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Determinants of bilateral trade flow between Ethiopia and its major trading partners: A gravity model approach

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Abstract

This study seeks to identify the internal and external factors determining Ethiopia's bilateral exports and total trade flows. It uses panel data covering 21 major trading partners of Ethiopia from 2000 to 2017 and estimates an augmented fixed effects gravity model. The results reveal that domestic and foreign revenues increase Ethiopia's bilateral exports, whereas the country's foreign direct investment and the population size of the trading partners decrease bilateral exports. The results further show that both the domestic and foreign income and similarity endowment of Ethiopia increase the country's total trade. The study provides recommendations for the effective implementation of supply side policies to enhance trade.

Key words: determinants, bilateral, trade flow, Ethiopia, gravity model

1. Introduction

Foreign trade is understood as a country's trade with other countries. It is the legal exchange of capital, goods and services across international borders or territories, consisting of imports and exports flowing in and out of the country respectively. International trade arises because no country can be completely self-sufficient. Over the years, international agricultural trade has allowed countries to obtain the benefits of specialisation, such as increases in the output of goods and services and obtaining those commodities and services that they do not produce, or do not produce in sufficient quantities (Arene 2008).

As nations are generally not self-sufficient in the global economy, they are involved in trade on various levels to sell what they produce in order to obtain what they require. In terms of conventional economics theory, trade eventually promotes economic efficiency, and therefore enhances global trade (International Monetary Fund [IMF] 2016). However, a combination of tariffs, quotas and subsidies can act as economic and, in some cases, political barriers, imposing significant trade restrictions (Caliendo *et al*. 2017).

By importing the required raw materials, intermediate and capital goods, consumer goods and services, , if these goods and services are not available domestically, a country is able to enlarge its productive capacity, foster export growth, meet the growing domestic demand and raise the living standards and economic well-being of its populace. Exports, on the other hand, generate the foreign exchange necessary to increase the import capacity of the country, and boost its industrialisation and overall economic activity, which, in turn, augment its economic growth. Exports also enable the expansion of markets and hence allow for economies of scale. In 2010, world trade recorded its largest ever annual increase, as merchandised exports surged 14.5%. This was buoyed by a 3.6% recovery in global output, after it took a major tumble in 2009, when it declined by 12%, with world gross domestic product (GDP) also waning, but at a much lower rate of 2.4% (World Trade Organization 2011).

Growth in world trade, in turn, is the result of both technological developments and concerted efforts to reduce trade barriers (IMF and World Bank 2001). In poor developing countries, agricultural trade is important because most of the world's poor live in rural areas, where agriculture is a key source of income and consumption (United States Agency for International Development [USAID] 2010).

In Sub-Saharan Africa, the various nations' share of goods exported to Europe fell from 31% in 2005 to 25% in 2010, and East Asia is rapidly replacing North America and Europe as Sub-Saharan Africa's key trading partner in both intermediate and capital goods trade (World Bank 2022). Deep-rooted structural problems, weak policy frameworks and institutions, protection at home and abroad and the structure of African exports, which are characterised by dependence on primary commodities (Alemayehu 2006; Biggs 2007; United Nations Conference for Trade and Development [UNCTAD] 2008), are considered the reasons for Africa's poor export performance.

The performance of foreign trade in Ethiopia has increased significantly in recent times. The available evidence shows that the value of both exports and imports improved tremendously, and government has implemented many export-incentive packages besides the reduction in the tariff rate for the import of raw materials and capital goods by the manufacturing sector. According to the annual report of the National Bank of Ethiopia (NBE), Ethiopia's total export earnings by value increased by 21% from 2019 to 2020 and, despite the decrease in imports from 2019 to 2020, the country's imports have increased steadily over the past decade, with a fivefold increase from 2007 to 2020. As a result, Ethiopia faces a growing trade deficit, with total imports increasing by 12.5% per year on average over the previous ten years (NBE 2021).

The trade deficit and its economic and social implications are matters of concern for both the public and private sectors and therefore requires concerted efforts in terms of trade strategy. There is an urgent need to address the trade deficit not only from the export side, but also from the import side, by identifying products that can be produced locally to reduce the deficit. The export basket of the country is concentrated on a few agricultural products such as coffee, oilseeds, pulses and semi-processed leather. The export destinations of the country's products are also very limited. On the other hand, as a consequence of the growing domestic economy, the demand for consumer and capital goods, as well as various services, is growing (Yeshineh 2016).

