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THE DETERMINATES OF EXPORT IN ETHIOPIA: COINTEGRATION AND ERROR CORRECTION MODEL ANALYSIS

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Abstract- This study attempts to examine determinates of export in Ethiopia over the period 1991-2021. In order to achieve the stated objectives, estimated by using Engle Granger two step procedures of cointegration and error correction model. Accordingly, the result shows that a the major supply side factors such as, domestic national income, internal transport infrastructure and FDI are found to be statistically significant and affect Ethiopian exports positively; demand side factor also play a significant role in Ethiopia's export performance, the major factor such as trade liberalization and foreign market access affects Ethiopian exports positively. Therefore, to increase export growth, government should attract inward FDI by providing special incentives to foreign firms and designing other appropriate polices and reforms, devaluated birr (on a real trade-weighted basis) against foreign currency, boosting potential output and expanding exports destinations.

Keywords: Exports, Foreign direct investment, Cointegration , Error correction, Ethiopia

1. INTRODUCTION

As parts of the trade liberalization, to promote exports the transitional government of Ethiopia has taken a number of measures including the devaluation of domestic currency, reduction of tariff rates, simplification of import and export licensing procedures establishment of an export promotion agency, the introduction of a duty drawback scheme (exporters exempts from paying customs duties), and foreign exchange retention scheme (which allows exporters to retain and deposit as much as 20% of their foreign exchange income for future use without export price control by NBE and the rest 80% of the foreign currency earned from export sales for a maximum of 28 days are allowed to hold by exporter) (MEDaC 1999, cited in Teshale 2005). Investment loans scheme (which can get 70% of their investment capital needs from the Development Bank of Ethiopia at an incredibly good interest rate, if they are export-focused manufacturing, agro-processing and agriculture industries**)** preferential interest rate scheme for exporters (lower as compared to the rates on non-export activity loans) are the prominent measures (EIC, 2016). In addition, foreign investors in the export sector are allowed to buy foreign exchange for remittances. These incentives as well as the efforts by the government, with the assistance of bilateral and multilateral donors, to upgrade the

domestic skill base and infrastructure capacity are aimed at stimulating export expansion and creating an environment conducive to export oriented FDI.

By considering the focus given to the export sector, it is rational to investigate factors affecting the flow export growth between Ethiopia and its trading partners. Therefore, this study is investigated determinates of export performance of the country in concurrence of other macroeconomic variables.

II. METHODOLOGY

Specification of the Model

We use a parsimonious Cointegration and error correction model and include, besides a proxy for domestic supply capacity, demand and supply side determinants of Ethiopia's export. Accordingly, we employ the following model specifications:

$X_t = f(REER_t, PGDP_{t-1}, TLI_t, FMA_t, INFD_t, FDIs_t)$ (1)

$X_t = \beta_0 (REER_t)^{\beta_1} (PGDP_{t-1})^{\beta_2} (TLI_t)^{\beta_3} (FMA_t)^{\beta_4} (INFD_t)^{\beta_5} (FDIs_{t-1})^{\beta_6} (e)^{\varepsilon_t}$ (2)

X_t= Real export earnings at time t;

$REER_t$ = Real Effective Exchange Rate at time t;

$PGDP_{t-1}$ = potential output at time t-1;

TLI_t = trade liberalization index at time t;

FMA_t =Foregin market access indicator at time t;

$INFD_t$ = Public expenditure in transportation and communication as a ratio of GDP as a proxy for infrastructural development at time t;

$FDIs_{t-1}$= Stock of foreign direct investment inflow at time t-1 ε_t = error term

Hence, allowing for changes over time or being in growth form and avoid hetroscedasticity problem (Gujarati, 2004) parsimonious model turns out to be the logarithm form. The cointegration or long run analysis allows capturing the two effects of FDI on export through separating supply increasing and FDI-specific effects. Therefore, the long run model reduces in to three equations as follow;

$$LnX_t = \beta_0 + \beta_1 LnREER_t + \beta_2 LnPGDP_{t-1} + \beta_3 LnTLI_t + \beta_4 LnFMA_t + \beta_5 LnINFD_t + \beta_6 LnFDIs_{t-1} + \varepsilon_t \quad (3)$$

