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Determinants of Ethiopian Trade Performance to Its Bordering Region: A Gravity Model Approach

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Abstracts
International trade has increasingly become a keystone of economic prosperity in many countries of the world. Ethiopia is the one which benefits from foreign trade. Therefore, the main focus of this paper is to identify factors influencing Ethiopian trade performance within the bordering countries such as Djibouti, Kenya and Sudan. The gravity model of trade was employed for the purpose. A gravity model based on a panel data for the period of 19 years (1991-2009) of sample countries was estimated by random effect estimators. The coefficients obtained are then used to predict the basic total trade and export trade potentials for Ethiopia. As a result, we found that the total trade flow was determined by Ethiopia per capital GDP, the product of the GDP of Ethiopia and its trading partners, weighted distance between Ethiopia and the bordering region and Per capita GDP differential. Ethiopia total exports trade to the bordering region is also affected by the GDP of the trading partners, per capita GDP of the exporting country and real bilateral exchange rate. The results of this study indicate that a depreciation of the real exchange rate would affect the international competitiveness of Ethiopian exports, therefore, we recommend Depreciation of a country's real exchange rate because it will cause a gain in competitiveness of that country and government needs also to pay adequate attention to destination markets with cheaper transport costs.
Keywords: Gravity Model, Ethiopia Border Trade.

1. INTRODUCTION

No county in the world become self sufficient so that countries in order to coupe up such insufficiency countries use foreign trade. International trade enables countries to obtain the benefits of specialization, such as increases in output of goods and services; obtain those commodities and services which they do not produce in sufficient quantities (Arene, 2008). Foreign trade has increasingly become a keystone of economic prosperity in many countries of the world. In principle, both export and import trades are equally important. A country must import the required inputs, capital items and appropriate technologies to broaden its production base and foster export growth. Imports of consumer goods are also essential to meet the growing demand at home. Export trade, on the other hand, is crucial to fill the foreign exchange gap of a country and hence to increase import capacity and reduce dependence on foreign aid. For that reason, increased participation in world trade is considered as the single most important tool of rapid economic growth and development (Rahman, 2009).

Over the past two decades, developing countries have progressively increased their share in global trade from just under one quarter to about one third. Asia and particularly China account for most of the change, which has been facilitated by diversification of exports. While developing Asia's share in total world exports increased from 11.7% in 1985 to 21.5% in 2005, Africa's share decreased from 4.3% to 2.9% over the same period (Bacchetta, 2007). Deep rooted structural problems, weak policy frameworks and institutions, protection at home and abroad (IMF and World Bank, 2001), and the structure of African exports, which is characterized by dependence on primary commodities (Alemayehu, 2006; Biggs, 2007; UNCTAD, 2008) are considered as the reasons for Africa's poor export performance.

Like other African countries, Ethiopia has faced these problems for a long time. For instance, in 1983 the Provisional Government of Socialist Ethiopia noted that the basic constraints for Ethiopian exports include the low volume of exportable products, the limited degree of diversification of exports, which are made up mainly of unprocessed primary products, frequent economic crisis which substantially reduce the demand for and prices of primary products, artificial trade barriers by trading partners etc. (cf. Abay and Zewdu 1999). Moreover, after the downfall of the Derg regime, the Transitional Government of Ethiopia stated that "it is essential to increase and diversify exports" (1991: 33, as cited in Abay and Zewdu 1999).

In response to the problem, Ethiopia has taken different measures such as export financing incentive schemes, export trade duty incentive scheme and duty free importation scheme to those wholly engaged in supplying their products to foreign markets. When compared to the pre-1991 period, the trade policy regime has become more liberal (Alemayehu, 1999).

Owing to this policy shift some improvements in export performance have been registered. Trade statistics show that export earnings have increased during the post reform period. According to the Ministry of Trade and Industry (MOTI), the real value of export earnings increased from ETB 5 billion during the first six year period of the Derg regime (1973-1978) to ETB 39.7 billion in the last six years of the EPRDF regime

(2000/1-2006/7).