Ethiopia has a trade relationship with many of the nations of the world. The country's exports included coffee, leather and leather products to Europe (41.3%), Asia (31%), Africa (17.4%), and the Americas (9.4%). The vast majority of Ethiopia's imports (61.3%) come from Asia, followed by Europe (22%), the Americas (7.6%) – of which the United States account for a sizable share (3.4%), and other African countries (8.9%). Imports from China accounted for 22.8% of Ethiopia's total foreign supplies (NBE 2021).

Despite these opportunities, the country's export performance is sub-optimal. Dealing with the underperformance and constraints of the external trade sector, particularly the export sector, is critical for maximising the country's trade potential and leveraging trade to benefit the entire economy. To optimise benefits from trade requires easing restrictions in order to take advantage of opportunities. Given the potential benefits of trade, countries are eager to liberalise their economies in order to reap these benefits of trade and globalisation via bilateral and multilateral means. It is critical that each country understands its full trade potential in relation to other countries or regions in order to begin the process of engagement.

The increasing volume and value of trade performance requires good trade policies based on reliable information. In this regard, although there have been some studies on trade issues, they are not current and not all trade factors have been explained sufficiently.

Therefore, the objective of this paper is to investigate the major factors influencing Ethiopian bilateral export and total trade performance with its major trading partners and to provide a suitable recommendation for the development of the export sector of the country.

2. Methodology

2.1 The gravity model

The gravity model explains export flows between two countries by their economic size (GDP or GNP), population, and direct geographical distances between them. The gravity model predicts that the flow of people, ideas or commodities between two locations is positively related to their size and negatively related to their distance, based on Newton's law of gravitation. They specified the following gravity model equation in its original form:

$$F_{ijt} = C\frac{GDP_{it}GDP_{jt}}{D_{ij}{}^{2}}, \quad (1)$$

where F_{ijt} are the bilateral trade flows between country i and country j; C is the constant of the equation; GDP_{it} is the gross domestic product of country i; GDP_{jt} is the gross domestic product of country j; and $D_{ij}$is the distance between the capitals of the two partner countries.

The gravity model in log linear form is typically used for empirical estimation, with the coefficients representing the elasticity of bilateral trade to estimated parameters (Butt 2008). Taking this fact into consideration, and applying it to the fundamental concept of the gravity model, yields the following linear form of the equation:

$$X_{ijt} = \alpha_0(GDP_{it})^{\alpha_1}(GDP_{jt})^{\alpha_2}(DIS_{ij})^{\alpha_3}, \quad (2)$$

where X_{ijt} is the trade flow between countries, which may be represented by total or average total trade, or only the export or import flow of a country, GDP_{it} and GDP_{jt} are the economic size of the two countries, which can be represented by economic variables such as GDP, GNP, per capita GDP, per capita GNP and population, and the variable D_{ij} stands for distance between trading countries as a proxy for transportation cost.

To analyse the determinants of Ethiopia's bilateral trade flows within the framework of the gravity model, this study employed a panel dataset of annual observations on a cross-section of 21 major trading partners of Ethiopia collected from different secondary sources over a period of 18 years, from 2000 to 2017. The choice of the sample period and countries in the cross-section was influenced by the availability of data on all the variables used in the study, and the relative importance of each country (measured in terms of its percentage share) in Ethiopia's total merchandise trade over the sample period. Pooled ordinary least squares, fixed effect and random effect models were applied to this panel dataset to investigate factors influencing trade.

2.2 Pooled ordinary least squares (OLS)

The simplest, and possibly naïve, estimation approach is the pooled OLS estimator, which proceeds by essentially ignoring the panel structure of the data (the space and time dimensions of the pooled data) and just estimates the usual OLS regression. The pooled specification can be written as:

$$y_{it} = X_{it}\beta + \alpha + u_{it}, \tag{3}$$

where y_{it} is the observation on the dependent variable for the cross-sectional unit (country) i in period t, X_{it} is the 1 x k vector of the explanatory variables observed for country i in period t, β is a 1 x k vector of parameters, and u_{it} is an error or disturbance term specific to country i in period t. This approach assumes that the intercept (α) and all the coefficients (β) are constant or identical for all individuals across time, and that $u_{it} \sim iid(0, \sigma_u^2)$ for all i and t, implying that the observations are serially uncorrelated. Furthermore, the errors are homogenous across individuals and time. As Gujarati (2004) indicates, these assumptions are highly restrictive, as the pooled regression ignores the 'individuality' of each country and distorts the true picture of the relationship between the dependent and independent variables.

