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DETERMINANTS OF ETHIOPIA'S LIVE ANIMAL EXPORT: A GRAVITY MODEL APPROACH

BY

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Determinants of Ethiopia's live animal export:

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I the undersigned declare that this Thesis is my original work; prepared under the guidance of Wendmageng Chekol (Dr.). All the sources of materials used for this thesis have been dully acknowledged. I further confirm that the thesis has not been submitted either in part or in full to any other higher learning institution for the purpose of earning any degree.

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TABLE OF CONTEN

CONTENT **Page number**

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LIST OF ACRONYMS

AGP- LMD	Agricultural Growth Program- Livestock Market Development Project
COMESA	Common Market for East and South Africa
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
G2SLS	Generalized Two Stages Least Squares
GDP	Gross Domestic Product
ICPALD	IGAD Center for Pastoral Area & Livestock Development (ICPALD)
IGAD	Intergovernmental Authority on Development
SPS	Sanitary and Phyto-sanitary
UNCTAD	United Nations Conference on Trade and Development
WTO	World trade organization
AGOWA	African growth opportunity
GATT	General Agreement on Tariffs and Trade
GSP	Generalized System of Preferences

LIST OF TABLE

LIST OF FIGURES

ABSTRACT

The purpose of this study is to analyze factors that determine export flows between Ethiopia and its trading partners using a gravity model approach. The research had used secondary data collected from different sources and covers periods from 2000 - 2017 for top 15 trade partners of Ethiopia, which implies that the data were panel. There was consideration of the importing capacity of the countries and successiveness of their importing condition for considering the countries as a sample. Different tests were applied in order to select the appropriate model to regress the gravity model. As of those tests, the research had adopted the random effects gravity model. The model result showed that 10 of the total variables four are significant at different level of significance. Partner country's Gross domestic Product, weighted distance between Ethiopia and partner countries', partners country's population and total road network of Ethiopia found to be a significant factors affecting Ethiopia's live animal export in the period between 2000 and 2017. While Partner country's Gross domestic Product, partner country total road network and partners country's population have significant and positive impact on live animal export of Ethiopia, the weighted distance between Ethiopia has significant but negative impact on the trade. On the other hand, bilateral real effective exchange rate between birr and partner's currency, foreign direct investment and Ethiopia's sharing of common border with partner country ,preferential trade and regional trade agreement(RTA) are found to be insignificant in affecting Ethiopia's live animal export in the indicated period. Ethiopian gross domestic product and Ethiopian population has been dropped because of the existence of milticollinierity problem.

***Keywords**: live animal export, Gravity model, random effects, Panel data, Demand and Supply side factors*

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the Study

Live animals have a significant contribution in the lives of millions of the world population. They serve as means of food, sources of income as well as means of transportation particularly in developing countries. Live animal and their products such as meat .milk, skin, hide etc also have big share in the world as well as local trades. That is why livestock play a great role in the growth of a countries' GDP. Livestock production and marketing is conducting in different parts of the world for instance Australia, Netherland, Africa and India.

"Well managed, a globalised livestock sector can benefit the national economy, provide employment, promote technology transfer, increase food safety and raise the diversity of food products available,"/ FAO 2008/.Therefore, livestock trade/export generally and live animals export particularly would have crucial and indispensable advantage if the a county is endowed and have the manner of well managed endeavors.

Live animal export is the commercial transport of livestock across national borders. From among the world countries Australia is one of the world's largest exporters of sheep and cattle. Beside feeding their people, they also feed many of Middle East and Asian countries. According to the Australian Bureau of Statistics, exports of live sheep rose 21.4% and live calves increased 9.7% between March 2017 and March 2018. During 2017 alone, Australia exported 2.85 million living animals in shipping containers and airplanes. The expansion of the trade has been supported by the introduction of purpose-built ships which carry large numbers of animals. The amount of livestock exported from the European Union grew to nearly 586m kilograms between 2014 and 2017, a 62.5% increase during the time period (Marie T. Hastreiter 20013).

By 2003, FAO estimates, the developing world will consume almost two-thirds of the global milk and meat supply, compared to just one-third 25 years ago. International trade in livestock products has increased from four per cent of production in the early 1980s to about 13 per cent in 2003. In value terms, several developing countries - notably Brazil, China and Thailand - are among the top 20 exporters and importers of livestock products.

Like to the rest of the continents, the livestock trade is important to the national economies of dry land Africa. "In East Africa the intra-regional livestock trade is a major and growing industry. The profitability of this trade is dependent on livestock being mobile across borders (Ced and Sue, 2010)."

Livestock export is a key element in the livelihood systems of pastoral and agro-pastoral Populations in the Horn of Africa (HOA). Export trade is supported by a network of regional cross border trade, where the core rangelands are connected with the final ports through a series of clan-based corridors. The cross-border trade network supports about 17 million people in the HOA including livestock producer, traders, and other groups such as trekkers, fodder traders, brokers, and middlemen who directly or indirectly derive their entitlements from livestock production and trade (AGP 2013).

