSHIP BETWEEN ECONOMIC GROWTH, EXPORT, POPULATION AND INVESTMENT OF ETHIOPIA

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Abstract

The objective of this study is to examine the long-run relationship between economic growth, population, export, and investment in Ethiopia using annual data collected from the World development indicator, and FAOSTAT for 18 years from 1990-2007 E.C. Co integration and Granger Causality test. Stationary properties of the data and the order of integration of the data were tested using the Augmented Dickey-Fuller (ADF) test. Variables were non-stationary at levels but stationary in first differences. The long-run effects of Population, export and investment on Economic growth indicated that these variables are positively related to economic growth and statistically significant at 1% level.

Keywords: Economic, growth, Annual GDP, Population, Investment

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Introduction

For the past two decades, numerous empirical studies have been undertaken to determine what are the main factors that drive economic growth. There are two groups of researchers with respect to the main factors that drive economic growth. One includes those investigating the correlation between export and economic growth and the hypothesis that export expansion is attributed to a country's economic performance (Feder, 1983; Ram, 1987). The other includes those attempting to determine the relationship between economic growth and investment in the hypothesis that economic growth may be driven by investment through export growth or vice versa (Baldwin and Seghezza, 1996; Rodrik, 1995). Which factor, export or investment, is more responsible for economic growth has remained an issue of debate.

Statement of the Problem

According to Global Multidimensional Index (GMI), published by Oxford University (2015), Ethiopia ranks the third poorest country in the world, just ahead of Niger followed by South Sudan. The majority of the Ethiopian population is poor subsistence farmers who grow crops and rear animals just to feed themselves and their families. The large majority of destitute people, about 52 million are living in Ethiopia.

In a similar argument, many scholars argue that FDI has an adverse effect on development. They complaining that increased FDI does not always contribute to upgrading but sometimes may even act to reduce the host country's long run potential, leading to a crowding-out effect whereby domestic firms are displaced or outcompeted by foreign-owned MNEs, hence affecting economic development negatively (Tang and Selvanathan, 2008).

During the last five years, the exports of Ethiopia have increased at an annual rate of 24.6%, from $1.85 billion in 2009 to $5.56 Billion in 2014. Ethiopian export is dominated by few raw or semi processed agricultural products which have been the main contributors to the country's foreign exchange earnings. Coffee, which is very critical to the Ethiopian economy (with exports around $400 million dollars a year) very often, meets low prices on the international market, which puts the entire Ethiopian economy in a very bad situation (Espen, 2006). The export sector is the primary sector for enhancing the foreign exchange earnings; there are various bottlenecks that prevent the sector from playing its role in the development of the national economy.

The Ethiopian economic growth registered over the last few years is not a deniable fact for it has got recognition both from the World Bank and the International Monetary Fund. However, the major issue that deserves a great concern is, more likely, how to keep the growth sustainable. Thus, this study was aimed to examine the long run relationship of Economic Growth and other macroeconomic variables like population, export, import and investment in Ethiopia.

Objectives

General objective

The major objective of this study is to examine the long-run relationship between economic growth, population, Export, and investment in Ethiopia.

Specific objectives

Specific objectives include:

i. To identify if there exists causal relationships and its direction among Economic growth and population, export and investment in Ethiopia.
ii. To examine whether there exists long run equilibrium among economic growth, population, export and investment in Ethiopia.
iii. To assess how Population, export and investment contribute to economic growth to adjust to its short run and long run equilibrium due to shocks inevitable in the economy.

Methodology

Data Source

Secondary data type was used for this particular study. Time series data on GDP growth as it is a proxy measure for economic growth, Population, gross investment, export and import from 1990 - 2007 were obtained from World Development indicators and Food and Agriculture Organization (FAOSTAT) accessed from their online data base.

Descriptive analysis

Among the descriptive statistics, graphical and tabular illustration are the once employed as they are widely applied by many other researchers.