2.3 The fixed effects model (FEM)

In the formulation of the fixed effects model, the intercept in the regression is allowed to differ among individual units in recognition of the fact that each cross-sectional unit might have some special characteristics of its own. That is, the model assumes that differences across units can be captured in differences in the constant term. The α_i are random variables that capture unobserved heterogeneity. The model allows each cross-sectional unit to have a different intercept term even though all slopes are the same, so that

$$y_{it} = x'_{it}\beta + \alpha_i + \mu_{it}, \tag{4}$$

where ε_{it} is iid for all *i* and *t*.

The subscript *i* on the intercept term suggests that the intercepts across the individuals are different, but that each individual intercept does not vary over time. The FEM is appropriate in situations where the individual specific effect might be correlated with one or more regressors (Greene 2003; Gujarati 2003).

2.4 The random effects model (REM)

In contrast to the FEM, the random effects model (REM) assumes that the unobserved individual effect is drawn randomly from a much larger population with a constant mean (Gujarat 2003). The individual intercept is then expressed as a deviation from this constant mean value. The REM has an advantage over the FEM in that it is economical in terms of degrees of freedom, since we do not have to estimate N cross-sectional intercepts. The REM is appropriate in situations where the random intercept of each cross-sectional unit is uncorrelated with the regressors. The basic idea is to start with Equation (3). However, instead of treating β1i as fixed, it is assumed to be a random variable with a mean value of β1. Then the value of the intercept for an individual entity can be expressed as:

$$\alpha_i = \alpha + \varepsilon_i, \text{ where } i = 1, 2, 3 \ldots n. \quad (5)$$

The random error term is assumed to be distributed with a zero mean and constant variance. Substituting Equation (2) into Equation (1), the model can be written as:

$$y_{it} = x'_{it}\beta + \alpha + \varepsilon_i + \mu_{it}$$
$$y_{it} = x'_{it}\beta + \omega_i. \quad (6)$$

The composite error term, ω_{it}, consists of two components: ε_{it} is the cross-sectional or individual-specific error component, and u_{it} is the combined time-series and cross-sectional error component, given that $\varepsilon_i \sim (0, \sigma_\varepsilon^2)$ and $\mu_i \sim (0, \sigma_\mu^2)$, where ε_i is independent of the X_{it} (Gujarati 2003).

Generally, the FEM is held to be a robust method of estimating gravity equations, but it has the disadvantage of not being able to evaluate time-invariant effects, which are sometimes as important as time-varying effects. Therefore, for the panel projection of potential bilateral trade, researchers have often concentrated on the REM, which requires that the explanatory variables be independent of the ε_{it} and the u_{it} for all cross-sections (i, j), and all time periods (Egger 2000). If the intention is to estimate the impact of both time-variant and invariant variables in trade potential across different countries, then the REM is preferable to the FEM (Ozdeser & Ertac 2010).

2.5 Model specifications

The gravity model in its most basic form explains bilateral trade (TTij) as being proportional to the product of GDPi and GDPj, and inversely related to the distance between them. The static general basic gravity model that we applied in this paper has the following log linear form:

$$lnT_{ij} = \beta_0 + \beta_1 lnGDP_i + \beta_2 lnGDP_j + \beta_3 lnWDIST_{ij} + \varepsilon_i \quad (7)$$

To account for other factors that may influence trade activities, other variables have been added to the basic model to form the augmented gravity equation.

2.6 Definition of variables

The following definitions are provided for the variables used in this study.

