The Contributions of Exports of Some Minerals to the Ethiopian Economy

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Abstract

An assessment on the contribution of exports of some mineral resources to Ethiopia's economy was carried out for the period 1994/95 – 2013/14. The study employed the testing of the long run and short run relationship and causality between exporting mineral resources and economic growth by including another macroeconomic variable, i.e., popular time series econometric techniques of co-integration, Vector error correction estimation and Granger causality test. The results from unit root test and co-integration have shown the existence of long-run relations and volatility among the variables, indicating that the export of minerals has not been constant as it fluctuates from year to year.The Granger causality test had indicated that in the short-run there was no causality among variables, but in the long-run, there was bi-directional causality among the five variables, namely, GDP, Export of Opal, Export of Tantalum, Export of Gold and Exchange Rate. The key finding in this study is that export of major minerals had positively and significantly affected economic growth in Ethiopia, and this growth had stimulated the export of minerals in the long-run.

Keywords: Export of Some Minerals, Ethiopia

1. Introduction

Ethiopia has reasonably good resource potential for development in agriculture, biodiversity, water resources, minerals, etc. The mining sector contributes less than 5% to the country's GDP but 20% in generating foreign currency (MoM, 2013). Most metallic mineral exploration has been carried out in the low grade Precambrian terrains in western, southern and northern Ethiopia. In sedimentary settings, geophysical surveys have been undertaken for petroleum and coal (MoM, 2013 -2015).

The country's overall economic development strategy has been based on Agriculture-led Industrialization Development as means of promoting development of market-oriented economy. Acknowledgement of export-development with the objectives of creating adequate markets so as to sustain growth of the agricultural sector, generate foreign exchange necessary for the overall economic development and ensure promotion of internationally competitive industry seems to count positively towards competition in the country and have the need to import large quantities of food and high value of minerals (MoFED, 2010).

Ethiopia's mining sector is undergoing an enormous transformation with an increase in opportunities for investment. A wide variety of mineral resources are available

in Ethiopia, according to recently conducted geological studies. Gold production is considered to have huge potential. Meanwhile, additional explorations have confirmed the presence of deposits of platinum, tantalite, soda ash and phosphate rock. Petroleum and other metallic, industrial and chemical minerals have also been identified. Ethiopia's mineral wealth, combined with its skilled and highly motivated workforce, provide the makings for a thriving and profitable mining sector (Ministry of Mines, October, 2012)

Mining is important to the economy of Ethiopia as a diversification from agriculture. Gold, gemstones (diamonds, phosphorus and opal) and industrial minerals are important commodities for the country's export-orientated growth strategy. Tantalum mining has also been profitable. Export of gold, tantalum and opal are a key development sector in the country. The mining sector in Ethiopia generates revenue from sales, taxes, as well as generates foreign currency earnings and also saving of hard currency in substituting the imported mineral related inputs of the country. The mining service sector activities are also contributing for employment opportunity (Ministry of Mines, October, 2012).

Among exported minerals Gold, Tantalum and Opal are the major ones. Gold occurrences are widespread in Ethiopia and exploitation of placer gold dates back at least 3500 years where the Egyptians sailed along the Red Sea and traveled deep into what later became Ethiopia to trade gold. During the following millenniums large amounts of gold were extracted from placer deposits. Today, two greenstones belt-hosted gold mines in South Ethiopia are in operation and feasibility studies are underway of two other greenstone hosted gold prospects in Western Ethiopia (MOFED ,2002).

The placer gold deposit has been mined traditionally by the artisanal miners for several thousand years back to biblical times. The presence of gold and precious stone (gemstone) in Ethiopia has long been known since Biblical time (1Kings 10: 1 - 13) referring to the Queen of Sheba's gift of gold and gemstones to the King Solomon of Israel. This indicates that the placer gold and gemstone deposits in Ethiopia have been mined mainly by the artisanal miners for several thousand years. (Ministry of Mines, October, 2012)

The other major export mineral is Tantalum. Its occurrence is recent, at least ten years, and above it is a strategic metal being a key metal in one of the most widely used gadgets in modern society the mobile phone. Tantalum is also used in other types of electronic equipments and is thus highly in demand. The trade name for

the most common Tantalum-bearing mineral is coltan whereas the mineralogical name is columbite. Ethiopia presently supplies close to ten percent of the World production of tantalum and has a good potential for a considerable expansion of the percentage. (Ethiopia Investment Guide, 2012).