It is true also in the case of Ethiopia which is greatly endowed in a variety of species of livestock. As belay indicated, naturally endowed with different agro-ecological zones and suitable environmental conditions; Ethiopia is a home for many livestock species and suitable for livestock production. The livestock sector has been contributing considerable portion to the economy of the country, and still promising to rally round the economic development of the country. An estimate indicates that the country is a home for 59.5million cattle, 30.7million sheep, 30.2million goats and 56.53million poultry. Similarly, the country has the highest draft animal population in the continent. It accounts 4.19% of global camel population, 34.5% of total Africa's animal population .It contributes 12 and 33% of the total and agricultural Gross Domestic Product (GDP), respectively, and provides livelihood for 65% of the population. The sector also accounts for 12-15% of the total export earnings. (Blay Zelke 2017).

"In Ethiopia livestock plays an important role in the national economy. Ethiopia is an important and major competitor in the live animal trade markets. Through both formal and informal trade channels, Ethiopia is a major supplier of live animals to neighboring and other international markets. Similarly, the number of live animals export has increased dramatically in last two decades(AGP- LMD, 2013; NBE, 2007).

The major markets for live animals are Saudi Arabia and Dubai. Although the potential market coverage in the Middle East countries is encouraging, the export earnings are far

below the existing capacity. However, if good infrastructures are built, the number of exporters is increased and the export problems are solved, the country can annually export over a million heads sheep, goats and cattle.(Yacob, 2002).

Even though ther is some progress in live animal market, it is not as per it could to be .As Belachew and Jemberu2002) articulated that the performance of the live animal market both for domestic consumption and for export is generally perceived to be poor. Underdevelopment and lack of market-oriented production, lack of adequate information on livestock resources, inadequate permanent animal route and others.

facilities like water and holding grounds, lack or non-provision of transport, ineffective and inadequate infrastructural and institutional set-ups, prevalence of diseases, illegal trade and inadequate internal and external market information are generally mentioned as some of the major reasons for the poor performance of this sector (Belachew and Jembaru, 2002; Yacob, 2002).

A gravity model is very important in the analysis of bilateral trade flows, and has proven to be a useful tool in determining export potential of a country. Accordingly, the purpose of this study is to analyze factors that determine export flows between Ethiopia and its trading partners using a gravity model approach(Alelign, 2014).

This study therefore motivated to investigate the major determinants of live animal export using the famous model on international trade which is gravity model approach.

1.2 Statement of the Problem

Livestock marketing is the circulation of livestock and the efforts made to supply to market stocks in order to increase productivity. Ethiopians have been engaged in livestock production and trade for centuries. Ethiopia has achieved considerable economic growth over the past five years, driven mainly by exports of agricultural products. Livestock is central to the Ethiopian economy, contributing 20% of the GDP, supporting the livelihoods of 70 % of the population and generating about 11% of annual export earnings (SPS-LMM, 2010).

It was evidenced from ICPALD (2013) that livestock and their products probably constitute a 5th of Ethiopia’s exports, but about half of these exports are not recorded or officially recognized because they are exported by the informal cross border trade in

live animals. Pastoral output underpins almost all of Ethiopia's live animal exports.

Although Ethiopia owns a significantly large livestock population, the sector has remained underdeveloped and its potential has not been efficiently and effectively used. According to Belachew and Jemberu, (2003), the country to export its livestock to the Middle East and make further improvement to enter other markets; there are internal and external challenges that Ethiopia should be dealt with in order to realize these benefits.

Regarding to the general market drawback of the sector, low productivity of the animals and the absence of market-oriented production systems, in adequacy of the volume of market surplus are among the list. In addition, the different live animals supplied to the market by pastoralists and farmers do not meet the quality attributes required by diverse market, as indicated by Adina and Elizabeth (2006).

It is vivid that absence of commercial animal health services, Non-existence of appropriate trucking equipment, Lack of sufficient air-cargo capacity, Underdeveloped feed industry, and lack of commercial fattening and holding facilities are an internal and computation and absence of clear market information are external bottleneck of Ethiopian live animal export. .

A lot of investigations were took place to identify factors affecting export performance in several countries using Gravity model approach based on a panel data set. For instance Yishak Taye(2009), has done his research on determinants of Ethiopian export : gravity model,

There is also a study on determinants of Ethiopia's agricultural export using gravity model which studied by teklewengel (2017) for his Masters fulfillment. In addition to this, Mr. Harrison Kimutal Yagot (2017) has been studied on the topic " the analysis of Kenyan live stock export : gravity approach "

Even though there are several studies regarding international trade, as per my investigation, I couldn't see the research done on Ethiopian live animal export specifically. Having this in mind, the study was focused on the factors affecting live animal export using gravity model approach.

1.3 Objectives of the Study

1.3.1 General Objective of the Study

Generally, the research was designed to identify the significant determinants of live animal export in Ethiopia using gravity model during the period of 2000-2017.