2.6.1 Bilateral exports (X) and total trade (TT)

The above are the annual values (in US dollars) of Ethiopian exports to each of the 21 trading partners. Bilateral exports are measured as the total value of all goods and services in US dollars flowing out of Ethiopia to the given 21 trading partners. The total trade is the sum of bilateral exports and imports. The data was collected mainly from the IMF DOTS 2019 CD-ROM.[1]

[1] Available at http://www.imf.org/data

2.6.2 Gross domestic product (GDP)

The gross domestic product is the market value of the total production of goods and services in a country. Data on the GDP of Ethiopia and its trading partners (in US dollars) was collected from the FAOSTAT[2] Outlook database.

2.6.3 Distance (WDIST)

Distance is the geographical distance between Addis Ababa (the capital city of Ethiopia) and the capital cities of its trading partners, measured in kilometres (km). Data on distance was sourced from an online distance calculator website, which can be found at www.distancefromto.net. Based on the distance data and the GDP, as measured above, the weighted distance between Ethiopia and its trading partners for each year in the observation period were calculated and used. A long distance between Ethiopia and its trading partner would result directly in a high cost of transportation, which means there will also be a reduction in demand for Ethiopian products and services, which implies this variable is expected to have negative effect on trade.

2.6.4 Foreign direct investment (FDI)

Foreign direct investment is the total annual inward flow of international investment. FDI flows are defined as investments that acquire a lasting management interest (10% or more of voting stock) in a local enterprise by an investor operating in another country. Such investment is the sum of equity capital, reinvestment of earnings, other long-term capital and short-term capital, as shown in the balance of payments and both short-term and long-term international loans. Data on FDI inflows to Ethiopia was sourced from the FAOSTAT database.

2.6.5 Real bilateral exchange rate (RBER)

The real bilateral exchange rate is the bilateral exchange rate between country i and country j at time t. The depreciation of the real exchange rate enhances the competitiveness of domestic goods vis-à-vis foreign goods. On the other hand, however, an appreciation in real exchange rate will decrease the competitiveness of home goods in international markets. Data on the nominal real exchange rate and price indices was collected from the FAOSTAT database.

2.6.6 Population (POPjt)

The effect of the population of the importing country is indeterminate where the absorption effects and effects of the economies of scale are expected to affect their imports positively and negatively, respectively.

2.6.7 Similarity endowment (SIM_{ijt})

With reference to the similarity endowment, Linder (1961) says that the more similar the demand structure of the two countries, the more intensive the trade between these two countries potentially is. The traditional way of testing the similarity of demand structure or preferences, as suggested by Linder, is by comparing the average (per capita) income of each country.

On the other hand, the Heckscher-Olin theorem postulates that trade patterns are determined by the comparative advantage arising from differences in the relative factor endowments of different nations.

[2] Available at http://www.fao.org/faostat

This difference in factor endowments of nations, in turn, produces differences in average income across countries. Thus, by predicting that nations with dissimilar factor endowments will trade more intensively with each other than countries with identical resource endowments, the Heckscher-Ohlin hypothesis deductively also predicts that countries with dissimilar levels of per capita income will trade more than countries with similar levels of per capita income. To summarise, a negative effect of per capita GDP differential between Ethiopia and its partners on Ethiopia's bilateral trade in this study suggests that Ethiopia's trade pattern follows the Linder hypothesis, whilst a positive effect implies that the country's trade pattern follows the H-O hypothesis.

2.7 Augmented gravity model for exports and total trade

The augmented gravity model that this paper used to estimate the determinants of trade is as follows:

$$lnT_{ijt} = \beta_0 + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnWDIST_{ijt} + \beta_4 lnFDI_{it} + \beta_5 lnRBER_{ijt} + \beta_6 lnPOP_{jt} + \beta_7 lnSIM_{it} + \varepsilon_{it}, \quad (8)$$

where T_{ijt} is total trade between country i and j at time t; GDPi and GDPj represent the GDP of Ethiopia and the trading partners at current market prices (in USD) at time t; $WDIST_{ijt}$ represents the weighted distance between Ethiopia and her trading partner j at time t, which is defined as $WDIST_{ijt} = \frac{(DIST_{IJ} XGDP_{it})}{\sum GDP_{it}}$; $FDI_{\boldsymbol{it}}$ represents FDI stock in Ethiopia (in USD) at time t; $RBER_{ijt}$ represents the real bilateral exchange rate between country i and j at time t, measured by the formula $RBER_{ijt} = \left(\frac{TCN_{i/\$}}{TCN_{i/\$}}\right) x (\frac{CPI_j}{CPI_i})$, where TCN is the nominal exchange rate vis-à-vis the dollar and CPI is the price index, notably the GDP deflator; POP_{jt} is the total population of the trading partners at time t, and SIM is defined as $1 - (\frac{GDP_{it}}{GDP_{it}+GDP_{jt}})^2 - (\frac{GDP_{jt}}{GDP_{it}+GDP_{jt}})^2$, which is the similarity in absolute factor endowments between economies to test the Debaere transformation of the Helpman theorem.