The leading economic objective of the government of Ethiopia is development of mineral wealth, but there is no extensive assessment about the country mineral resources.This research presented assessment of the economic contribution of exports of mineral resources, such as Gold, Tantalum and Opal in Ethiopia on twenty years trend analysis. There is an extensive body of theoretical and empirical literature on the role of mineral resources in economic development. The schools of thought are divided between those who argue that mineral resources are a curse and that, in general, growth in mineral-rich and dependent economies has been worse than in less endowed countries, and scholars who consider mineral resources as an endowment that has the potential to spur growth and development in developing countries. Generally this paper tried to show the economic analysis of the contribution of exports of mineral resources in Ethiopia on the basis of twenty years data.

2. Research Methodology

2.1 Research Design and techniques

The research design used in this study was descriptive approach. It allows causal inferences to be made and seeks to identify cause-and-effect relationships. Growth accounting techniques was applied to see the trend analysis of gold, tantalum and opal export and its economic contribution.

2.2 Data Source and Data Collection Method

The study required reliable information with reference to Gold, Tantalum and Opal export and its trend analysis. Both qualitative and quantitative data were generated from secondary sources of data used in this study. Secondary data was obtained from reports of Ministry of Finance and Economic Development, Ministry of Mines and Energy, National bank Export Performance of Gold, Tantalum and Opal (1994-2014), Central Static Authorities and other published and unpublished materials.

This study used annual data of Ethiopia, and the variables included in the analysis were Gross Domestic Product (GDP), export of Gold, Tantalum and Opal (X) and Exchange Rate.

2.3 Methods of Data Analysis and Estimation Technique

To analyze export performance of major export minerals, the export equation was estimated using time series data for the period 1994/95 – 2013/14. The contribu-

tion of exports of minerals to Ethiopian economy was calculated by using models of Cobb-Douglas Production Function. The data consists of information on Gold, Tantalum and Opal export earnings in different years. The method of analysis was mainly dependent on descriptive approach using relative figures, trends, and charts that was tabulated in summarized forms.

A Linear Regression model was employed to study the relationship between variables. OLS analysis was applied to analyze factors that influence export of Minerals. Moreover, the unit roots test and integration test applied to check stationary of the time series data.

The empirical framework of the model took the following form:

Real GDPYt= A+B1Ex +B2G+B3T+B4O+Et   (1)

Where yt= mining output export

RGDP= real gross domestic product

EX= Foreign Exchange Rate

G= Gold

T=Tantalum

O=Opal

Et = White Noise Error Term

The base regression presents the effect of mining to economic growth generally in Ethiopia. The real gross domestic product is a dependent variable that is expected to be affected by the export of gold, tantalum, opal and the variable of exchange rate. The result is expected to be positive in relation to their contribution to economic growth and development.

2.4 Model Specification

In studying of the contributions of exporting major minerals to the Ethiopian economy, a number of variables that are important in the analysis were considered. However, the limited number of available observations often necessities the use of simple models that capture the basics of the relationships of interest.

The assessment of the effect of export of Minerals on economic growth was carried out in a production function and ordinary least square (OLS) Estimation Method.

Yt =f (XG XT XO EX)

Where, Yt is aggregate real output mineral Export, XG XT and XO denote exports of Gold, Tantalum and Opal, respectively. EX is exchange rate and Gold, Tantalum and Opal export value (Y) in $ dollars is a dependent variables whereas, Gold export volume (XG), Tantalum export volume (XT), Opal export volume (XO) and

Minerals exchange rate (Ex) are independent (explained) variables.