1.3.2 Specific Objectives of the Study

The specific objective of the study has depicted as two major objectives. Those are:

1) To assess the performance of live animal export.
2) To identify the determinants of live animal exporter in Ethiopia using gravity model approach.

1.4 Research Hypothesis

The increase in the inflow of foreign direct investment, the growth of Ethiopia's and partner country's GDP, sharing a common border with partner country, improvements in internal transport infrastructure and bilateral real effective exchange rate, affect the performance of Ethiopia's agricultural export.

1.5 Significance of the Study

In fact, Ethiopia's major exports of live animals have indeed shown improvements in terms of volume and generating foreign currency. Ethiopia is attaining significant outcome from the export of livestock products, and has been contributing crucial role in the development of nation's economy. But many argue that as Ethiopia is the leading country in Africa with its large livestock inventory and potential supply base for the live animals' export, the quality and quantity being exported are not as it would be compared to the stock./AGP/.

This research was focused on the analyze of the main determinants of Ethiopian live animal export and as it also will assess the root cause of poor performance of live animal export in Ethiopia , exports and other stake holders can use the result of the stud to alleviate the identified problems and enhance their export performance .

As AGP (Livestock Market Development Project) stated that one of the major economic objectives of the government of Ethiopia is pursuing a policy of maximizing revenue of live animal and meat exports.

Therefore, so as to attain the above objectives of the country this study could have its own contribution to the policy makers for using appropriate policy interventions. Furthermore, study will also provide a clue of the main focus areas that the government in large and the exporters as well as the producers/suppliers should give due attention on it, so as to achieve the intended goal. Lastly , since more is not studied in this area specially in nationwide , the study will also be used as an input and reference for researches aimed at similar or related areas of the study.

1.6 Scope and Limitation of the Study

The scope of the study period was limited on the determinants of live animal export during the period between 2000 and 2017. In addition to this the performance of Ethiopian live animal export during this period was also assessed. The study would better if it was assessed including animal products like milk, hide and skin beside the live animal export. Because of time and cost limitation the researcher was concentrated on the factors affecting live animal export in Ethiopia.

1.7 Organization of the study

In this paper, the introductory part of the proposal, which addresses background of the study, statement of the problem, objectives of the study, significance of the study, and scope and limitations of the study have been discussed. In addition to that, in chapter two literatures have been reviewed. Moreover, in chapter three methodologies as well as in chapter four result and discussion was discussed. Finally, conclusion and recommendation have been depicted.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Theoretical Literature

2.1.1 Determinants of Export Performance

The specific factors influencing export performance vary from one country to another. Many scholars have categorized determinants of a country's export performance into two major factors: internal supply and external market conditions (UNCTAD, 2005).

2.1.1.1 Internal Supply and External Market Condition

Export supply capacity

Supply conditions are fundamental in defining the export potential of an economy and, for a given level of access to international markets, countries with better supply conditions are expected to export more (Fugazza, 2004). The agenda for assessing export supply constraints needs to consider both constraints to traditional export supply as well as constraints to shifting resources into new export activities (Biggs, 2007). Key determinants of supply side conditions are classified into four major components: domestic transport infrastructure, macroeconomic environment/real exchange rate, foreign direct investment and institutional quality (UNCTAD, 2005). Those factors are discussed below;

- Domestic Transport Infrastructure:

Among the main determinants that affect supply capacity generally t and live animal supply capacity specifically is the domestic transport infrastructure. It is likely to play an important role especially at the early stages of export sector development (UNCTAD, 2005). Most African countries are characterized by poor transport infrastructure, which is a major impediment to trade, competitiveness and sustainable development and isolates countries, inhibiting their participation in global production networks. Due to poor internal transport infrastructure .African transport costs are high making their exports expensive and uncompetitive and reducing foreign earnings from exports (UNCTAD, 2003;).

The analysis of African trade flow shows that their relative volume is low due to poor infrastructure Therefore, improvements in transportation services and infrastructure can lead to improvements in export performance (Fugazza, 2004).

It has been shown that infrastructure affects trade via altering transport costs. In this

context (Edwards and Odendaal 2008) argue that infrastructure directly affects transport costs by determining the type of transport used (for example, the type and quality of roads determines the maximum size of trucks) and delivery time for the goods. Bougheas, Demetriades and Morgenroth (1999) have analysed the effects of infrastructure on trade through its influence on transport costs and found a positive relationship between the quality of infrastructure and the volume of trade. Fugazza (2004) also finds that the internal transport infrastructure has a significant and positive impact in raising exports.

- Real Exchange Rate:

The second major factor that affects export supply capacity is the real exchange rate. The real exchange rate can be an important element in determining export growth, diversification and international competitiveness of goods produced in a country (UNCTAD, 2005).