In this paper, an attempt is made to devise a model for export and total trade to identify the major determinants of bilateral trade. Thus, an estimation was done of the two trade models, as set out below.

The bilateral export flow can be modelled as:

$$lnX_{ijt} = \beta_0 + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnWDIST_{ijt} + \beta_4 lnFDI_{it} + \beta_5 lnRBER_{ijt} + \beta_6 lnPOP_{jt} + \beta_7 lnSIM_{it} + \varepsilon_{it}, \quad (9)$$

where all the variables are as defined above.

For the purpose of estimation, we modelled the bilateral total trade (exports plus imports) as follows:

$$lnTT_{ijt} = \beta_0 + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnWDIST_{ijt} + \beta_4 lnFDI_{it} + \beta_5 lnRBER_{ijt} + \beta_6 lnPOP_{jt} + \beta_7 lnSIM_{it} + \varepsilon_{it}, \quad (10)$$

where T_{ijt} is total trade between country i and j at time t, and the other variables are as defined above.

3. Model estimation and interpretation of empirical results

The main concern of this section is to present and analyse the estimated results of the gravity models of bilateral trade flow. The empirical analyses and discussions in this section are presented in two main parts. The first of these presents the results of the pooled OLS, fixed effects (FE) and random effects (RE) estimators for the determinants of Ethiopian exports. In the second part, the results of the pooled OLS, fixed effects (FE) and random effects (RE) estimators for the determinants of Ethiopian total trade (exports plus imports) are presented. The two parts are also devoted to the choice of the appropriate estimator based on the Hausman test and a discussion of the results.

3.1 Analysis of the estimated pooled OLS, fixed effects and random effects models for Ethiopian exports

In view of the nature of the dataset employed in this study, it was imperative that we select an appropriate estimation method that accounts for the heterogeneity in the gravity models resulting from the presence of individual and time effects in the panel data. In so doing, we first estimated the pooled OLS model, along with the fixed effects (FE) and random effects (RE) models, with bilateral exports as the regressand. The preliminary results of these models are presented in Table 1 below.

Table 1: Pooled OLS, fixed effects (FE) and random effects (RE) estimates of the augmented gravity models of Ethiopia's exports

Dependent variable: Ethiopia's bilateral exports			
	Estimation method		
Variables	**Pooled OLS**	**Fixed effects model**	**Random effects (GLS) model**
lnGDPi	1.753***	1.113***	1.737***
	(0.211)	(0.366)	(0.277)
lnGDPj	-0.048	1.441***	0.796***
	(0.118)	(0.230)	(0.171)
lnWDIST	-0.261	-0.273	-0.634**
	(0.214)	(0.366)	(0.317)
lnFDI	-0.216**	-0.123*	-0.160**
	(0.085)	(0.064)	(0.066)
lnRBER	0.0147	-0.152	-0.284***
	(0.042)	(0.137)	(0.082)
lnPOPj	-0.192**	-1.829***	-0.692***
	(0.081)	(0.619)	(0.169)
lnSIM	-0.549***	0.015	-0.064
	(0.072)	(0.153)	(0.126)
_cons	-12.297**	-1.906	-17.261***
	(3.343)	(10.492)	(4.741)

Notes: ***,**, and * indicate statistical significance at the 1%, 5% and 10% error levels respectively. The values in parenthesis are the standard errors associated with the parameters. The results were obtained with the aid of Stata13.
Source: Results from model, 2019

In estimating the FE model, we treated the country-specific effects as fixed. From the results, the Hausman chi^2 statistic for the export model is 34.38 (with a *p*-value of 0.0000). Since the associated *p*-values are less than the 1% error level, the Hausman test strongly rejects the null hypothesis that both the FE and RE estimators are consistent and that there is no significant difference between their respective coefficients. In other words, this leads to strong rejection of the null hypothesis that RE estimator provides consistent estimates. Thus, based on the Hausman test, we conclude that the FE estimator is appropriate for the estimation of the export's models. Consequently, the remainder of this section is devoted to analysing the results of the gravity models of bilateral trade and exports as yielded by FE estimator.

