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AGRICULTURAL FOOD EXPORT PERFORMANCE IN ETHIOPIA: AN ERROR CORRECTION APPROACH

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ABSTRACT

This study investigated the determinants of food export supply of Ethiopia using available time series data that spans about 32 years from world development indicator (WDI) of World Bank report. This study was applied co-integration and error correction approaches to test the relationship of food export supply and other variables. The finding of the study revealed that food export supply of Ethiopia is affected by openness of the country for international trade in the long run whereas the domestic national income, rural population, world oil price Urban population, Agricultural land, overall investment and the domestic inflation affects the food export supply of Ethiopia both in the short run and long run operation. Given all these, the adjustment period of the deviation from the normal trend is 29.38%, which is around 29 percent.

Keywords: Error Correction Model, Ethiopia, Export Performance, Food

INTRODUCTION

Background

Ethiopia's base of natural resources is the foundation of any economic development, food security and other basic necessities of its people. Smallholder agriculture is the dominant sector that is depicted on Table 1 and its Value of Major Export Item depicted on Table 2.

Table 1. Sectoral contribution to GDP and GDP Growth

Item			**2012/13**	**2013/14**
Sector	Agriculture	Share in GDP (in %)	41.8	39.9
		Absolute Growth	7.1	5.4
	industry	Share in GDP (in %)	12.9	14.2
		Contribution to GDP growth	24.0	21.2
	Service	Share in GDP (in %)	45.3	45.9
		Contribution to GDP growth	9.0	11.9
Real GDP (In Billions of Birr)			**567.9**	**626.6**
Growth in Real GDP (In Billions of Birr)			**9.8**	**10.3**
Mid-year population (in millions)			84.8	87.0

Source: Ministry of Finance and Economic Development (MoFED, **2013/14**)

Table 2. Value of Major Export Item

(In Millions of USD)

	2012/13	%	2013/14	%
Particulars	**B**	**share**	**C**	**share**
Coffee	746.6	24.2	714.4	21.9
Oilseeds	443.5	14.4	651.9	20.0
Leather & Leather products	121.1	3.9	129.8	4.0
Pulses	233.3	7.6	250.7	7.7
Meat & Meat Products	74.3	2.4	74.6	2.3
Fruits & Vegetables	43.9	1.4	45.9	1.4
Live Animals	166.4	5.4	186.7	5.7
Chat	271.3	8.8	297.3	9.1
Gold	578.8	18.8	456.2	14.0
Flower	186.7	6.1	199.7	6.1
Others	215.4	7.0	247.4	7.6
Total	**3,081.2**	**100.0**	**3,254.8**	**100.0**

Source: Ministry of Finance and Economic Development (MoFED, **2013/14**)

However, Ethiopia's share in total world exports is still very low, amounting to 0.01% in 2006 (WTO, 2007). In this regard, Alemayehu (1999) and Abay and Zewdu (1999) argue that Ethiopia's external trade has major problems both on the supply side (its dependency on few primary products, characterised by large fluctuations in volume; and a very high degree of concentration of exports on few commodities) and on the demand side (a low income elasticity for the type of commodities that Ethiopia exports, declining prices for its exports, and limited destinations for Ethiopian exports). That is why the relative export performance of developing nation is highly driven by relative poor performance in the supply capacity, rather than the deterioration of foreign market access. Yishak (2009) also suggested that it is the supply side performance that has more impact on the Ethiopian export in general and the agricultural export performance in particular. Thus, this research had focused on the supply side of the agricultural food export performance of Ethiopia. Therefore, the objective of the paper was to find out the supply side determinants of agricultural food export in Ethiopia.

METHODOLOGY

Sources of Data

The study was persistence on secondary data sources, which were collected from published annual reports of the National bank of Ethiopia, Central Statistical Authority of Ethiopia,

World Bank and international Monitory Fund, in which they had collected for their own purpose. It mainly relied on time series data which covers from 1981 to 2012 of world development indicator (WDI) of World Bank, for 32 years.