As stated in Yshak Tekalgn Taye 2009, a stable real exchange rate is conducive to export expansion. The real exchange rate is often rendered uncompetitive in low income countries by poor economic management and turbulence in financial markets (Biggs, 2007). Ensuring that the real exchange rate adjusts to more realistic levels is a means of enhancing the economy's incentives for exporting and can lead to an increase in the production of export products (De Rosa and Green, 1991; Oyejide, 2007). While an overvalued currency can undermine export competitiveness through a direct loss of price competitiveness for exporting firms undervaluation of the currency can bolster export competitiveness (Biggs, 2007), enhance the incentives for export activities (Oyejide, 2007) and lead to diversification of exports (Sorsa, 1999; Mouna and Reza, 2001).

Empirically, it has been proven that the real exchange rate has a significant effect on a country's export performance (Sekkat and Vaoudakis, 1999; Mouna and Reza, 2001). While appreciation of the real exchange rate affects exports negatively (Sharma, 2000; Love and Turner, 2001; Edwards and Alves, 2005; Morrissey and Mold, 2007), depreciation affects exports positively (Asmerom, 1999; Achy and Sekkat, 2001; Mouna and Reza, 2001; Edwards and Alves, 2005). On the other hand, some

Studies indicate that the effect of exchange rate variability on exports is ambiguous (Hooper and Kohlhagen, 1978; Klaassen, 1999; Du and Zhu, 2001; Kihangire, Potts and

Cameron, 2005).

The effect of the exchange rate on exports depends on the price elasticity of export supply because the real exchange rate should incorporate the price effect on exports. Thus, the higher the price elasticity, the more competition face exports of a particular country on the world market. In general, industrial products have a higher price elasticity than primary products, which causes industrial exports to respond perfectly to changes in the exchange rate (Roshan, 2007). Conversely, the low response to price changes of demand for primary products, which are the main exports of LDCs, implies that LDC exports respond imperfectly to changes in the real exchange rates, i.e. the effect of exchange rate changes on LDCs exports is ambiguous.

- Foreign Direct Investment:

Foreign direct investment (FDI) is another important factor affecting the export supply capacity of a country. By increasing capital stock, FDI can contribute to a more efficient use of existing resources and absorb unemployed resources and thus increase a country's output and productivity (De Gregorio, 1992; Seetanah and Khadaroo, 2007). However, the World Bank (1993) notes that the role of FDI in export promotion depends crucially on the motive for such investment: If the motive behind FDI is to capture the domestic market (tariff-jumping type of investment), it may not contribute to export growth. On the other hand, if the motive is to tap export markets by taking advantage of a country's comparative advantage, then FDI may contribute to export growth. Thus, whether FDI contributes to export growth or not depends on the nature of the policy regime (Sharma, 2000).

- *Institutional Quality:*

The fourth and last major factor that affects export supply capacity is institutional quality. Weak and missing institutions have been shown to limit the ability of firms to take advantage of new trading opportunities in low-income countries (Roland 2000; Stiglitz and Charlton 2006; Biggs, 2007). In this regard, Francois and Manchin (2006) show that export performance and, the propensity to take part in the trading system at all, depend on institutional quality. Anderson and Marcouiller (2002) also find that a deterioration of the quality of a country's institutions should result in a reduction of its exports (cf. Francois and Manchin 2006). However, evidence from successful exporting countries indicates that

good institutions have large elements of indeterminacy and characteristics specific to individualcountries (Biggs, 2007).

In addition to the direct effect, institutions may also indirectly affect trade through their impact on other variables that determine trade flows like investment and productivity (Méon and Sekkat, 2006). The quality of institutions affects the investment climate, which in turn affects the supply capacity of the economy (World Bank, 2004a; Munemo, Bandyopadhyay and Basistha, 2007). Méon and Sekkat (2006) have shown in their empirical analysis that a deterioration of the quality of institutions results in lower investment which in turn lowers trade. Moreover, bad institutions reduce aggregate productivity (Hall and Jones, 1999; Olson, Sarna and Svamy, 2000; Méon and Sekkat, 2006). In relation to this, Méon and Sekkat (2006) argue that countries whose institutions result in low productivity will likely have difficulties in exporting and trading abroad.

- Market access conditions:

The other major factor that determines export performance of a country is related to the external market access conditions for its exports. The literature has shown that foreign market access and supply capacity conditions are equally important for the development of a country's external sector (Redding and Venables, 2003; Fugazza, 2004). In the case of foreign market access, two dimensions can be considered. The one is explained through interventions by trading partners, and the second one is related to the measures implemented by the exporting country to provide its exportable with a price advantage (McCarthy, 2008).

Trading partners influence the export performance of a country through their trade policies tariff and non-tariff measures). In the world economy since 1950 there has been a massive liberalization of world trade, first under the auspices of the General Agreement on Tariffs and Trade (GATT) and now under the auspices of the World Trade Organization (WTO)1 (Thirlwall, 2000). Due to these and other trade negotiations, access to international markets has improved (Thirlwall, 2000; Fugazza, 2004; Clarke, 2005; Biggs, 2007).