Table 2: Hausman specification test results for Ethiopia's exports

Variables	_Coefficients_			
	(b)	(B)	(b - B)	sqrt (diag(V_b-v_B))
			Difference	
lnGDPi	1.113	1.737	-0.623	0.239
lnGDPj	1.441	0.796	0.644	0.154
lnWDIST	-0.273	-0.634	0.361	0.183
lnFDI	-0.123	-0.160	0.037	
lnRBER	-0.152	-0.284	0.132	0.110
lnPOPj	-1.829	-0.692	-1.137	0.595
lnSIM	0.015	-0.064	0.079	0.087

Notes:
b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ho; efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic
$chi^2(6)$ = (b-B)'[(V_b-B_)^(-1)](b-B) = 34.38
Prob > chi^2 = 0.0000
(V_b-V_B is not positive definite)

According to the FE estimates, Ethiopia's bilateral trade export flows increase significantly with the economic mass of its GDPi and the trading partners' GDPj. The results fittingly concur with the theoretical postulation of the gravity model of trade. Specifically, the results show that a 1% increase in domestic income (GDPi) and foreign income (GDPj) significantly increases Ethiopia's total bilateral exports, by 1.11% and 1.44% respectively. This suggests that Ethiopia's elasticities of exports with respect to domestic and foreign incomes are highly elastic.

Foreign direct investment is found to exert a negative and significant impact on Ethiopia's bilateral exports. By increasing capital stock and enhancing the transfer of technology, new processes, managerial skills and know-how in the domestic market, FDI is expected to result in a more efficient utilisation of domestic resources and higher absorption of unemployed resources. This, in turn, will lead to increased productivity, especially of the country's comparative advantage export products.

The population size of the trading partners of Ethiopia was found to have a negative and statistically significant effect on the bilateral exports of Ethiopia. The coefficients of population of the trading partners imply that, all other things being equal, a 1% growth in population size of the trading partners results in a decrease in bilateral exports by 1.83% (which is significant at the 1% error level).

3.2 Analysis of the estimated pooled OLS, fixed effects and random effects models for Ethiopia's total trade

To addresses the biased estimates of the pooled ordinary least square (POLS) estimator due to the omission of country-specific effects, the results using the fixed effects (or within-group) and random effects (generalised least squares (GLS)) estimators are presented in Table 3. From the results of the Hausman specification, the Hausman chi^2 statistic for the export model is 37.88 (with a *p*-value of 0.0000) (Table 4). Since the associated *p*-values are less than the 1% error level, the Hausman test strongly rejects the null hypothesis that both estimators are consistent and that there is no significant difference between their respective coefficients. In other words, this leads to the strong rejection of the null hypothesis that the RE estimator provides consistent estimates. Thus, based on the Hausman test, we can again conclude that the FE estimator is appropriate for the estimation of the total trade models. Consequently, the remainder of this section is devoted to analysing the results of the gravity models of bilateral trade as yielded by the FE estimator.

Table 3: Pooled OLS, fixed effects (FE) and random effects (RE) estimates of the augmented gravity models of Ethiopia's total trade

Dependent variable: Ethiopia's bilateral total trade			
	Estimation method		
Variables	**Pooled OLS**	**Fixed effects model**	**Random effects (GLS) model**
lnGDPi	0.815***	0.517***	0.909***
	(0.134)	(0.177)	(0.147)
lnGDPj	-0.062	0.917***	0.578***
	(0.075)	(0.111)	(0.091)
lnWDIST	0.143	-0.207	-0.333**
	(0.136)	(0.177)	(0.167)
lnFDI	-0.048	0.001	-0.012
	(0.054)	(0.031)	(0.032)
lnRBER	0.009	0.089	-0.088*
	(0.027)	(0.066)	(0.048)
lnPOPj	0.216***	-0.026	-0.097
	(0.051)	(0.299)	(0.116)
lnSIM	-0.270***	0.223***	0.145**
	(0.046)	(0.074)	(0.067)
_cons	-5.206**	-12.716**	-10.704***
	(2.12)	(5.067)	(2.702)