Method of Data Analysis

Co-integration and error-correction techniques are applied in this study. These techniques are believed to overcome the problem of spurious regressions and to give consistent and distinct estimates of long-run and short-run variables that satisfy the properties of the classical regression procedure. This is because all variables in an ECM are integrated of order zero, I (0). Spurious regression and inconsistent and indistinct short-run and long-run elasticity estimates are major problems exhibited by traditional Adaptive Expectation and Partial Adjustment models (Hallam and Zanoli, 1993; McKay *et al.*, 1998). Co-integration and ECMs have been used in agricultural supply response analysis in other countries by a number of researchers, namely Townsend (1997), Schimmelpfennig *et al.* (1996) and Townsend and Thirtle (1994).

One major use of the co-integration technique is to establish long-run equilibrium relationships between variables. However, two conditions must be met for co-integration to hold. First, individual variables should be integrated of the same order. Second, the linear combination of these variables must be integrated of an order one less than the original variables (Engle and Granger, 1987). In other words, if the variables under consideration are integrated of order one, or I (1), the error term from the co-integrating relationship should be integrated of order zero, I (0), implying that any drift between variables in the short run is temporary and that equilibrium holds in the long run.

If deviation from the long-run equilibrium path is bounded or co-integration is confirmed, Engle and Granger (1987) show that the variables can be represented in a dynamic error-correction framework. Therefore, in this paper, like similar studies elsewhere, supply response is modelled in two stages. First, a static co-integrating regression given by equation 2 is estimated and tests for co-integration are conducted. Second, if the null for no co-integration is rejected, the lagged residuals from the co-integrating regression are imposed as the error correction term in an error correction model. ECM model is represented by the following equations.

$$\Delta Y_t = \alpha_1 + p_1 e_1 + \sum_{i=0}^{n} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{n} \delta_i \Delta X_{t-i} + \sum_{i=0}^{n} \gamma_i \Delta Z_{t-i}$$

$$\Delta X_t = \alpha_2 + p_2 e_{i-1} + \sum_{i=0}^{n} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{n} \delta_i \Delta X_{t-i} + \sum_{i=0}^{n} \gamma_i \Delta Z_{t-i} \quad (1)$$

Agricultural commodity export is the one part and main actors in affecting the national income of the country. Given this, this research had tried to use the food export of the country, in which the main source is agriculture of the nation. This dependent variable was from the overall merchandise export of the nation based on the personage share calculated by WDI.

Factors from the supply (variable related to domestic community) and demand side domestic national income (Y), export production capacity (C), world oil price (WOP), the domestic inflation (I), openness of the nation for international trade (Op), agriculture growth (AG), agricultural land (AL), exchange rate (R), Interest rate (r) and other variable can be considered. Having this real income of importer nations (Ỹ), elasticity of foreign importer (export destination ε_i) and others are factors from the demand side. However, those two factors are the main actors in affecting the export of Ethiopia, but this considers only the supply side factors. More succinctly, the export function can be specified as:

X= F(Y,Ỹ , C, WOP, I, Op, AG, AL, R) (2)

Definition of Variable in the model

Explanatory variables were chosen based on rigorous survey of both theoretical and empirical literature. The variables specified in the model are briefly discussed below:-

Gross Domestic Income: It is the total national income of the country that tries to show the power of the nation for supplying exportable items. This means it is an indicator for the overall economic status of the country. It is expected to have a positive impact on the level of agricultural export.

Macro-economic stability (Domestic Inflation): A stable economy provides a frame work for an improved supply side performance of agricultural export. Conducive macro-economic environment usually reduce uncertainty of export earnings. For this study, inflation rate was used as a proxy measure of macro-economic instability and is expected to take negative sign.

Openness to international trade: "Openness" refers to trade barrier and how restrictive the country in international trade. It is measured as a ratio (X) plus import (M) to GDP; often refer to as measure of openness or trade dependence index but more appropriately considered as a trade volume measure. The value varies from zero to one. It is zero for autarchy country. As openness promotes the efficient allocation of resource through specialization and comparative advantage, it promotes competition in national and international markets. Thus the variable is expected to have a positive impact on the agricultural export performance.

Investment: It is measured by monitory value of the total direct investment in Ethiopia by domestic and foreign firms. This enhances production of high value export oriented crops. Since, the overall investment of the country could pave the way for expanding the production and productivity of agriculture the variable is expected to have positive impact.