- Trade Barrier/Tariff and Non -Tariff Barrier:

Meaningful market access requires a further lowering of all kinds of barriers to trade (Mold, 2005; UNCTAD, 2005). In this context, UNCTAD (2005) notes that the most

important actions should be tackling high tariff peaks and escalation2 facing items of export interest to developing countries' agricultural and non-agricultural exports. In industrial countries, border protection in manufacturing is generally low but remains high for labor-intensive products of interest to developing countries (IMF and World Bank, 2001).

As indicated by the IMF and the World Bank (2001), tariff peaks and escalation in sensitive products (textiles and clothing, agriculture, food products, wood products, and pulp and paper) disproportionately affect the products exported by developing countries and inhibit the diversification of exports toward higher value-added products.

In recent years, non-tariff barriers (NTBs)3 have become increasingly important (UNIDO, 2002; UNCTAD, 2005). As noted by UNIDO (2002), products have to comply with a myriad of technical standards, health and safety requirements and regulations etc. set by importing countries. These barriers have had serious implications for developing countries in terms of high compliance costs and potential or actual trade losses (UNCTAD, 2005).

Moreover, such barriers to market access undermine incentives in low income countries to move into higher productivity, nontraditional export areas (Biggs, 2007). UNCTAD (2007), based on a data for 1999-2001, NTBs affect LDC exports more than other developing country exports. For example, NTBs like environment related trade barriers affect 41% of merchandise exports of LDCs but only 21% of other developing country exports. In this regard, Mold (2005) estimated the potential loss of Africa's trade through the imposition of higher quality standards and phyto- sanitary controls and indicated that the potential loss for LDCs could run into millions of dollars. In relation to this, Kirchbach and Mimouni (2003) also note that LDCs are the most exposed to NTBs and show that while 40% of LDC exports are subject to NTBs, the figure for developing and transition economies is only 14%.

Developed countries have designed and offered preferential access schemes (such as EBA andAGOA) for poor developing countries in order to ensure better access to their markets without asking for a reciprocal treatment in exchange (Kirchbach and Mimouni, 2003), with the objective of raising beneficiaries' export earnings (Paul, 2003). Even though, to some extent, the restrictive effects of tariff and non-tariff measures are mitigated by these

preferential access schemes for poorer countries, these schemes are still affected by the existence of tariff peaks and tariff.

As mentioned before external factors affecting the country's export performance are those that affect market access, location of a country relative to main international markets and other factors that affect demand of importing country. Some of the main external factors determining export performance include;

- Gross Domestic Product/ Economic Size

Gross Domestic Product used as an indicators or proxy for a country's economic size. Higher GDP values in the exporting country imply increased capacities for export. It is expected to have to have a positive impact on a country's export performance. A higher level of production is the main cause of export expansion. Thus a higher GDP implies a higher production and hence larger volume of exports (Nega, 2013). Improvement in GDP of the exporting country indicates supply capacity of the exporting country while improvement in the GDP of a partner's country indicates market access for exported products. Higher income of an exporting country indicates the capacity to produce more output and hence surplus for exports. Meanwhile, higher income of importing countries boosts the affordability of their economies for imports (Gebreyessus, 2011).

- Preferential markets:

Exports from developing countries have historically received unilateral tariff preferences in industrial country markets via the Generalized System of Preferences (GSP) and other similar arrangements. Several developed and transition economies granted duty-free and quota-free market access for all or almost all exports from least-developed countries (UNCTAD, 2008; WTO, 2005).

Least developed countries (LDCs) have been granted preferential tariff treatment in the markets of developed and developing countries (transition economies) for their export under a number of schemes and arrangements, such as the Generalized System of Preferences (GSP), the trade preferences under the former African, Caribbean and Pacific Group of Countries (ACP)–European Community (EC) Cotonou Partnership Agreement, duty-free and quota free schemes (such as AGOA) and other unilateral preferential instruments granted to selected countries and groups of countries (UNCTAD, 2012; WTO,

2005).

A number of developed and transition economies granted a unilateral duty-free and quota-free market access for all or almost all exports from least-developed countries. These include a preferential market access offered by Canada, the EU, New Zealand, Norway and Switzerland. Among the major developing countries (transition economies) , Singapore and Hong Kong, China ,India Turkey and Korea already offer preferential duty-free and quota-free access on mostly in a non-reciprocal basis almost to all or a limited range of products from least-developed countries (WTO, 2005).

Those initiatives have an encouraging contribution in promoting exports of the least developing countries especially those in Sub-Saharan Africa. However as it is frequently stated, most LDCs fail to fully utilize those preferential market access offers mainly due to their supply capacity limitations.