In analyzing the relation between export of minerals and economic growth, different tests have been used, such as, a random or stochastic process, which is a collection of random variables, ordered in time. Y denote a random variable, if it is discrete, we denoted it as Yt. A stochastic process is said to be stationary if its mean and variance are constant over time and the value of the covariance between the two time periods depends only on the distance or gap or lag between the two time periods. The other test used by this study was unit root test which attests the stationarity or non- stationarity of the data. The long term relation between the variables was also analyzed by applying co-integration tests. The DF or ADF unit root test was used on the residuals estimated from the co-integrating regression.

3. Results and Discussion

3.1 Economic Growth and Export of Mineral Resources in the long run

Since the study involves time series analysis, it is mandatory that the data to be tested is stationary. The stochastic process is said to be stationary if the mean and variance are constant regardless of the actual time taken. Stationary test makes sure that there will be a spurious result which is often forwarded in non-stationary time series. If the data is non-stationary, forecasting the result to other time period may not have any practical significance (Gujarat, 2004). Thus, Augumented Dicky Fuller test **(**ADF) for the variables is non-stationary since ADF calculated is greater than the critical value at different level of significance, implying that the test is non-stationar

Table 1: Interpolated Dickey-Fuller Unit Root Test for GDP

	Test Statistics	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	2.439	-3.750	-3.000	-2.630
Mackinnon approximate p=value for Z(t)=0.9990				

It can be observed that the real GDP is non-stationary since the calculated value is greater than the Critical values. Non-stationarity indicates that individual time series are not stationary; the linear combination of GDP become co-integrated, implying that it has long term or equilibrium relation between them and the real GDP doesn't have constant variance and mean, which indicates that the GDP of the country by all means fluctuate from year to year (Table 4.1).

Under this circumstance, Gold export is found to be non-stationary when tested by using Augmented Dicky–Granger (ADF) due to the fact that the calculated value is greater than the critical value at the given level of significance, which implies that gold export will tend to have long run relationship between export of gold and growth of national income. The result shows that export of Gold can magnify the impact on the country's National Economy, though there was no reliable annual re-cord of gold export, and the assumption is that the value of exported mineral varies as well.

Opal and Tantalum are also found to be non-stationary when tested by using the familiar test ADF due to the fact that calculated value is greater than critical value. The result shows the existence of volatility of export of Tantalum and Opal, as the record of export of both minerals   was not constant (Table 2 & Table 3).

Table 2:   Interpolated Dickey-Fuller Unit Root Test for Opal

	Test Stastices	1% Critical Value	5% Critical Value	10% Critical Value
Z(t) -0.356 -3.750 -3.000				-2.630

Table 3:   Interpolated Dickey-Fuller Unit Root Test for Tantalum

	Test Statistics	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.121	-3.750	-3.000	-2.630

(Check the test statistics for opal and tantalum, it does not compare with gold).
Where is the Table for Interpolated Dickey-Fuller Unit Root Test for Gold?

In general, the stationary test result indicates the existence of volatility among all variables included in the regression, and also, the result shows that Gold export had more intensified relation with the country's national income as compared to Opal and Tantalum export. The magnitude of impact of minerals in the long run will be   much higher and significant than in the short-run, indicating that the impact of change in those variables on economic growth are   much stronger in the long-run than in the short-run. Though individual time series are not stationary, a linear combination of these variables could be stationary (i.e., they may be co-integrated).

Economically speaking, two variables will be co-integrated if they have a long-term or equilibrium relationship between them. In this study, GDP, Export of Gold, Opal and Tantalum and Exchange Rate are co-integrated, confirming the existence of long-run relation among the variables.