Econometric model and specification

To establish the causality relationship between the four variables, the VAR model in the form: (VAR) = (GDP, Pop, Exp, Inv) was used. The dependent variable is Economic Growth (GDP, $ billion). The explanatory variables are Population (million), Export ($million), and investment ($ billion). These variables were chosen because of their theoretical and empirical justification on economic growth of a given country. However, before the estimation of the specified long run and the short-run growth models, the time series properties of the variables of interest were first explored to eliminate any trend element that could lead to spurious parameter estimates GDP as theoretically outlined was used as proxy for Economic growth. Based on the underlined assumption, the model for GDP could be written as:

GDP = fs (Pop, Inv, Exp, Inv) -----------------(1)

In order to evaluate the impact of the dependant variables, the model is modified by transforming the equation into a log form;

$$\log GDP_t = \beta_0 + \beta_1 \log Pop_t + \beta_2 \log Inv_t + \beta_3 \log Exp_t + \varepsilon_t \text{ ---(2)}$$

where,

GDP = Gross Domestic Product; **Pop** =Total population; **Exp** = Exports;
Inv = Investment**;** ε = error term; t = time series period;
$\boldsymbol{\beta_0}$ **=** the intercept; $\boldsymbol{\beta_1, \beta_2, \beta_3, \beta_4}$ are coefficient for the explanatory variables.

Estimation Techniques

The estimation technique employed in this study is co-integration and error-correction modeling technique. To estimate the co-integration and error-correction, three steps are required: these are testing for order of integration, the co-integration test and the error correction estimation.

Unit root test

Testing of the stationarity of the time series ensures that the variables used in the analysis are not subjected to spurious correlation and should be done before the estimation of the econometric model. There are at least two important reasons why unit root test is so necessary. One is to know if shocks have permanent or transitory effects.
i.
Second, it is important for forecasting to know if the process has an attractor. A stationary series tends to always return to its mean value and variations around this mean value. In the same way, a variable that has to be differenced once to become stationary is believed to be *I(1)* that is integrated of order I(1) Gujarati (2003).

Several procedures for the test of order of integration has been developed. The most popular ones are Augmented Dickey-Fuller (ADF) test due to Dickey and Fuller (Gujarati, 2004), and the Phillip-Perron (PP) due to Phillips and Perron (1988). Thus, ADF test has three Models. As these concerning, the Augmented Dickey-Fuller (ADF) is utilized to indicate the properties of time series (Dickey and Fuller, 1979; 1981) by using the models in equation (3-5) as follow:

$\Delta y_t = \alpha_o + \alpha_1 y_{t-1} + \sum_{i=1}^{n} \alpha \Delta yt + e_t$ (model with intercept only)……………………(3)

ii. $\Delta y_t = \alpha_o + \alpha_{1t} + \alpha_2 y_{t-1} + \sum_{i=1}^{n} \alpha \Delta yt + e_t$ (model with trend and intercept) …….(4)

iii. $\Delta y_t = \alpha_1 y_{t-1} + \sum_{i=1}^{n} \alpha \Delta yt + e_t$ (model does not have trend and intercept) …….(5)

Where:

'y' a vector for all-time series variables under consideration in a particular regression model (our variables of interest); **'t'** is a linear time trend, **'Δ'** is the first difference operator, **'α_0'** is a constant, **'n'** is the optimum number of lags in the dependent variable determined by maximum lag selection criteria (Akaike Information Criteria (AIC) and **'e'** is the random error term; and the Phillip-Perron (PP) is equation is represented as:

$$\Delta y_t = \alpha_0 + \alpha y_{t-1} + e_t \text{ ……………………………………………………………………….(6)}$$

Hypothesis:

Null Hypothesis, **Ho**: Variable is not stationary or has unit root.
Alternative Hypothesis, **HA**: Variable is stationary or does not have unit root.

Co-integration test

The basic idea behind co-integration is that if, in the long-run, two or more series variables move closely together, even though the series themselves are trended, the difference between them is constant. The most commonly used methods for co integration test are the Engle-Granger two step test (Engle and Granger, 1987) and the Johansen Maximum Likelihood procedure (Johansen and Juselius, 1990).