For all variables we take natural logarithms. In equation 3 the dependent variable is the natural logarithm of real exports (*X*). As standard macroeconomic theory suggests, relative prices are important in explaining a country's exports through export competitiveness of the country. We believe that REER is a good measure that would capture the competitiveness of the Ethiopian export. Therefore, the empirical specifications include the natural logarithm of REER to capture the influence of relative prices. The index of real effective exchange rate is constructed in a way that an increase in REER denotes a real appreciation of the currency. Thus, it is expected that the sign of REER is negative (or $\beta_1 < 0$). PGDP is the natural logarithm of potential output which is a trend of real domestic GDP, as a proxy for supply capacity. This variable is expected to capture the effect of FDI on export through increased supply capacity. The potential output variable enters the regression with one year lag since it may take some time before

additional supply capacity is reflected in increasing exports (Kutan and Vuksic ,2007; Njong and Raymond ,2008). We expect the sign of PGDP to be positive (or $\beta_2 > 0$). Whether, and to what extent, FDI contributes to increased supply capacity is tested using a supplementary regression of PGDP on FDI stock (as shown equation 4).

TLI represents trade liberalization index. It is calculated as import ratio on total international trade volume (Bamou et al., 2006). FMA represents the foreign market access indicator which is approximated by the growth rate of export penetration index, calculated as export ratio on total international trade. The reason for including these two trade-related variables is to account for the potential impact of the trade policy reform undertaken by both exporting and importing countries. We expect the sign of TLI and FMA are positive or ($\beta_3 > 0$ and $\beta_4 > 0$). INFD represents public expenditure in transportation and communication as a ratio of GDP as a proxy for infrastructural development. Economic theory states that the quality of infrastructure (road, power, communication, etc) is one of the key determinants of export growth the countries. Therefore, expanding infrastructure density of various types with an acceptable level of quality or the increase in public investment in infrastructure to GDP ratio in Ethiopia will have positive impact on export growth. That is, the expected sign of INFD is positive ($\beta_5 > 0$).

The FDI variable enters the model with a one-year lag as a measure for cumulated stock of FDI. This variable was used by Kutan and Vuksic (2007), Njong and Raymond (2011) and Muzurura et al (2014) following the suggestion by Girma *et al* (2007) which show lags in the effect of FDI on acquired domestic companies. Also, even for an export-oriented Greenfield foreign investment, one can assume that building a new plant and achieving a desired level of production takes time. Importantly, cumulative stock variable is a better choice than FDI inflows is implied by the results of Barrios et al. (2005), which show that the sign and intensity of the effects of FDI on domestic producers changes as the number of foreign companies in the host economy increases. Thus, it is the cumulated FDI that matters. The same effect could possibly be achieved by using FDI inflows, but this would require using many lags of FDI variable, reducing the number of observations. Also, there is a potential endogeneity issue, when regressing exports on FDI. Hence, using FDI stock with a one year lag should alleviate this problem (Girma *et al.*, 2007). We expected that the sign of FDIs is positive ($i.e\ \beta_6 > 0$).

Estimation Techniques

Unit Root Test

The first step in time series econometric analysis is to undertake unit root test on the variables of interest. The test identifies whether the data series is stationary or not. To conduct the test, the conventional Dickey-Fuller (DF) and Augmented Dickey–Fuller (ADF) test has been used with and without a trend. Since the actual data generating process is not known a priori, the test of determining the orders of integration of the variables has conducted first by including a constant and adds a drift. The ADF test is based on the regressions run in the following forms.

$$\Delta Y_t = \alpha_1 + \beta Y_{t-1} + U_t \qquad (4)$$

Where, U_t is a white noise error term. In each case the null hypothesis is that $\beta = 0$, that is, there is a unit root. The null hypothesis (H0) is thus a series contains a unit-root (nonstationary) against the alternative hypothesis (H1) stationary. Even though the individual time series are not stationary, a linear combination of these variables could be stationary i.e. they may be co-integrated (Engel and Granger, 1987). If these variables are co-integrated, then they have a stable relationship and cannot move "too far" away from each other. There are two common methods for testing co-integration and estimating the relationship among cointegrated variables. These are the Engle and Granger (1987) two-step procedure and the Johansen's (1988) maximum likelihood methods.