Table 4: AEG unit root test

Pair-wise Granger Causality Tests			
Sample: 20			
Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Prob.
GDP does not Granger Cause EXCHANGE	19	7.73984	0.0133
EXCHANGE does not Granger Cause GDP		1.41402	0.2517
GOLD does not Granger Cause EXCHANGE	19	4.09874	0.0599
EXCHANGE does not Granger Cause GOLD		7.64537	0.0138
OPAL does not Granger Cause EXCHANGE	19	11.8684	0.0033
EXCHANGE does not Granger Cause OPAL		16.3658	0.0009
TANTALIUM does not Granger Cause EXCHANGE	19	0.12750	0.7257
EXCHANGE does not Granger Cause TANTALIUM_OPAL		0.27445	0.6075
GOLD does not Granger Cause GDP	19	2.10636	0.1660
GDP does not Granger Cause GOLD		5.16426	0.0372
OPAL does not Granger Cause GDP	19	2.02415	0.1740
GDP does not Granger Cause OPAL		5.75158	0.0290
TANTALIUM_OPAL does not Granger Cause GDP	19	0.07955	0.7815
GDP does not Granger Cause TANTALIUM_OPAL		1.42928	0.2493
OPAL does not Granger Cause GOLD	19	29.8636	5.E-05
GOLD does not Granger Cause OPAL		48.2134	3.E-06

The existence of granger causality implies the effect of exchange rate in explaining variation in the export of Tantalum. Moreover the granger causality test indicated that gold Tantalum, Opal and exchange rate and GDP were not found to cause variation in real gross domestic product. In the long run, all variables have a cumulative effect for each other's causality that means in the long run mineral export granger cause economic growth. Exchange rate granger cause economic growth which confirms long run bi-directional causality that runs among the variables (GDP, Mineral Export and Exchange Rate). However, in the short run, there was no causality among variables. The result had shown the importance of mineral export in influencing economic growth, at the same time, the role of growth in enhancing mineral export of Ethiopia (Table 4).

3.2 Vector Error Correction Model

All variables in this study were known to have short run dynamics but had co-integration when tested by vector auto-regression. This method was used to correct the error and to cheek the co-integrated variables. For the variables to have long run equilibrium all were co-integrated based on this model. This model was also used for additional test of co-integration of Export of Opal, Export of Tantalum, Export of Gold, GDP and Exchange Rate, which implies that in the long run they have co-integration, but in the short run, they have dynamics because export and GDP were long run variables (Table 4.5).

Table 5. Vector Error Auto Regression Estimation

Vector Error Autoregression Estimates				
	EXCHANGE	GOLD	OPAL	TANTALIUM
EXCHANGE(-1)	2. 094392	1064449.	623. 0133	-8692.486
	(0. 27750)	(390632.)	(5610. 28)	(27057. 4)
	[7.54745]	[2.72494]	[0.11105]	[-0.32126]
EXCHANGE(-2)	-1.246026	-1216419.	-2828.393	-11996.79
	(0. 27973)	(393776.)	(5655. 44)	(27275. 1)
	[-4.45439]	[-3.08911]	[-0.50012]	[-0.43984]
GOLD(-1)	6. 39E-08	0. 980832	0. 021239	0. 125774
	(2. 7E-07)	(0. 37578)	(0. 00540)	(0. 02603)
	[0.23939]	[2.61015]	[3.93536]	[4.83220]
GOLD(-2)	-3.52E-07	0. 451561	0. 008162	-0.045963
	(4. 8E-07)	(0. 67096)	(0. 00964)	(0. 04647)
	[-0.73917]	[0.67301]	[0.84703]	[-0.98899]
OPAL(-1)	-1.10E-05	-51.54898	-0.213898	-4.885016
	(1. 4E-05)	(19. 1476)	(0. 27500)	(1. 32627)
	[-0.81191]	[-2.69218]	[-0.77781]	[-3.68326]
OPAL(-2)	1. 52E-05	-21.41699	-1.132726	-0.727905
	(2. 3E-05)	(32. 3071)	(0. 46400)	(2. 23777)
	[0.66079]	[-0.66292]	[-2.44123]	[-0.32528]
TANTALIUM_OPAL(-1)	-5.87E-06	1. 545383	-0.051346	-0.308637
	(3. 2E-06)	(4. 49757)	(0. 06459)	(0. 31153)