Government Expenditure: It includes expenditure by the government on purchase of final goods and services and it does not include transfer payments. The more the government spends on the productive investment, the more the yield by all sectors in general and the agricultural sector in particular.

Agricultural growth (Cereal production): Since agriculture is the main source of export supply of the country it is logical to have the growth rate of the sector as one determinant in the formulation of the model for export supply. As of being main source of supply, then there will be positive relationship between the growth rate and the export supply, which implies that the expected coefficient is positive.

Agriculture cultivated land: Since agriculture is the main source of food export and land is the core input for the production process, each increment of the agricultural land would have positive contribution for the enlargement of the food export supply.

Population (Rural and Urban): Increment in the population may be an asset or a liability. To observe the effect differently this research had try to see the effect of population increment in the urban and rural part of the country. Since the agriculture of Ethiopia is purely based on small holders, which means the rural population is the source of labor. This indicates that there would be positive relationship between food export supply and the rural population. Given this, the urban population is consumer of the products supplied by the rural society, which implies that increment of the urban population would result into reduction in the food export supply.

World oil price: It is the main component of the cost of transporting goods, which implies that increment of it would result into reduction in supply. This variable is also an approximation to world inflation since it is the main actor in the cost of supply.

RESULTS AND DISCUSSION

Test for Unit Root/ Test of Stationary

In order to justify the theories behind the models, it is important to test for the stationery properties of the variables. This helps to make conclusions in case where the test statistics (the calculated F-value) lies between the upper and lower critical values of the tabulated F-statistics (Pesaran *et.al,* 2001). In fact, many time series analysts confirm that most time series variables are stationary after the first difference. This is what has happened in this study, as well. As indicated in table 1, three of the independent variables are stationery at the level but the dependent and the remaining independent variables are stationary at the first difference. The fulfilment of being stationary at the first difference should directly lead into implementation of co-integration test (long run equation).

Table 1: Augmented Dickey Fuller test for unit root

No.	Variables	At levels	At 1st difference	Orders of integration
1	FoodEx	0.025	0.0000	I(1)
2	RPopu	0.0000	0.0000	I(0)
3	Agrigrow	0.9250	0.006	I(1)
4	Infla	0.0000	0.0000	I(0)
5	WOP	0.3980	0.0000	I(1)
6	GNI	0.0750	0.0050	I(1)
7	INV	0.0360	0.0000	I(1)
8	AGLAND	0.6700	0.0000	I(1)
9	GovEXPE	0.0240	0.0000	I(1)
10	UrPOPU	0.0000	0.0000	I(0)
11	OPPENN	0.3260	0.0000	I(1)
12	lnCereaPro	0.9720	0.0000	I(1)

Source: Own estimation, 2014

Lag Length Determination

Since the dependent variable is time series type the previous year observation either the dependent or the independent variable may be considered an explanatory variable. This implied that the previous year value of the dependent variable may be also taken in to account as an independent variable. This process could force the research to determine the lag length that would be considered into the operation. To determine this one can use one of the well

known method of the lag length. It is common to find instances of this type where alternative strategies for model choice lead to different outcomes, making some subjective judgement necessary (Hill *et al.*, 2011). In some occasion, three of them may show different level of lag; this did not happen in this research. As of this, the maximum lag that the research considered in this work is four.

Table 2: Estimation result of test of determination of number of lags

Lag	LR	FPE	AIC	HQIC	SBIC
0		4.4e+52	143.919	144.036	144.3
1	621.41	1.2e+45	126.298	127.345	129.723
2	276.27	2.3e+43	121.002	122.981	127.473
3	5190	8.9e-33	-59.7817	-56.8726	-50.2659
4	5373.1*	5.e-112*	-249.391*	-246.016*	-238.352*

Source: Own estimation, 2014

Given this, the research considers only the forth lag of the dependent as well as independent variables (Table 2).

Long Run Co-integration Test

This test tries to show the co-integration of the dependent variable and the independent ones, which asserts the existence of long run co-movement in the two types of variables. These imply that the research is trying to see long run first order of integration. In having this, the research firstly tries to have the first difference of them both dependent variable and the independent variable to facilitate the application of vector error correction (VEC) model of analysis and it confirmed that each of the variables consider here should be at its first difference as well as stationary at the level (see Table 3).