- Regional Trade Agreements:

A south–south trade and regional economic and trade agreements, can provide a supportive environment for improving export performance. Intraregional market access played an important role in enhancing the export performance. There has been a dramatic increase in the number of regional trade agreements (RTAs) in the post-Uruguay Round period, many of them among developing countries, indicating the interest of developing countries to open their own markets to one another. Regional trading groups are growing in the developing world, especially in Africa. There are a number of regional groups in Africa and on average each of the 53 countries on the continent is a member of four (typically overlapping) groups (UNCTAD, 2008).

A growing South- South trade represents an important opportunity for developing countries to increase their exports. Large percentage of developing country exports are to other developing countries and trade between them is increasing. It can also be a useful testing ground for developing countries to build export capacities, including in dynamic and new sectors (Ibid, 20000).

- Theoretical Framework for Modeling Export Performance

Redding and Venables (2003) and Fugazza (2004) developed a theoretical framework using one of the international trade models, i.e. a trade model based on product

differentiation derived from a CES demand structure, for estimating the gravity model in order to analyse a country's export performance. In this paper, I follow their approach to develop a theoretical framework for modeling Ethiopia's live animal export performance. Following Redding and Venables (2003) and Fugazza (2004), the range of products produced in each country i and the demand for differentiated products by country j is modeled by the constant:

$$\mathbf{Uj = [\sum n_i x_{ij}(\sigma\text{-}1)/ \sigma]\sigma/(\sigma\text{-}1)\ ,\sigma > 1}$$

Where Uj denotes the utility function of country j; σ is the elasticity of substitution between any pair of products; ni refers to the set of varieties produced in country i; and xijis the consumption in country j of a single product variety from this set.

In this framework, the demand in country j for each variety is given by the form:

$$\mathbf{X_{ij} = p_{ij}\text{-}\sigma\ _E j\ ^G j^{(}\sigma\text{-}1)_{(2)}}$$

Where Gj = [∑Ri nipij1-σ]1/1-σ refers to the price index defined over the prices of individual varieties (pij) produced in i and sold in j; Ej is country j's total expenditure on differentiated products; Ej Gj(σ-1) is a scale factor that indicates the position of the demand curve in market j; and σ refers to the own price elasticity of demand across varieties. It is assumed that the producer price piis the same for all varieties produced in country i.

Transport frictions, which reflect the cost of getting a good from country i to country j, are set proportional to producer prices. This cost includes: the cost of getting the product to and from the border in countries i and j (ti and tj respectively) and the cost of getting the product across the border (Tij). While intra-country cost (ti and tj) would reflect internal geography and infrastructure, inter-country cost (Tij) would reflect external geography and policy barriers. Thus price pij = pitiTijtj, which refers to the cost of delivery of a product from country i to market j.

The value of total exports of country i to country j, therefore, take the form

$$\mathbf{n_i p_i x_{ij} = n_i p_i 1\text{-}\sigma_{(t} i^T ij\, j^{t_j)} 1\text{-}\sigma_E j^G j\sigma\text{-}1}$$

This equation of bilateral trade flows provides a theoretical support for estimation of gravity trade model. This equation can be re-written as

$$n_i p_i x_{ij} = [n_i (p_i t_i)^{1-\sigma}{}_{](T} ij^{)} 1-\sigma_{[E} j^{(G} j^{/t} j^{)} \sigma-1_{]}$$

The right hand side of this equation contains both importer and exporter country characteristics. The term ni(piti)1-σ reflects supply capacity of the exporting country. It is the product of the number of varieties and their price competitiveness. The last term Ej(Gj/tj)σ-1 refers to market conditions of country j: it depends on the total expenditure in country j, on internal transport costs tj, and on the number of competing varieties and their price expressed in the price index. Denoting market capacity and supply capacity by Mj and Si respectively, so

$$M_j = E_j (G_j / t_j)\sigma-1, \qquad S_i = n_i (p_i t_i)^{1-\sigma}$$

Therefore, from equation number 4, bilateral trade flows can be expressed as the product of exporter supply capacity, importer market conditions, and the term Tij1-σ which measure bilateral trade costs between them. Hence,

$$n_i p_i \sum x_{ij} = S_i \sum (T_{ij})^{1-\sigma}{}_M j$$

Considering a country's overall export performance, the total value of exports at the country level can be expressed as :

$$x_i = n_i p_i \sum x_{ij} = S_i \sum (T_{ij})^{1-\sigma_M} j$$

Where the term $\sum (T_{ij})^{1-\sigma}{}_M j$ refers to country **i**'s foreign market access $\mathbf{FMA_i}$.

Therefore this equation implies that the product of supply capacity and foreign market access gives the total value of a country's exports.

2.1.2 Theoretical Foundation of Gravity Model In The international trade

Gravity model is one of the most important empirical approaches in international trade. Its origin goes back to the Newton's law in physics, in which the gravitational attraction between two objects is equated to the product of their masses divided by the distance between them (Rahman, 2006). It was Anderson (1979) who first attempted to provide theoretical justification for gravity model based on constant elasticity of substitution (CES) preferences and goods that are differentiated by country of origin which came to be known as the Armington assumption. The implication of these assumptions is that countries consume at least some of every goods from every country no matter what the prices are. Therefore, in equilibrium, all countries participate in international trade and all

commodities are traded so that national income is the sum of home and foreign demand for the commodity that each country produces. Hence larger countries tend to export more and import more.