	[-1.83742]	[0.34360]	[-0.79489]	[-0.99072]
TANTALIUM_OPAL(-2)	6. 04E−06	10. 13548	-0.001537	-0.267169
	(2. 7E−06)	(3. 75979)	(0. 05400)	(0. 26042)
	[2.26104]	[2.69576]	[-0.02846]	[-1.02590]
GDP	5. 85E−06	3. 736190	0. 049221	0. 765016
	(1. 9E−06)	(2. 68478)	(0. 03856)	(0. 18596)
	[3.06642]	[1.39162]	[1.27650]	[4.11380]
R-squared	0. 997583	0. 994528	0. 993577	0. 972911
Adj. R-squared	0. 995435	0. 989664	0. 987868	0. 948832
Sum sq. resids	0. 689995	1. 37E+12	2. 82E+08	6. 56E+09
S.E. equation	0. 276886	389773. 0	5597. 949	26997. 87
F-statistic	464. 4206	204. 4582	174. 0308	40. 40509
Log likelihood	3. 812097	-251.0223	-174.6454	-202.9658
Akaike AIC	0. 576434	28. 89137	20. 40504	23. 55176
Schwarz SC	1. 021620	29. 33656	20. 85023	23. 99694
Mean dependent	10. 69059	2605887.	28149. 60	78670. 03
S.D. dependent	4. 098295	3833770.	50823. 17	119352. 5
Determinant resid covariance (dof adj.)	1. 16E+26			
Determinant resid covariance	7. 25E+24			
Log likelihood	-617.3451			
Akaike information criterion	72. 59390			
Schwarz criterion	74. 37465			

In the short run, change in economic growth is positively and significantly affected by last year growth and negatively and significantly affected by Exchange rate, Export of Gold, Opal and Tantalum. The base year growth matters for the current year economic improvement and become the base for the enhancement of its components for the years to come. The lagged error correction term (ECT-1) included in the model is negative and significant indicating speed of adjustment towards equilibrium and indicates the existence of a long-run causality between the variables of the study. However the effect of export of minerals is insignificant in the short run.

3.3 Trends of Mineral Export

 The graphs below indicate that the mineral export trends have shown progressive improvement for the study period ranging from1994 to 2012 and declining export trend -2012/14 due to global macroeconomic instability and rapidly growth export in terms of value and volume of export (Fig. 4.1).
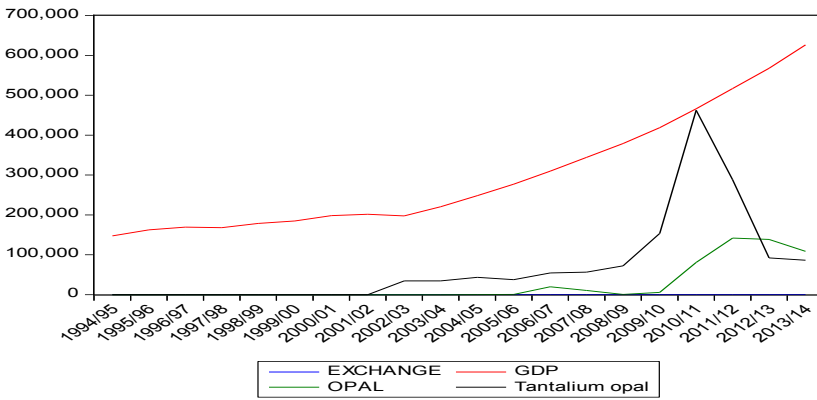
Figure 1: Trend Analysis of Mineral Export (please draw all lines in black and show the difference by x mark, circle, square, etc. on the lines).
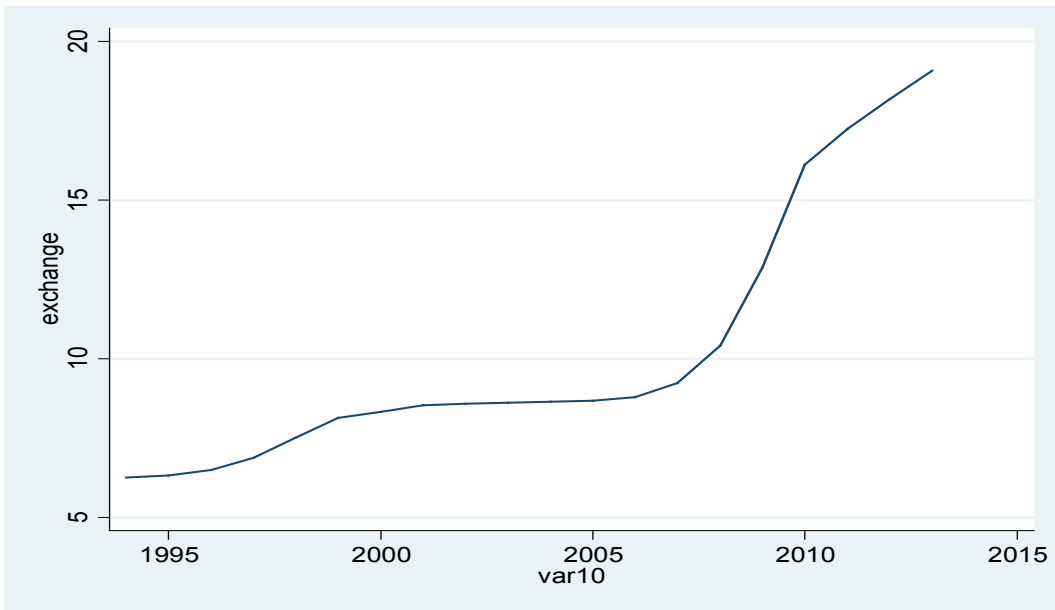