For this analysis, Johansen (1988) co-integration procedure was employed because this approach is performing better than other co-integration tests. Johansen co- integration test will be employed if variables are non stationary at levels but they become stationary when differenced. Johansen's methodology takes its starting point in the vector auto regression (VAR) of order P given by: In conducting the Johansen co-integration test, we estimate the following model:

$$y_t = \mu + \Delta_1 y_{t-1} + \ldots\ldots + \Delta \rho y_{t-\rho} + \varepsilon_t \text{ ……….(7)}$$

Where:

'Y_t' is an **'nx1'** vector of variables that are integrated of order commonly denoted (1) and 'ε_t is an **'nx1'** vector of innovations. VAR can be rewritten as

$$\Delta y_t = \mu + \eta y_{t-1} + \ldots\ldots + \sum_{i=1}^{\mu-1} \tau_t \Delta y_{t-1} + \varepsilon_t \text{ ……….(8)}$$

Two set of statistics purposed by Johansen and Juselius (1990) which indicate the number of co-integrating rank, **trace statistic**, LR (λ_{trace}) and maximum likelihood statistics.

The null hypothesis for the eigen value test is r = equals the number of co-integration vectors in the model, while the null hypothesis for trace test is r ≤ the number of co-integration vectors in the model. The test statistics of the null hypothesis for λ_{max} is ***"r"*** of no co-integrating vectors against alternative hypothesis that "***r+1"*** co-integrating vector. Where, **"T"** is the number of observations, and the **"λ_i"**is the estimated eigen value from the matrix.

Error correction model (ECM)

If co-integration is proven to exist, then the third step requires the construction of error correction mechanism to model dynamic relationship. The purpose of the error correction model is to indicate the speed of adjustment from the short-run equilibrium to the long-run equilibrium state. The greater the co-efficient of the parameter, the higher the speed of adjustment of the model from the short-run to the long run.

If the variables are found to be integrated, a vector error correction model (VECM) would be estimated. Because a co-integrating relationship deals only with long run relationship without considering the short run dynamics. Thus, if the series LnGDP, LnPop, LnExp and LnInvt are found to be I(1) and co-integrated, the ECM model is represented by the following equation:

$$\text{for trace statistics, LR}(\lambda_{\text{trace) (r)}}) = \text{- T} \sum_{i=r+1}^{k} \ln(1-\lambda_t) \text{……………………………….(9)}$$

$$LnGDP_t = \alpha_1 + \sum_{t=1}^{n} \beta_{1i} \Delta LnGDP_{t-1} + \sum_{t=1}^{n} \gamma_{1i} \Delta LnPop_{t-1} + \sum_{t=1}^{n} \delta_{1i} \Delta LnExp_{t-1} + \sum_{t=1}^{n} \tau_{1i} \Delta LnInv_{t-1} + \lambda Ec_{t-1} + e_1 .....(11)$$

$$LnPop_t = \alpha_2 + \sum_{t=1}^{n} \beta_{2i} \Delta LnGDP_{t-1} + \sum_{t=1}^{n} \gamma_{2i} \Delta LnPop_{t-1} + \sum_{t=1}^{n} \delta_{2i} \Delta LnExp_{t-1} + \sum_{t=1}^{n} \tau_{2i} \Delta LnInv_{t-1} + \lambda Ec_{t-1} + e_1 ....(12)$$

$$LnExp_t = \alpha_3 + \sum_{t=1}^{n} \beta_{3i} \Delta LnGDP_{t-1} + \sum_{t=1}^{n} \gamma_{3i} \Delta LnPop_{t-1} + \sum_{t=1}^{n} \delta_{3i} \Delta LnExp_{t-1} + \sum_{t=1}^{n} \tau_{3i} \Delta LnInv_{t-1} + \lambda Ec_{t-1} + e_1 ....(13)$$

$$LnInv_t = \alpha_4 + \sum_{t=1}^{n} \beta_{4i} \Delta LnGDP_{t-1} + \sum_{t=1}^{n} \gamma_{4i} \Delta LnPop_{t-1} + \sum_{t=1}^{n} \delta_{4i} \Delta LnExp_{t-1} + \sum_{t=1}^{n} \tau_{4i} \Delta LnInv_{t-1} + \lambda Ec_{t-1} + e_1 ....(14)$$