Regarding the composition of exports, until the 1990s the Ethiopian export sector could be characterised as a 'three-commodity sector' consisting of coffee, hides and skins, and oilseeds and pulses. Between 1966 and 1996, on average 59% of the country's export earnings came solely from coffee (Abay and Zewdu, 1999). According to MOTI data, although coffee is still the dominant export item, since 2001/02 its contribution to total export earnings has declined to 36.3% in 2007. On the other hand, the share of non-coffee agricultural exports and major manufacturing export commodities (leather and leather products; textile; and agro processing products) has increased remarkably and reached 63.7%.

Since the country is emerging, needs to pay more attention to improve its trade with world countries-especially with African countries. Therefore the main focus of this paper is to identify factors influencing Ethiopian trade performance within the bordering countries (Djibouti, Sudan, and Kenya).

2. METHODOLOGY

2.1. Sources and Nature of the Data

Our study has been conducted based on bilateral trade flows between Ethiopia and border countries–Djibouti, Kenya, and Sudan. The study uses Panel data for the period 1991 to 2009 for three border countries and Ethiopia. Annual data for the years 1991 through 2009 about Ethiopia and the trading partners are collected from the following sources: Ethiopian GDP and the three trading partners'GDP are collected from International Monetary Fund's (IMF) International Financial Statistics database. Ethiopia's bilateral exports and imports are from the Ethiopian Economic Association (EEA) statistical Database. All monetary values are measured in dollar at the current prices. Population data (in millions) was accessed from the world Economic Outlook Database, while the distances in kilometres between the capital cities are from the website http://www.indo.com/distance/. The exchange rates are gathered from the National Bank of Ethiopia. As the bilateral exchange rates between the Ethiopian birr (ETB) and trading partner's currencies are not available, they are calculated through the US dollar (USD) by multiplying the value of foreign currencies per US dollar with the ETB/USD exchange rate.

2.2. Gravity Model of International Trade

Gravity models are econometric models that many economists often use for ex-post analyses of international trade flows. If after estimation the model is used for simulations, it can also predict future values (Piermartini and Teh, 2005). The gravity model of trade is based on the idea that overall trade volumes between two nations depend on the size of the two nations and the distance they are apart (Armstrong, 2007). Unlike trade indices, the gravity model of trade is one of the most empirically successful approaches in economics, both to explain the state of trade flows and estimate trade potentials (Helmers and Pasteels, 2005). It is also widely used as a baseline model for estimating the impact of a variety of policy issues (Baldwin and Taglioni, 2006). We can generally say that the estimation of trading partners within the gravity framework is a line of research that has been studied extensively (Helmers and Pasteels, 2006). There are a couple of reasons for the central role played by the gravity model in such empirical works (Piermartini and Teh, 2005).

The first has to do with the high explanatory power of the model in explaining bilateral trade flows. The second reason is that it provides an easy method to test the role that other variables play in affecting trade. Besides, the model can overcome the basic limitations of trade indices. For instance, it can incorporate dynamic effects (Bun and Klaassen, 2002), measure the impact of policy shocks or trade agreements (Piermartini and Teh, 2005) and capture the level as well as structure of trade (Alemayehu *at al*, 2010). Tinbergen (1962) and Poyhonen (1963) were the first authors to developed Gravity models of international trade.

$$Ti\,j\,t = K\,(GDP^{\alpha}i\,t \,.\, GDP\beta j\,t) / (DIS^{\lambda}\,i\,j) \qquad (1)$$

In its basic formulation, the gravity model explains bilateral trade flows in analogy to Isaac Newton's law of gravity, by the attraction of two countries'"masses" (measured by GDP and/or population), reduced by the "distance" (which is a proxy of transport costs) and expanded by preferential trade agreements between them and by other factors, as, for example, a common language or exchange rate. Some studies (Bergstrand, 1989; Limao and Venables, 2001) contribute to the refinement of the traditional explanatory variables and to the addition of new ones. Others (Cheng and Wall, 2005; Egger, 2000) improve the econometric specification of the model (Cardamone, 2009).