Based on the regression result out of the nine variable considered except cereal production are found to be statistically significant. The rural population variable indicate that it is the source of labor for the production process and agricultural land variable is the other input that has a direct effect of enlarging the export supply of food products sourced from agriculture. In the same fashion openness of the economy for international trade participation and the economic power, which can be approximated by gross domestic income, have positive effect in increasing the agricultural food export of the country.

Table 3: Co-integration equation of Johannes normalization restriction (the dependent variable is Dfoodexports)

Description	Coef.	Std. Err.	Z	P>z
Dinflationc~l	-3.678414	.1199531	-30.67***	0.000
DGNI	1.97e-08	5.02e-10	39.20***	0.000
Druralpopul~n	.0000204	3.86e-06	5.28***	0.000
Durbanpopul~n	-.0000285	.000014	-2.03**	0.042
Doilprice	-279.8594	11.6582	-24.01***	0.000
Dtotalinves~t	-6.858441	.225829	-30.37***	0.000
Dagricultur~m	.0757123	.0014477	52.30***	0.000
Dlncerealyi~e	-.0008357	5.833763	-0.00	1.000
Dopenness	1.699579	.2283157	7.44***	0.000
_cons	446.4025	.	.	
chi2				
8014.576				
P>chi2	0.0000			

Source: Model result, 2014

***and ** Represents significance at 1% and 5% respectively

The investment here is the overall one in which it is not towards agriculture that implies there is resource diversion towards other sectors and result into reduction in the export supply of agriculture.

Since the nation is purely dependent on imported oil, increment of price would result into increment in the cost of transport that would lead to reduction in export of agricultural food items. At the same time, importer may restrain to import agricultural products from Ethiopia when there is successive increment of the oil price.

Estimation of the Vector Error Correction Model (VECM)

VECM is the time series of residual from the long run co-integration equation. The question of this model incorporation a corrective mechanism by which previous disequilibrium in the relationship between the food export and one or more determinants are permitted to affect current change. In this way, an allowance is made for any short run divergence in the export from its long run trend. The equation can then be reduced to a parsimonious equation through the elimination of insignificant terms and imposition of constraints that holds a reasonable approximation (Vincent, 2003).

This econometric analysis tries to show the short run interaction of the two variables. This model is direct extension of the above long run results after consideration the significance variable in the Johansen normalization. Based on the results of the long run regression there

was formulation of the speed of adjustment for each deviation from the equilibrium level. The change in one or more independent variables would result into short run deviation from the long run trend of the food export supply. Based on this formulation the research tried to regress the dependent variable on variables that were just transferred from the long run model and variable those are stationary at their level without differentiating. The vector error correction model was formulated in the following form: -

ECM= -3.678414*inflationc~l+1.97e-08* GNI+.0000204* ruralpopul~n-.0000285* urbanpopul~n+279.8594*oilprice-6.858441-.0757123agricultur~m -1.699579openness+446.4025

Table 4 depicted that variable like rural population, world oil price and gross domestic income affect the dependent variable positively and significantly. Considering the gross domestic income of the country which affect the food export supply significantly and positively not only in the long run but also in the short run, thus one can say that there is a direct relationship between the food export supply of the country and GDP. The same is true for the case of rural population.

Whereas variables like the first lag of food export, domestic inflation, total investment and agricultural land affect the dependent variable negatively and significantly.

Table 4: The parsimonious vector error correction model (dependent variable DFoodEX)

DESCRIPTION	**Coef.**	**Std. Err.**	**T**	P>z
Dfoodexports-L	-.6785841	.1236988	-5.49***	0.000
Dinflationc~1	-.6173486	.3070613	-2.01**	0.044
Dgni-1	1.09e-08	4.46e-09	2.45**	0.014
Druralpopul~n-1	.0001572	.000069	2.28**	0.023
Durbanpopul~n-1	-.0002422	.0001706	-1.42	0.156
Doilprice-1	72.4588	29.93514	2.42**	0.015
Dtotalinves~t-1	-2.340807	1.07328	-2.18**	0.029
Dagricultur~m-1	-.0120747	.0062903	-1.92*	0.055
Dlncerealyi~e-1	6.492485	29.42561	0.22	0.825
Dopenness-1	.7537811	.7007416	1.08	0.282
LECM	-.2937851	.1094594	-2.68***	0.007
_cons	-5.717303	33.65027	-0.17	0.865
R-sq	0.8084			
Adj R-squared =	0.7301			
F(9, 22) =	10.32			
Prob > F	0.0000			