Where:

Where *LnGDP*, LnPop, LnExp, LnInv are logarithm transformation of Economic growth (GDP in Billions, $US), Population (in millions), export (in millions, $US), and investment (in Billion, $US) respectively; EC_{t-1} is the error correction term is the lagged estimated error series. **"Δ"** is the difference operator and ε_t is the error term which takes care of other variables that could have influence on Economic growth but not specified in the model and while n is the optimal lag length orders of the variables.

Granger-Causality/Block Exogeneity Test

Existence of co-integration implies that there is a long-run equilibrium relationship existing between the variables in the equation. When the existence of the long run relationship among the variables is established, then further analysis such the Granger causality can be applied. Granger causality distinguishes between unidirectional and bi-directional causality (Granger and Newbold, 1988).

a). Unidirectional Granger-causality from X to Y and not Vice-versa

b). Unidirectional Granger-causality from Y to X and not Vice-versa

c). Bidirectional (or feedback) causality from X to Y, and from Y to X.

c). Lack of Causality: There is no relationship among the variables,

In order to test for Granger causality, we will estimate a **VAR** model as follows:

$$[\log y_t] = \alpha_o + \beta_1 [\log y_{t-1}] + \beta_2 [\log y_{t-2}] .... + \beta_n [\log y_{t-n}] + \mu_t ....(15)$$

$$Y = [GDP \quad POP \quad Ex \quad Inv] ....(16)$$

where **'*t*'** is the time subscript, **'*n*'** is the number of lags for the **'VAR, α'** is the vector of constant and $\beta_1, \beta_2, ..., \beta_3$ are all parameter matrices and the variables have their usual meaning.

Accordingly, the direction of causality between Economic growth (LnGDP), Total population (LnPop), Export (LnExp), Import and Gross Investment (LnInv) would be examined. The test for five variables can be formulated as follows:

Variables Definition and Justification

Economic Growth (GDP): There are many ways of measuring economic growth of a given country. These include real output per capita and growth in real gross domestic product. This study however used GDP as a measure of economic growth. This is because other researchers have used it in their work as dependent variable (Frimpong and Oteng-Abayie, 2008).

- GDP (Gross Domestic Product, measured in $ billion) is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. Figures for GDP are converted from domestic currencies using single year official exchange rates.
- **Pop (Total population)** measured in millions**:** is based on the definition of population, which counts all residents regardless of legal status or citizenship.
- **Exp (Exports,** measured in $ million): goods and services represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services.
- **Inv (Investment,** measured in $ billion**) :** investment means creation of capital
- goods capable of producing other goods or services.

Results and Discussion

Descriptive analysis

Annual data of GDP (mill. $US, total Population (mill), Export (mill $US), and investment (mill

$US) of Ethiopia from the year 1990 to 2007 E.C. were statistically summarized and presented in Table 1. The result shows that the mean value of the GDP, Pop and Expand Inv are 21252.18, 76.415, 1002.67, and 15587.61, respectively. The ranges of standard deviation of these series are 15633.92, 10.60, 880.71 and 11369.26 for GDP, Pop, Exp, and Inv; the maximum value also 55612.23, 94.56, 3307.25, and 33217.5, for GDP, Pop, Exp, and Inv. Graphical representations of these series are presented in Figure 1 below.

Table 1. Summary statistics result of LnGDP, LnPop, LnExp, and LnInv.

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP	18	21252.18	15633.92	7700.83	55612.23
Pop	18	76.415	10.60	62.71	94.56
Exp	18	1002.67	880.71	43.62	3307.25
Inv	18	15587.61	11369.26	3158.01	33217.5

Source: Own computation.