Some criticism for the lack of theoretical foundations has emerged. However, as empirical applications of the gravity model have grown, theoretical bases of the model have also been proposed. Indeed, Anderson (1979) derives a theoretical foundation for the gravity model based on constant elasticity of substitution (CES) preferences and goods that are differentiated by region of origin. Subsequent extensions (Bergstrand 1989; Deardoff, 1995) consider monopolistic competition or an Heckscher-Ohlin structure to explain specialization.
Finally, Anderson and van Wincoop (2003) manipulate the"CES expenditure system to derive an operational gravity model with an elegantly simple form". According to the generalized gravity model of trade, indicating with (i,j) a pair of countries, the volume of exports of country i towards country j (Xij) depends on their incomes,

measured by GDPs (Yi and Yj), their populations (Ni and Nj), their geographical distance (Dij), h preferential trade variables (Pij), and a k-dimension vector of country-pair specific factors that affect trade (Fij).

Despite the fact that the gravity model is formulated in the multiplicative form, most studies have estimated the gravity parameters using the following log-linearised form (Cardamone, 2009):

$\ln(Xi\,jt) = \alpha 0+\beta 1\ln(Yit) +\beta 2\ln(Yjt) +\beta 3\ln(Nit) +\beta 4\ln(Njt) +\beta 5\ln(Dij) +\sum\delta hPijh + \sum\lambda ijk + Uij$ (2)

Where Uij is the error term

Thus the functional form of the gravity model estimated in this study was as follows:

$$\ln TRD_{ijt} = \beta_o + \beta_1 \ln \mathrm{Re}albilateralER + \beta_2 \ln(percapita_i) + \beta_3 \ln(GDP_{it} \cdot GDP_{it}) + \beta_4 \ln DST_{ij} + \beta_5 \ln percapita\,GDPdiff + U_{ijt} \quad (3)$$

and

$$\ln X_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln realbilaeralER + \beta_4 \ln percapita_i + \beta_5 \ln percapita_j + \beta_6 \ln DIST_{ij} + \beta_7 \ln \mathrm{fdiethio\ pia} + U_{ijt} \quad (4)$$

In the above model (Equation 3 and 4):

1) Xijt indicates the amount of trade exports of country i to country j at time t. Since the gravity model refers to the trade volume, the study deflated the values of the annual imports, measured in US dollars, using the US Consumer Price Index (CPI).
2) TRDijt indicates the total trade flow (export + import) between trading partners
3) GDPit and GDPjt represent the GDPs in current values (US dollar) of countries i and j, respectively.
4) $percapitaGDPdiff$ per capita represents absolute value GDP difference of country i to j at a time t.
5) Per capita GDPit and per capitaGDPjt represent the per capita GDPs in US dollars of countries i and j, respectively.
6) DIST measures geographical distance between country i and country j in kilometres.
7) $\mathrm{Re}albilateralER$ is the real bilateral exchange rate between country i and country j at time t measured by the following formula: TCR ijt = (TCNi/$/TCNj/$ × (CPIj / CPIi), where TCN is the nominal exchange rate vis-à-vis the dollar and CPI is the price index, notably the GDP deflator.
8) Foreign direct investment of Ethiopia
9) U_{ij} is the stochastic term, log normally distributed error with E(Uij)=0.

2.3. Econometric Issues

Before setting up our estimation models, it has to be explored whether the variables specified in the model are normally distributed random variables. A graphical (histogram and box plot) and numerical inspection (Skewness-Kurtosis test) has been performed for testing normality. The results indicate that, for most of the variables in the sample, the null hypothesis of a normally distributed random variable is rejected. In order to make the variable as close as to a normally distributed one, I take the log transformed variables. The graphical and numerical inspection of the log transformed variables confirms that they exhibit an almost normal distribution (see details in figures Appendix figure1 up to figure 8; I performed a Variable Inflation Factor (VIF) Analysis to check for multicollinearity. The analysis indicates that all the variables have a VIF value of less than 10, meaning there is no a problem of multicollinearity in the data (see Table 4 and Table 5).

A diagnostic analysis has been conducted to examine which estimation technique fits the model and the data well (Table 6). The Hausman specification test (Hausman, 1978) is performed to discriminate between fixed and random effects model. The test result indicates that the fixed effect is strongly preferable to the random effects model.

One common problem encountered in panel data studies is a problem of heteroskedasticity, whose presence renders OLS estimators inefficient. The Breusch-Pagan / Cook-Weisberg test for heteroskedasticity is applied, and the null hypothesis of homoskedastic disturbances is accepted.