In Johansen test we specified the relevant order of lags (p) of the VAR model similar to Ahmed (2000), Belayneh and Wondaferahu (2013) and Kingu, (2014). Engle-Granger test is employed in our study followed the similar procedure as in unit root test. It should be noted that, under cointegration test we estimated cointegrating regression residual obtained in equation (3) and we employed Augumented Dickey-Fuller tests.

Error Correction Model

If the time series variable seems to be cointegrated, that is, there is a long-term, or equilibrium relationship. Of course, in the short-run there may be disequilibrium (Gujarati, 2004). Therefore, we can treat the error term in the following equation as the "equilibrium error." The use of error correction (EC_t) term helped to link the short run information (behaviors) of variables to its long run. The error correction model (ECM) first used by Sargan and later on was popularized by Engle –Granger under name of "corrects for disequilibrium". Engle-Granger (1987) under "Granger representation theorem" instituted Error Correction term in the Model. Granger representation theorem pointed out that, if two variables are cointegrated, then the relationship between the two can be expressed as error correction model or mechanism (ECM) (Gujarati, 2004) and Kingu, (2014). Therefore, error- correction term (EC_t) lagged one period (EC_{t-1}) so as to capture short run dynamics in the long run equilibrium. Under error correction model we discuss only the FDI specific effects, since supply increasing effect only exist in the long run. Hence, we use real GDP (RGDP) rather than potential GDP, PGDP. The study specified a general error correction model (ECM) as follows:

$$\Delta \mathrm{LnX_t} = \beta_0 + \sum_{i=0}^{n} \beta_{1i} \Delta \mathrm{LnREER_{t-i}} + \sum_{i=1}^{n} \beta_{2i} \Delta \mathrm{LnRGDP_{t-i}} + \sum_{i=0}^{n} \beta_{3i} \Delta \mathrm{LnTLI_{t-i}} + \sum_{i=0}^{n} \beta_{4i} \Delta\, \mathrm{LnFMA_{t-1}} + \sum_{i=0}^{n} \beta_{5i} \Delta \mathrm{LnINFD_{t-i}} + \sum_{i=1}^{n} \beta_{6i} \Delta \mathrm{Ln} FDIs_{t-i} + \beta_{7i} EC_{t-1} + \varepsilon_t \quad (5)$$

Where EC_{t-1}error-correction term is lagged one period. It is expected a coefficient to have a negative sign. While $\varepsilon_t$is a white noise error term. Diagnosis tests on the estimation technique is performed at each stage of reduction to check parameter consistency.

Data Source and Type

Time series secondary data have been used in this study. The data set is collected from National Bank of Ethiopia (2021), Ministry of Finance and Economic development (2021), and WB (2021). For the purpose of analyzing impact of FDI on country's export growth, the export equation in this study is estimated using time series data for the period 1991-2021.

The time series data that are used in this study such as, export of goods and services valued in US dollar, potential output which is a trend of real domestic GDP valued USD, trend is obtained by applying a linear regression of the log of real GDP on a constant and a time trend, FDI stock valued USD, trade liberalization index, foreign market access calculated as import ratio on total international trade volume and export ratio on total international trade which are unit free respectively are collect from WB (2021). Data for real effective exchange rate is collected from EEA statistical data base (2021) and NBE (2021) and check to WB data for consistency. Government expenditure for transportation and communication is calculated by taking both capital and current expenditure for communication and transportation including road. Since the other researcher did not find data for such variables from IMF and WB, this variable is collected from both NBE (2021) and EEA statistical data base (2021).

III. RESULTS AND DISCUSSION

Unit root test

Before proceeding with our estimations, it is important to analyze the time series properties of the individual series. We first of all establish the order of integration (or stationarity) of the variables using the Augmented Dickey-Fuller (ADF) unit root tests. The results of the tests and their level of significance for the unit root tests are displayed in table.1

Table 1: ADF Unit Root test result for level and differenced variables

Variables at level	ADF test statistics	Variables at first difference	ADF test statistic
Ln$\mathbf{X_t}$	-2.235	DLn$\mathbf{X_t}$	-4.512***
Ln$\mathbf{REER_t}$	0.614	DLn$\mathbf{REER_t}$	-3.742**
Ln$\mathbf{PGDP_{t-1}}$	0.129	DLn$\mathbf{PGDP_{t-1}}$	-38.330***
Ln$\mathbf{TLI_t}$	-5.015***	DLn$\mathbf{TLI_t}$	-7.876***
Ln$\mathbf{FMA_t}$	-0.759	DLn$\mathbf{FMA_t}$	-4.792***
Ln$\mathbf{INFD_t}$	-3.404**	DLn$\mathbf{INFD_t}$	-6.126***
Ln$\mathbf{FDIs_{t-1}}$	-4.649***	DLn$\mathbf{FDIs_{t-1}}$	-6.709***