***, ** and * indicate statistical significance at the 1%, 5% and 10% error level respectively. The values in parenthesis are the standard errors associated with the parameters. The results were obtained with the aid of Stata13.
Source: Model results, 2019

Table 4: Hausman specification test result for Ethiopia's total trade

Variables	**Coefficients_**			
	(b)	**(B)**	**(b - B)**	**sqrt (diag(V_b-v_B))**
			Difference	
lnGDPi	0.517	0.909	-0.392	0.098
lnGDPj	0.917	0.578	0.339	0.064
lnWDIST	-0.207	-0.333	0.126	0.059
lnFDI	0.001	-0.012	0.013	
lnRBER	0.089	-0.088	0.178	0.046
lnPOPj	-0.026	-0.097	0.071	0.275
lnSIM	0.223	-0.145	0.079	0.030

Notes:
b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ho; efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic

$chi^2(7)$ = (b-B)'[(V_b-B_)^(-1)](b-B) = 37.88
Prob > chi^2 = 0.0000
(V_b-V_B is not positive definite)

According to the FE estimates, Ethiopia's bilateral total trade flows increased significantly with Ethiopia's GDP and its trading partners' incomes (as measured by GDPj). The results follow the theoretical postulation of the gravity model of trade. Specifically, the results show that a 1% increase in domestic and foreign GDP significantly increases Ethiopia's total bilateral trade, by 0.52% and 0.92% respectively.

Ethiopia's similarity in endowment is also found to have a positive and statistically significant effect on total trade in Ethiopia. The coefficients of Ethiopia's similarity endowment imply that, all other things being equal, a 1% growth in similarity endowment increases its total trade by 0.22% (which is significant at the 1% error level).

4. Conclusions and policy implications

This study set out to analyse the determinants of Ethiopia's bilateral trade flows within the gravity model of trade, using panel data covering a cross-section of 21 major trading partners of Ethiopia for the period 2000 to 2017. The estimation of the model was made using the fixed effects gravity model, since it is an appropriate model according to the Hausman specification test.

The empirical results show that the gravity model is very successful in explaining the pattern of Ethiopia's bilateral trade flows. This is because the coefficients of the standard gravity variables (domestic and foreign incomes and distance) were found to be consistent with the predictions of the gravity model.

The results in relation to Ethiopia's bilateral exports confirm that the elasticities of the conventional gravity variables, domestic income and foreign income, where statistically significant and had their theoretically stipulated sign. However, even though the geographical distance had its expected sign, it was insignificant. This suggests that Ethiopia's elasticities of export with respect to domestic and foreign incomes are highly elastic. In addition to the basic gravity model variables, foreign direct investment in Ethiopia and the population size of its trading partners were also statistically significant in determining the country's bilateral exports.

On the other hand, the results on the bilateral total trade of Ethiopia show that, as in the cast of bilateral exports, they correspond with the theoretical postulation of the gravity model of trade. In other words, Ethiopia's bilateral total trade is positively and significantly determined by the country's productive capacity and foreign income, but not by the geographical distance between Ethiopia and its trading partners. Furthermore, Ethiopia's similarity endowments are found to exert negative effects on the country's total trade, while being statistically significant.

The main limitation of this study was that it examined the determinants of Ethiopia's bilateral trade flows using aggregated data on bilateral exports and total trade. However, the effective implementation of the supply-side policies (such as increasing the productive capacity of the agricultural sector) recommended in this study necessitates the identification and detailed understanding of factors that significantly affect specific export sectors of Ethiopia. Thus, analysing the bilateral flows of Ethiopian trade from within the gravity model using disaggregated data specific to the sector can be considered in future studies.

Another limitation of the study is that it failed to examine Ethiopia's trade potential with its partners. That is, this study is unable to indicate with which countries Ethiopia has unexploited trade potential and with which it has exhausted its trade potential. A consideration of this in future studies will help the nation to identify the countries in which there are high prospects for expanding exports in order to maximise its gains from bilateral trade.

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