3. RESULTS AND DISCUSSION

3.1. Estimation Results

The OLS regression technique was employed for the analysis after testing several other estimators which did not give any superior results.

3.2. Factors Influencing on the Total Trade of Ethiopian within Its Trading Partners

Table 1 indicates that out of five explanatory variables, four of them have significant effect and the model fitted the data well and explained over 67.23% of the variations in the total trade discussed as follows:

1. For the per capita GDP of the exporting countries, the coefficient estimated was negative and statistically significant. Significance of the coefficient for per capita GDP (income) of exporting county signified 'importer market effects.' This suggested that an increase in income of the exporter country decrease the domestic consumption of the product thereby increase the quantity to be exported to the imported countries.
2. Economic size (GDP) of trading pairs is found to have a positive and significant effect on the total trade flows. The concept behind demonstrates that Ethiopia's trade relationship is stronger with larger economies than smaller economies. In absolute terms, when economic size increases by one percent, other things remain unchanged, the flow of trade between a pair of countries grows by some 2.368 percent.
3. Distance treated as a proxy for trade costs and has an inverse and statistically significant impact on trade flows. For every one percent increase in the distance between a pair of countries, merchandise trade tends to fall by 4.613 percent, ceteris paribus.
4. Per capita GDP differential is also an important factor that determines the flow of trade. Its positive sign indicates that the Linder hypothesis of trade is true. That is countries with similar characteristics trade more with each other in other word Countries with lesser per capita income differential trades more than countries with higher differential. Other factors being equal, a one percent increase in per capita income differential leads bilateral trade to increase by 2.358 percent.

Table 1. Gravity regression results of determinants of total trade flow with in Ethiopia, Djibouti, Kenya and Sudan.

Ltotaltrade	**Coef.**	**Std. Err.**	**T-value**
Lrealbilat	-0.046	0.146	-0.32
Lpercapital	-4.248	1.553	-2.73*
lgepgdp	2.368	0.270	8.77*
lweigteddi~e	-4.613	1.386	-3.33*
lpergdpdiff	2.358	0.647	3.64*
_cons	75.263	19.074	3.95*
F(5,31) = 23.77			
Prob > F = 0.0000			
R-squared = 0.6723			
No. Of observation=39			

Source: Own Computation
* means significant at the 1%

3.3. Factors Influencing on the Ethiopian Export with Its Trading Partners

1. The GDP of the importing countries (lgdp) was used as proxies for marketing sizes of these countries. The coefficients of the GDP in importing countries were positively and statistically significant at 1% level of significance. The positive and statistically significant coefficients of the importing GDP for the augmented gravity model were consistent with the theory behind the conventional gravity model, suggesting that the size of the economies should enhance the amount of trade between trading partners. The result implied that a percent increase in GDP of the importing countries increased imports by 6.584% for the period under consideration.
2. For the per capita GDP of the exporting countries (Lpercapital), the coefficient estimated was negative and statistically significant. The low value and non-significance of the coefficient for per capita GDP (income) of producing countries signified 'home market effects.' This suggested that an increase in income of the producing country increased the domestic consumption of the product thereby reducing the quantity to be exported to the partner countries.
3. Bilateral exchange rate was added to the gravity equation to estimate the effects of currencies exchange between the importing countries and those exporting countries. The coefficient estimated had negative sign and statistically significant at 1%. The significance of exchange rate of currency in the trading partners could be as a result of different currency used by those trading partners. This result implied that holding other variables constant, a depreciation of importing country's currency will decrease export of goods and services by 1.180%.