*Source: own computation using Stata software. Note: Critical Values are at 5 % = -3.000 and at 1% = -3.750. **= Indicates stationary at 5% level of significance, & *** = Indicate stationary at 1% level of significance.*

The ADF tests reported in Table 1 reveal that $\mathbf{LnTLI_t}$, $\mathbf{LnINFD_t}$ and Ln$\mathbf{FDIs_{t-1}}$ stationary at the level form at 1%, 5% and 1% significance levels respectively. While $\mathbf{LnX_t}$, Ln$\mathbf{PGDP_{t-1}}$ and Ln$\mathbf{FMA_t}$ are stationary after the first differences at 1% and $\mathbf{LnREER_t}$ at 5% significance levels. Thus, variables are integrated of order one and considered as I(1) processes (Verbeek, 2012). These results imply that we can reasonably proceed with tests for co-integration relationships among combinations of stationary and non-stationary series. We then test for the existence of a long run relationship using the Engle-Granger two step procedures.

The Engle –Granger two step procedure of cointegration

Cointegration is the statistical implication of the existence of a long run relationship between economic variables. The idea behind cointegration analysis is that, although macro variables may tend to trend up and down over time, groups of variables may drift together. If there is some tendency for some linear relationships to hold among a set of variables over long periods of time, then cointegration analysis helps us to discover it.

In this study a unit root test to the retained residual was applied to determine its Stationarity. The ADF test revealed that the retained residual is stationary at its level. This implies export is cointegrated with the other explanatory variables, and that there exists a linear combination of the variables that is stationary. This finding leads to a conclusion that there are long-run equilibrium relationships among the variables. The steps of conducting a cointegration analysis are as follows: In the first step the long run relationship among the variables has been estimated using OLS and the second step test for a unit root in the residuals of the estimated model.

Estimation of Long Run Model

The real effective exchange rate variable in table 2 is significant with the expected sign. The supply capacity variable is also positive and significant, indicating supply increasing effects of FDI stocks on exports. Similarly foreign market access statistically significant and have positive signs. Trade liberalization and infrastructural development variables are significant and have positive effect on export.

Table 2. Long Run Regression Result of Determinates of Export
Dependent Variable (LnX_t)

Variable	Coefficient	Std. Err	t-Statistic	Prob.
$Ln\mathbf{REER_t}$	-0.5953	0.0858	-6.93	0.000
$Ln\mathbf{PGDP_{t-1}}$	0.9943	0.1703	5.84	0.000
$Ln\mathbf{TLI_t}$	0.0755	0.0627	3.45	0.007
$Ln\mathbf{FMA_t}$	1.2609	0.1928	6.54	0.000
$Ln\mathbf{INFD_t}$	0.1325	0.1680	2.15	0.005
$\mathbf{LnFDIs_{t-1}}$	0.0668	0.0192	3.48	0.003
Cons	-5.6732	2.9105	-1.95	0.066
R-squared	0.9839	F-statistic	514.38	DW Stat 1.738909
Adjusted R-squared	0.9819	Prob (F-stat)	0.0000	Observation 26

The results imply that, all variables has significantly contributed to higher exports. Then the residual from the above regression can be written as

$\boldsymbol{\varepsilon_t}$= $Ln\mathbf{X_t}$ - [-5.6732 -0.5953$Ln\mathbf{REER_t}$ +0.9943$Ln\mathbf{PGDP_{t-1}}$ + 0.0755$Ln\mathbf{TLI_t}$ + 1.2609$Ln\mathbf{FMA_t}$ + 0.1325 $\mathbf{LnINFD_t}$ + 0.0668 $\mathbf{LnFDIs_{t-1}}$]

In the second step, the order of integration of residuals $\boldsymbol{\varepsilon_t}$ has been tested using ADF statistic and the result indicates that the null hypothesis of non-stationary of $\boldsymbol{\varepsilon_t}$ can be rejected. The result of ADF on residual, including the intercept is presented in the table below.