Figure 2: Trend Analysis of Mineral Export: Exchange rate of currency

Source: own Computation from national bank estimation

The above graph reveals that the exchange rate of the currency has shown substantial increment in terms of USD due to rapid growing of the economy in Ethiopia and the increased import and export trends of goods and services. This implies that if the export of minerals increase, it helps the country to earn more foreign currency and creates condition for balanced trade (Fig. 4.2).

The evidence obtained from the analysis portrayed that even though mineral export is a recent venture, as compared to export of Agricultural output, such as oil seed, coffee, pulses and cereals, the performance of mineral export has shown progress when evaluated in terms of volume and value of export.

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There is gradual and continuous advancement in the value, volume and share of mineral export. In years between 1994/95 and 2001/02, Gold took the dominant (100%) share of mineral exports. After 2002/03 up until 2003/04 Gold's share was 92% of mineral exports and 8% covered by Tantalum and opal. From year 2004/05 to 2013/14, export of Gold rose to 96% and Tantalum consists 2.9% and 1.1% covered by Opal. The contribution of the mining sector to the national economy has been minimal, less than 1% of the gross domestic product (GDP). The main export mineral is gold. In recent years, however, the contribution of mining to the national economy is showing some progress (5.8% of GDP) due to improvement in policy measures, favorable commodity prices and the introduction of other minerals in the export list (Fig. 3).
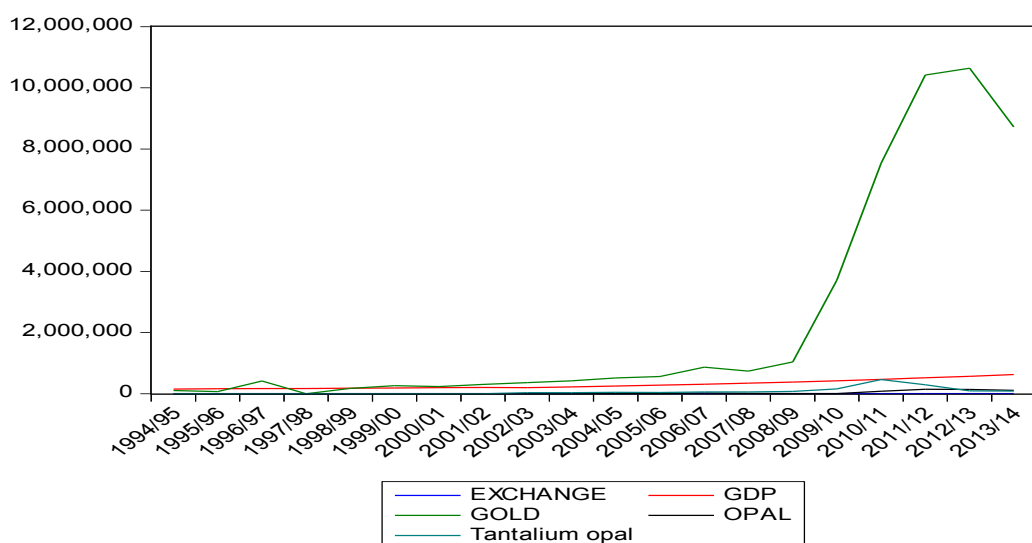

Figure 3: Export trends of major mineral resource
Source: own computation from the data obtained from MOFED

Based on the evidence obtained from the data of MoM, Gold plays a leading role in terms of value and volume of export, whereas opal and tantalum are at their infant stage.