Table 2. Gravity regression results of determinants of Ethiopia's Export to its Trading Partners (Djibouti, Kenya and Sudan)

Lexport	Coef.	Std. Err.	T-value
Lgdp	6.584	1.472	4.47*
lweigteddi~e	-1.039	1.910	-0.54
Lethiopiagdp	-2.706	1.614	-1.68
Lfdiethiopia	-.253	.206	-1.23
Lpercapitalj	.481	.394	1.22
Lpercapital	-.792	.348	-2.28**
lrealbilat~e	-1.180	.366	-3.22*
_cons	19.994	26.445	0.76
F(7,38) = 11.23			
Prob > F = 0.0000			
R-squared = 0.7143			
No. of Observation =48			

Source: Own Computation
* and ** means significant at the 1% and 5% probability levels, respectively

4. CONCLUSION AND RECOMMENDATIONS

In recognition of the importance of international trade in most African economies, this study attempted to identify and analyse the determinants of trade in goods and services within the Ethiopia, Djibouti, Kenya and Sudan. From the results, intra-trade within those bordering countries were consistent with the gravity theory that total trade flow between countries depended on the mass (economic size) of the importing and inversely proportional to the distance between them. The per capita GDP of Ethiopia turned out to be insignificant factors in determining the total trade among those trading partners. This implied that boarder trade pattern, followed a per capita pattern. Besides the above factors the total trade flow affected Per capita GDP differential.

The empirical results also suggest that Ethiopia's export performance to those bordering countries are determine by GDP of the importing countries, per capita GDP of the exporting countries and bilateral exchange rate.

Based on the findings of this study, the following recommendations are made:

1. Depreciation of a country's real exchange rate will cause a gain in competitiveness of that country. The results of this study indicate that a depreciation of the real exchange rate would affect the international competitiveness of Ethiopian exports.
2. The effect of transport costs on the Ethiopian trades (exports) tends to decrease over time. So the government needs also to pay adequate attention to destination markets with cheaper transport costs. Access to such markets should be facilitated by relevant policies to take advantage of the geographical location in strengthening Ethiopian trade (exports') competitiveness.
3. Finally, we provide some propositions that we think are relevant for future empirical studies. Our comments concentrate on specifications of the gravity model and the sample of countries required for estimation of trade potentials. Thereafter, we suggest estimation of Ethiopia's trade potential that incorporates the maximum possible number of trade partners, and investigation of mechanisms through which such potentials will be exhausted. The number of sample countries can increase by taking trade values of the most recent few years. These issues are left for future investigations.

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6. APPENDIX

Table 1: Skewness-Kurtosis Test for Normality

Item	Variable	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
1	lrealbilat~e	0.0002	0.0319	14.84	0.0006
2	lethiopiap~l	0.0000	0.0005	27.84	0.0000
3	lGepgdp	0.0000	0.0000	39.69	0.0000
4	lweigteddi~e	0.0312	0.0000	19.16	0.0001
5	Lpergdpdiff	0.0001	0.0053	17.27	0.0002
6	LPercapita	0.0000	0.0000	34.36	0.0000
7	lethiopiagdp	0.0005	0.3540	10.77	0.0046

Table 2: Multicollinearity Test total trade (Variable Inflation Factor for the Variables)

Item	Variable	VIF	1/VIF
1	Lpercapital	5.99	0.166841
2	lweigteddi~e	4.71	0.212140
3	Lpergdpdiff	4.52	0.221044
4	Lgepgdp	3.48	0.286958
5	lrealbilat~e	2.30	0.433977
Mean of the VIF		4.20	

Table 3: Multicollinearity Test log export (Variable Inflation Factor for the Variables)

Item	Variable	VIF	1/VIF
1	Lgdp	7.54	0.132589
2	lrealbilat~e	6.97	0.143545
3	Lpercapitalj	6.75	0.148152
4	lweigteddi~e	5.80	0.172385
5	Lethiopiagdp	2.17	0.460094
6	Lfdiethiopia	1.65	0.606911
7	Lpercapital	1.31	0.761065
Mean VIF		4.60	

Table 4: Summary of diagnostic test

No.	Types of test	Dependent variables	Observed statistics	P-value
1	Lagrange multiplier test for presence of random effect	Total trade	-36.42	-
	Lagrange multiplier test for presence of random effect	Total export	22.23	0.0023
2	Housman Specification for Fixed and Random effect	Total trade	28.08	0.001
	Housman Specification for Fixed and Random effect	Total export	8.25	0.000
3	Breush-Pagan Test for Heteroskedasticity	Total trade	0.65	0.4212
	Breush-Pagan Test for Heteroskedasticity	Total export	0.04	0.8483

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