Anderson and van Wincoop (2003) develop a theoretically grounded estimable gravity model which owes its form to homothetic preferences approximated by constant elasticity of substitution (CES) utility function for consumers. Consumers' utilities increase from consuming more of a particular good, or from consuming a variety of goods. On the production side, Anderson-van Wincoop model assumes that each firm produces a unique product under increasing returns to scale. Hence consumers enjoy variety of products from different country.

Appleyard & Alfred J. Field, 2004; Shepherd, 2012 indicate that the model able to provide an empirical explanation for international trade and uses an equation framework to predict the volume of trade on a bilateral basis between any two countries. It differs from most other theories in that it trying to explain the volume of trade but not on the composition of that trade. It considers economic sizes and distances between nations are the primary factors that determine the patterns of trade across national boundaries.

As per this model, larger economies are more likely to produce goods and services for domestic consumptions and exports than small economies. In addition the distance or geographical location between individual countries or markets has an influence on the cost of imports and exports of products (Verter, 2015). The variables that are nearly always used in the equation as determining factor to the flow of volume of exports from a country I (exporting country) to a country (importing county) II are national income variables (GDP and GNP) and Distance as proxy for transportation cost.

A national income variable expected to have a positive relationship with the volume of exports from country I to country II. This is because higher income in importing country would cause its consumers to buy more of all goods, including goods from country I. country may reflect a greater capacity to produce and hence to exports more goods to II. On the other hand a distance variable expected to have a negative impact on the volume of export since being at greater distance would reduce the volume of exports from country I to country II (Appleyard & Alfred, 2004). Sometimes other variables are introduced, such

as population size in the exporting and/or importing country (to get at large market size and thus perhaps to economies of scale) or a variable to reflect an economic integration arrangement.

2.2 Empirical Study of Determinants of Live Animal Export

A lot of investigations were took place to identify factors affecting export performance in several countries using Gravity model approach based on a panel data set. The studies focused on signifying the country's export growth and performance in the global and regional market. Below is selected presentation of these studies.

Taye (2006) employed gravity model with panel data using 30 Ethiopia's trading partners for the period 1995-2007 to study the determinants of Ethiopia's export performance. The model was estimated with the Generalized Two Stages Least Squares (G2SLS) method. The findings of the study suggest that supply side conditions are a major factor for Ethiopia's export performance. The results also showed that good institutional quality and internal transport infrastructure appear to be major determinants, whereas the real exchange rate and FDI have no statistically significant effect on Ethiopia's export performance.

As indicated in the study among supply side factors improvement in institutional quality, internal transport infrastructure and growth Ethiopia's GDP found out to be positive and significant in affecting Ethiopia's export. Furthermore the study shows that factor related to foreign market access condition such as improvement in the partners country's GDP have a positive but import country's trade policy (import barrier) by partner country and weighted distance (proxy for transport cost) have a negative but significant effect on Ethiopia's export. On the contrary bilateral real exchange rate and FDI has no statistical significant effect on the country's export performance in the stated period.

The study indicates that both Ethiopia's and partners countries GDP and population size have positive and significant while distance between Ethiopia and importing countries have a significant but negatively impact on country's export performance. The study further indicates that Ethiopia's population size, Real exchange rate and everything. But Arms initiative (GSP by EU) found to be insignificant in affecting the Ethiopia export in the stated period. On the other hand, study signifies that Ethiopia has the highest

unexploited potential in U.A.E and even a significant amount in Saudi Arabia. Based on estimated coefficients coupled with International Trade Center's (ITCs), the study indicated that Gold, coffee and tea, fruits and vegetables, live animals, meat and meat preparations and cut flowers are among the products that have the highest future potentials for Ethiopia's export in those three middle east countries.

Based on an extended Gravity model, Alelign (2014) investigated factors deterring Ethiopia's export with its 14 major trading partners for the period 1995-2010. Based on a Hausman specification test the author adopted a random effect model to conduct a Gravity model estimation. As indicated in the study, Ethiopia's and partner country's per capita GDPs, population size of trading partners and the distance between nations are significant in affecting the country's export with the expected sign. In addition the despite against their expect sign, population sizes of Ethiopia and bilateral exchange rate found to be significant in affecting country's export in the indicated period. On the other the study concluded that improved paved roads and institutional quality didn't have a statistical significance in affecting the Country's export to those major trading partners in the stated period.

Some factors which identified by Karl M.Rich, Brian D. Perry Simeon Kaitibie, Mitiku Gobana Nega ,Tewolde Taye (2007) will be discussed below.