From Figure 1, One can observe that Inv and GDP showed an irregular pattern over the time span of 1990 to 2007 E.C. GDP was increasing and above 30 bill$ from 1990 to 1992. But from 1992-1993, it was dramatically decreased and become below 10 bill$. However, it has shows steadily increased thereafter. On the other hand, Investment although showing a slightly increasing until 1994 EC, but thereafter increased considerably until 2011 EC. Export shows insignificant increase throughout the time this paper considered. However, it a remarkable increase could be observed from 2000 to 2005 EC.

Test for unit root

A stationary series is denoted as I(0), meaning integrated of order zero (Dickey and Fuller, 1979). The data were transformed into natural logarithms to account for the expected non-linearity's in the relationships and also to achieve stationarity in variance (Chang and Caudill, 2005). All the variables used in this study were first tested for long run relationship between economic growth, population, export, and investment.

$$\Delta y_t = \alpha_0 + \alpha y_{t-1} + e_t$$

where $\alpha = \rho - 1$; u : s^2 IID(0,δ^2)

Hypothesis:

HO: ρ **= 1** (**y_t** series has unit root or not Stationary or it)
HA: ρ **< 1** (**y_t** series is stationary or integrated of order zero)

The result of stationarity test indicated the rejection of the null hypothesis of no stationarity at 1%, 5% and also 10% significance level for trend and also without trend of all the series variables examined. Thus the variables examined were found to be non stationary at levels, but after taking first difference, we can reject null hypothesis which indicates that all of these variables are stationary at 1% and also at 5% significance level.

Table 2. Augmented Dickey Fuller (ADF) unit root test results at level.

Coefficient	Level I (0) t-statistics	Level of significance			Decision
		1%	5%	10%	
-0.14949 (0.201)	2.58	-2.602	-1.753	-1.341	Accept Ho
-0.32261 (0.101)	-1.754	-2.602	-1.753	-1.341	Accept Ho
-0.390395 (0.078)	-1.894	-2.602	-1.753	-1.341	Accept Ho
-0.275186 (0.149)	-1.521	-2.602	-1.753	-1.341	Accept Ho

Source: Own computations

Table 3. Augmented Dickey Fuller (ADF) unit root test result at first difference.

Var.	Coefficient	Level I (1) t- stat.	Level of significance			Decision
			1%	5%	10%	
LnGDP	-0.6319** (0.029)	-2.43	-2.624	-1.761	-1.345	Reject Ho
LnPop	-1.0653** (0.011)	-3.994	-2.624	-1.761	-1.345	Reject Ho
LnExp	-1.256*** (0.000)	-4.861	-2.624	-1.761	-1.345	Reject Ho
LnInv	-0.9891*** (0.002)	-3.70	-2.624	-1.761	-1.345	Reject Ho

Source: *Own computations*
Note: ****;** indicates stationary at I(1) at 1% and 5% level of significance, respectively.*

Selecting of number of lags

To test for co-integration, we must specify how many lags to include. Nielsen (2001) has indicated methods used to determine the lag order for a VAR model with I(1) variables. The order of the corresponding VECM is always one less than the VAR.

Table 4. Selection-order criteria result.

Maximum rank	LL	eigen value	SBIC	HQIC	AIC
0	-281.95164	33.83742	33.66086	33.64137	-
1	-267.97843	0.80678	33.36013*	32.87458	32.82099
2	-261.43289	0.53702	33.42336	32.71711*	32.63916
3	-258.48456	0.29310	33.57648	32.73781	32.64524
4	-256.92108	0.16801	33.5592	32.67639	32.57895

Source: Own computations

As indicated by the table above, the Schwarz Bayesian information criterion (SBIC) method of optimum lag selection determine one lags for the data used in the model while, Hannan–Quinn information criterion (HQIC) method indicated two lags. Thus one lag was used to proceed for co-integration test.

Co-integration Test

This analysis adopted Johansen Maximum Likelihood procedure because it allows for all feasible co-integration relationship and the number of co-integrating vectors to be verified practically. The result of the co-integration condition (that is the existence of a long term linear relation) is presented in Table 5 and 6 below using methodology proposed by Johansen and Juselius (1990). The trace statistic test (50.0611) is greater than 5% critical value implying that the hypothesis of no co-integrating equations (a maximum rank of zero) is rejected. However, we fail to reject the null hypothesis of at most one co-integrating equation.