The above graph indicate that the trend of growth in the country economy is increasing from time to time due to the fact that upward movement of gold price in the global market added to it NBE's decision to purchase gold at the prevailing world market price plus a premium makes AM an attractive venture in the short run. Furthermore, one of the macro-economic measures taken by the Ethiopian government to make Ethiopian exports more competitive in the international market and that of imports more expensive was devaluation of the Birr against the USD and other major currencies. This measure has an income boosting effect on the miners and that of mining sector at large. The GDP of the country has shown substantial increment due

to rapid increased of import and export trends of goods and service.

Gold is also a source of FDI in Ethiopia. Among the export items gold is ranked second next to coffee for long years. There are companies' engaged in extracting gold and providing it to the world market and also the above graph show that from 2005 the country GDP is increase because a lot of investment which is controlled by government become privatized this encourage country's investment and have great contribution for the country GDP. Generally, the magnitude of Mineral export and Exchange rate in the long run are much higher and significant than the short-run impacts indicating that the impacts of change in those variables on economic growth are much stronger in the long-run than in the short run. On the other hand the existence of long run bidirectional causality between export of minerals and growth but no short run causality among the variables this indicates that Ethiopia will accelerate its growth if the country focus on diversify export in to the sector of mining from other sectors and follow Export promotion oriented. The potential of mineral resource to generate substantial foreign exchange, employment generation, growth in real gross domestic product coupled with serving as most important source of improving Economic Growth of the country. However, the mineral potential of the country is not utilized substantially due to inherent lack of capital, technology, infrastructure as well as the prevalent tedious legal procedure followed to gain license to the private investors.

4. Conclusion

The study examined the contribution of export of mineral resource in economic growth of Ethiopia from 1994/95 to 2013/14 by including another macroeconomic variable that is import in the conventional production function form using annual time series data. In empirical analysis Augmented Dickey Fuller (ADF) and Augmented Engle–Granger (AEG) unit root test are used in testing the stationarity of the variables. The study result shows that all variables (i.e., Gross Domestic Product, Export of Opal, Export of Gold, Export of Tantalum and Exchange Rate) are found to be long run relation between the variables in the long run but have short run dynamics and the volume of export of minerals and GDP are volatile. Therefore, the study proceeds to determine the existence or otherwise of cointegrating vectors in the variables. The result of cointegration test shows that Gross Domestic Product, Export of Opal, Export of Gold, Export of Tantalum and Exchange Rate are cointegrated (i.e., they have long run equilibrium relationship).

The Regression result which indicated the impact of mineral export of Gold, Tan-

talum and Opal in the Real GDP of Ethiopia indicate that Gold export have shown significant impact in promoting growth of Real GDP. The export of tantalum is statistically significant to influence real GDP. Moreover the opal exports have shown statistically insignificant result in determining the growth of GDP. The result of granger causality test also indicate that gold ,Tantalium , Opal and exchange rate and GDP were not found to cause variation in real gross domestic product.

The trend analysis of different charts and graph on the study shows that mineral export trends have shown progressive improvement for the study period ranging from 1994 to 2012 and declining export trend 2012/14 due to global macroeconomic instability. Rapidly growth export in terms of value and volume of export and gold account the lion share of mineral export followed by tantalum and opal. We watch on the study period almost 96% of mineral export covered by Gold.

Generally Export of Minerals has great contribution for economic growth of Ethiopia and from time to time the extraction and exploration and export of minerals are increase in Ethiopia and the all tests indicate in the Long run Export Create valuable effect on the country GDP.

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