Source: Model result, 2014

***, **and *shows the 1%, 5% and 10% level of significance respectively

Domestic inflation may reduce the demand of foreigners to import from the domestic economy, which may be due to having expensive domestic products that result into having negative relationship between food export supply and domestic inflation. This implies that there is direct reduction in export supply of the country due to inflation in the short run period of operation. Given all the above, the speed of adjustment of the deviation/disequilibrium, that results from change in one of the independent variables in the short run, from the long run trend is 29.38% per year.

CONCLUSION AND RECOMMENDATIONS

This research had try to identify the main factors that determine export supply of Ethiopia using time series data collected from WDI of world bank. The study used error correction model of analysis, after having the long run co-integration equation and identification of the significant variable, to assess the factor in the short run.

The gross income of the country affect the export supply both in the long run and in the short run positively and significantly, which implies that capacity to export is the main actor in increasing export of a country that is a theory accepted by many scholars. This result indicates that to have a consistent export increment and supply it is necessary to have strong overall economic strength.

The other consistent and significant variable that affects the export supply is domestic inflation. This variable has negative effect both in the short and long run. This indicates that inflation has negative impact on the export performance of the country, which implies that there must be having due effect to reduce the domestic inflation in order to create additional demand for domestic products.

Openness of the country for international participation has positive and significant effect in the long run but not in the short run and short run operation, which imply that providing free access for exporter has positive contribution for enlarging for the export supply of the country in the long run. Thus further reduction of any of the obstacles on the export import of the country advisable.

The overall investment of the country negatively affect the food export supply in both the short run and long run period, which imply that the investment direction of the country is not toward the increment of the productivity of agriculture.

World oil price has different effect depending on the period of consideration. It affects the export supply negatively in the long run but the effect become positively in the short run. This indicates that the current time world oil price has positive impact on the export performance of the country which implies that there must be having due effect to increase the world oil price in order to create additional demand for domestic products. The World oil price was considered as a proxy variable, which would substitute the world inflation.

The adjustment period for the deviation from the normal, long run trend is 29.38% of the deviation within one year. A factor corrects about 29 percentage of disequilibrium in the food export with the greatest by the external and internal forces. This the need for future research, to investigate the influence of external and internal factors that affects the Ethiopian food exports.

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APPENDIX

Tests of short run relation ship

```
. test ([D_foodexports1])

 ( 1)  [D_foodexports1]L._ce1 = 0
 ( 2)  [D_foodexports1]LD.foodexports1 = 0
 ( 3)  [D_foodexports1]LD.inflationconsumerpricesannual = 0
 ( 4)  [D_foodexports1]LD.gni = 0
 ( 5)  [D_foodexports1]LD.ruralpopulation = 0
 ( 6)  [D_foodexports1]LD.urbanpopulation = 0
 ( 7)  [D_foodexports1]LD.oilprice = 0
 ( 8)  [D_foodexports1]LD.totalinvestment = 0
 ( 9)  [D_foodexports1]LD.agriculturallandsqkm = 0
 (10)  [D_foodexports1]LD.cerealyieldkgperhectare = 0
 (11)  [D_foodexports1]LD.openness = 0

           chi2( 11) =   44.51
         Prob > chi2 =    0.0000
```

Tests of normality

```
. vecnorm, jbera

Jarque-Bera test
```

Equation	chi2	df	Prob > chi2
D_foodexports1	1.162	2	0.55934
D_inflationconsumerpricesannual	0.844	2	0.65581
D_gni	1.570	2	0.45612
D_ruralpopulation	1.758	2	0.41520
D_urbanpopulation	0.932	2	0.62757
D_oilprice	0.315	2	0.85432
D_totalinvestment	1.010	2	0.60338
D_agriculturallandsqkm	0.268	2	0.87477
D_lncerealyieldkgperhectare	0.056	2	0.97252
D_openness	0.047	2	0.97701
ALL	7.961	20	0.99212

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