Table 5. Unrestricted co-integration rank test (Trace) result.

Trend: constant Number of obs = 17
Sample: 1991 - 2007 Lags = 1

Maximum rank	LL	eigen value	trace statistic	5% critical value	1% critical value
0	-281.952		50.0611*1	47.21	54.46
1	-267.979	0.80678	22.1147*5	29.68	35.65
2	-261.433	0.53702	9.0236	15.41	20.04
3	-258.485	0.29310	3.1270	3.76	6.65
4	-256.921	0.16801			

Source: Own computations for data obtained from FOSTA, World development indicator
*Note: * indicates at least one cointegrating vectors at 5% level of significance respectively for the number of lags.*

Estimates of long run and error

Correction model

The long-run effects of population, export and investment on economic growth indicated that these variables are positively related to economic growth and statistically significant at 1% level. This means that a one percent increase in population, export and investment will increase 28%, 238% and 774% in economic growth respectively, as these variables are theoretically acknowledged to enhance the capacity of the economy through the multiplier effect. The results revealed that the coefficient of the error correction term (ECT-1) which measures the adjustment towards long-run equilibrium was negative as expected -0.033, -0.0675, -0.594, and -0.052 for ΔLnGDP, ΔLnPop, ΔLnExp and ΔLnInv, respectively.

Table 6. Vector error correction estimates result of economic growth of Ethiopia.

Longrun Estimates (Johansen normalization restriction imposed)				
LnGDP			1	
LnPop			0.29188 *** (4.426211)	
LnExp			2.38061*** (0.0489924)	
LnInv			7.7402 *** (1.93348)	
constant			-2025.49** (3.05664)	
Shortrun Estimates				
Error correction	Δ(LnGDP (1)	Δ(LnPop (1)	Δ(LnExp (1)	Δ(LnInv (1)
EC_{t-1}	-0.032431 ** (0.00995)	-0.067464 ** (0.01435)	-0.59391 *** (1.35797)	-0.051573 *** (0.01823)
Δ(LnGDP (1)	0.002431 (0.009944)	0.0707232 (0.2892889)	-0.0009253 (0.0037847)	0.0261097 (0.1068003)
Δ(LnPop (1)	0.067464 *** (0.0143518)	1.962654 *** (0.4175213)	-0.025677 *** (0.0054623)	0.7245767 *** (0.1541414)
Δ(LnExp (1)	6.593909 *** (1.357966)	191.8292 (39.50578)	-2.509662 *** (0.5168459)	70.81992 *** (14.58483)
Δ(LnInv (1)	-0.0515726 ** (0.0182292)	-1.500344** (0.5303219)	0.0196287 ** (0.0069381)	-0.5539001** (0.1957854)

Source: Own computations using stata software.
*Note: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.*

Granger-Causality Test

The estimation result indicated that there exists bidirectional causality significant at 1% between export and population. The implication of the result is that an increase in production of high quality of goods and services through hiring more skilled labour with high payment will increases export, which in turn leads to cause to produce more skilled and highly productivity labour. The result also shows that there is a unidirectional causality relation from export to economic growth (GDP), from investment to export significant at 1%. Investment in new technology and capital can increase the productive capacity of the economy.

Table 7. Granger causality Wald tests result.

Equation	Excluded	Chi^2	df	Prob > Chi^2
GDP	Inv	2.3769	1	0.013
GDP	Pop	4.0001	1	0.045
GDP	Exp	3.4513	1	0.003
GDP	All	4.0145	3	0.003
Inv	GDP	0.84563	1	0.028
Inv	Pop	5.3611	1	0.051
Inv	Exp	6.1329	1	0.015
Inv	All	14.182	3	0.003
Pop	GDP	0.70853	1	0.400
Pop	Inv	6.402	1	0.011
Pop	Exp	21.388	1	0.000
Pop	All	26.563	3	0.000
Exp	GDP	1.5793	1	0.029
Exp	Inv	9.0317	1	0.003
Exp	Pop	23.686	1	0.000
Exp	All	26.038	3	0.000

Source: Own computations using stata software.