Table 3. *ADF test on Residual*

		t-Statistic	Prob.♦
Augmented Dickey-Fuller test statistic		-4.244 ***	0.0006
Test critical values:	1% level	-3.750	
	5% level	-3.000	
	10% level	-2.630	

♦ MacKinnon (1996) one-sided p-values.

Therefore, Engle-Granger two-step procedure affirms that LnX_t, $LnREER_t$, $LnPGDP_{t-1}$, $LnTLI_t$, $LnFMA_t$, $LnINFD_t$ and $LnFDIs_{t-1}$ are cointegrated. Since the residuals from the cointegration equation are stationary, which means that the regression on the levels of variables is meaningful (that is, not spurious).

Estimation of an Error-Correction Model (ECM)

Having established that, there long run relationship amongst the variables. We estimated an error-correction model (ECM) in order to determine short run behaviors of the variables. Normally variables adjusted to the long run equilibrium. The error correction term provides the speed of adjustment of the variables in short run dynamics behavior to the long run equilibrium.

Table 4: Results of Error Correction Model
Dependent Variable ($DLnX_t$)

Variable	Coefficient	Std. Err	t-Statistic	Prob.
DLn$\mathbf{REER_t}$	-0. 4121	0.1463	-2.82	0.012
DLn$\mathbf{RGDP_{t-1}}$	0. 0597	0. 3918	0.15	0.881
DLn$\mathbf{TLI_t}$	0. 0303	0.0550	0.55	0.589
DLn$\mathbf{FMA_t}$	1.0282	0. 1875	5.48	0.000
DLn$\mathbf{INFD_t}$	0.0629	0. 1416	0.44	0.662
DLn$\mathbf{FDIs_{t-1}}$	0.0554	0. 0160	3.46	0.003
$\mathbf{ECT_{t-1}}$	-0.6793	0.2459	-2.76	0.013
Cons	0.0795	2.9105	-1.95	0.026

R-squared	0.8207	F-statistic	11.11	DW Stat	1.5
Adjusted R-squared	0.7468	Prob (F-stat)	0.0000	Observation	25

The empirical result obtained in the error-correcting model is significant. We obtain an expected sign of error term coefficient (-0.6793) and it is statistically significant at 5% level. The speed of adjustment 68 percent per annum which is high implying that it takes short for export to move back to its equilibrium once its drifts away from its long run equilibrium value.

The results of error correction model show some similarity with those of the cointegration equation model. However, the coefficient of the Real GDP is positive but statistically insignificant which is in contrast to the results of the long run model. To sum up, both the long run and short run model it's indicates that supply and demand side determinates are play key role in the performance export of the country the last four decades.

IV. CONCLUSIONS AND POLICY RECOMMENDATION

Conclusion

In this study, an attempt has been made to examine determinates of export performance in Ethiopia by using Engle Granger two step procedures of cointegration and error correction model over the period 19991-2021. The empirical results suggest that supply side conditions are a major factor to determine Ethiopia's export performance, the major supply side factors such as, domestic national income, internal transport infrastructure and FDI are found to be statistically significant and affect Ethiopian exports positively; demand side factor also play a significant role in

Ethiopia's export performance, the major factor such as trade liberalization and foreign market access affects Ethiopian exports positively.

Policy Recommendation

These findings carry various policy implications

- Policy makers therefore need to encourage inward foreign direct investment by providing special incentives to foreign firms and designing appropriate polices and reforms that would attract further foreign investment.
- The result indicates that real effective exchange rate appreciation or revaluation has a negative influence on country's export. To improve export therefore, the government of Ethiopia should devaluated birr (on a real trade-weighted basis) against foreign currency. The improvement is caused by the devaluating birr increasing competitiveness of the Ethiopian export goods in foreign markets.
- In this study it has been found that potential output has significantly contributed country's exports. Hence, the government of Ethiopia has to set policies to boost potential output. This includes increase saving mobilization like selling of government bonds, expanding financial institutions, and promoting investment in R&D, human capital and technology and innovation by providing subsidy, tax incentives and others.
- Finally, in order to enhance the contribution of the foreign market access, the country should capturing new export markets through expanding its export destinations. The recent expansion of exports to some African and the Middle East countries gives a clue that the country may benefit significantly if it manages to exploit these increasingly growing markets.

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