Diagnostic tests

Diagnostics test are usually undertaken to detect model misspecification and as a guide for model improvement. These tests include serial correlation, normality and heteroscedasticity tests.

Normality tests

The Jarque-Bera normality test is used to determine whether the regression errors are normally distributed. The standard test for the normality of a data series in Stata is a joint asymptotic test whose statistic is calculated from the skewness and kurtosis of the residuals as follows (www.cambridge.org/ Stata Guide Cambridge University Press, n.d). Jarque-Bera normality test result showed that the probability value is greater than the χ^2 value that we accept the null-hypothesis of residuals are normally distributed.

Table 8. Jarque-Bera Normality Tests result.

Equation	χ^2	df	Prob > χ^2
dgp	7.851	2	0.11973
inv	9.517	2	0.50858
pop	0.938	2	0.62578
exp	0.680	2	0.71171
ALL	18.986	8	0.11493

Null Hypothesis: Residuals are multivariate normal
Source: Own computations using stata software

Serial correlation test

The serial correlation test can be done using the Durbin-Watson test or the lagrange multiplier (LM) test. It helps to identify the relationship that may exist between the current value of the regression residuals and lagged values. This review analysis used the LM test to investigate serial correlation.

The Hypotheses for the Durbin Watson test are:
H_0 = no serial correlation.
H_1 = serial correlation exists.

Conclusion and Recommendations

Conclusion

The objective of this study is to examine the long-run relationship between economic growth, population, export, and investment in Ethiopia using annual data collected from the World development indicator, and FAOSTAT of 18 years from 1990-2007 E.C. Econometric methodology like Co-integration and Granger Causality test was also employed. At first, the stationary properties of the data to verify the existence of spurious relation among the series data and, order of integration were tested using the Augmented Dickey-Fuller (ADF) test. We used the VAR and VECM approach to determine the long-run and short-run relationship between these variables.

Furthermore, the granger causality test was employed to find the direction of causality. The test result indicated that there exists bidirectional causality statistically significant at less than 1% between export and population. There is also statistically significant at less 5% a bidirectional causal relation between investment and population and economic growth (GDP). Similarly, the test result also reveals that there is a unidirectional causality relation from two variables. Normality Tests was conducted using Jarque-Bera to determine whether the regression errors are normally distributed.

Another diagnostics test includes the test of serial correlation. This test was adopted using the Durbin-Watson test or the lagrange multiplier (LM) test. It helps to identify the relationship that may exist between the current value of the regression residuals and lagged values. The analysis used the LM test to investigate serial correlation. Statistical analysis found that (Prob> chi2) was 0.693 which justify the rejection of alternative hypothesis of existence serial correlation, and acceptance of the null-hypothesis of the LM test that the residuals are not serially correlated is accepted at 5% level of significance.

Recommendations

Based on the finding of this particular study of Economic growth of Ethiopia, for which data obtained from World Bank development indicator and FAOSTAT baseline, the following policy recommendations are forwarded.

- Population has positive impact on Ethiopian economic growth. In order to achieve an observable contribution of population to economic growth, the increase in population has to be integrated with the human capital formation through education and skill development. So that the government of Ethiopia has to give due attention to the adequate quality of education that can bring transformation in technology and innovation as a spring board of economic growth through population growth.

- Exports of goods and service have significant positive impact on Ethiopian economic growth as it can be evidenced theoretically. Therefore, the Ethiopian Government should strengthen the existing strategy of export diversification and production of quality goods that enables the country competitive at international market and harvests enough foreign exchange currency.
- Investment affects the economic growth of Ethiopia positively. The Ethiopian Government should design and establish conducive investment policy both for domestic and foreign investors in areas where it can benefit the country. Domestic investment has to be encouraged through domestic saving for it is groundwork for investment. Thus, the government of Ethiopia has to strengthen the existing saving strategies like selling of government Bonds, expanding financial institutions, banking system of payment for employs, *etc.*

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