The longer period taken to lift the ban: Many efforts were made both by the government and the exporters in order to retain original market positions in the Middle East countries. To facilitate these tasks, the government was highly involved in convincing the Saudi Arabia government in general and the buyers in particular. The buyers were invited to visit the export abattoirs with the objective of checking them whether they meet their requirements or not. Accordingly, some of them were found appropriate to export their products and the rest are still not allowed to export until they become satisfying the requirements. Beyond the longer time it took to lift the ban, the achievements are only for sheep and goat meat not for live animals, which is still under banning.

Lack of Quality and Sanitation: Any export product has to qualify and get acceptance by buyers for its quality before its shipment to the export market. In other words

certification for standard conformity is one of the basic elements to enter export market. However, when it comes to these products, there are many difficulties encountered by exporters starting from the source of animals where the animals are not free from diseases and to the export outlets. In short, due to quality problems, products are mainly not competitive. Therefore, one cannot blame the buyers in a situation where the supply is highly constrained by poor quality product.

Prevalence of animal diseases: The supply chain begins from the selection of animals at each animal collection center where animals will be tested for their health conditions. If they qualify then they will be transported by truck to animals' rest places where veterinary treatment services will be provided for few days before they are taken to the slaughtering houses. After slaughtering, the meat should be preserved in the abattoirs before transporting it to the airport for export. All these supply chains are determinant factors for the quality of the meat. Not caring one of these will impact negatively on the quality and ultimately the demand for the product will decline. Therefore, animal diseases and problems arise through the whole production processes are bottlenecks for the export growth.

Karl M. Rich,Brian etal, 2008 in their Final report for the Texas Agricultural Experiment Station continue to list the factors determining live animal export.

High labor cost for loading and unloading of live animals at the port of Djibouti: This problem accompanied by high port rent and poor port facilities, which cannot accommodate the animals for a certain period of time with feeding, and the necessary veterinary services have intensified the export problems.

Levying taxes on live animals by different regions: These taxes are mainly levied in the Southern Nations, Nationalities and Peoples Regional Government (SNNPRG) and the Oromia Regional Government. This approach will discourage animal producers to supply them on a legal base and they rather prefer to go for the contraband. Ultimately, the supply of animals will be restrained.

Levying taxes at the port: The exporters are always complaining about unnecessary taxes imposed on them and at the end of the day the business will not be profitable for them. Therefore, they will be forced to quit the export business

Existence of contraband trading: This problem has been there for the last many years and has constrained the supply of animals for export. These illegally traded animals are rather exported in the name of the recipient country where the animals are contraband. This has really damaged the country's export activities and at the same time it has contributed for the declining trend of exports.

Delay in counting live animals at the border by the Ethiopian Customs Authority (ECA): This delay has created inconveniences for the smooth facilitation of the export of live animals.

Existence of poor transportation infrastructure: In the case of live animals export, this problem has become a usual case. Therefore, lack of well-conditioned livestock truck will deteriorate the equality of the product.

Lengthy bureaucratic procedures: At present, an exporter has to pass many steps before loading the product for export. According to the views of exporters, they have to knock at least 9 offices for signatures. Moreover, this long process is accompanied by making effective different payments. In terms of time, it is very costly. All the processes, for instance, health, and authentication by respective embassies are compulsory.

High freight cost and space problem: The transportation cost has restrained the exporters not to expand their export markets. Let alone to expand, even to retain the existing markets has become a difficult task due to the periodic increase of the freight cost. On the other hand, export cancellations are every flights phenomenon because of cargo space problems in the passengers' plane, The EAL is always giving priorities to ts passengers and then whenever there is space, it will manage to carry export products. One can realize from this experience that the export is basically handicapped by shortage of transportation infrastructure. In connection with this problem, the airport is also lacking cold storage facilities. Without these facilities, it is difficult to imagine that export businesses are sustainable trading ventures.

High cost charged by Embassies: For every shipment the embassies are asking for payments to be effective for their approvals. This has created inconveniences among the exporters because it has increased their overhead costs.
Sanitary and Phytosanitary compliance/SPS Certification: Karl M. Rich,Brian etal,

(2008), in their Final report for the Texas Agricultural Experiment Station,they indicated different issues regarding SPS Certification on livestock production. Some of them are detail discussed here below. Ethiopia is the largest livestock producer in Africa and one of the largest in the world. Despite increasing growth in livestock product exports, most exports from this sector remain concentrated in informal sales of live animals, with limited benefits in terms of foreign exchange and value-adding opportunities. The Ethiopian Government has set a target to increase exports to 30,000 tons of meat by 2008 that will need to be met by export growth in beef/MOA , 2016 /. This will necessitate significant improvements in the marketing and sanitary and phytosanitary (SPS) certification of beef exports to meet rising standards in growing markets.

As in stated in the Final report for the Texas Agricultural Experiment Station 2014, the proposed SPS certification system involves the following export steps

- Pre-purchase inspection of animals
- Phase 1 SPS certification
- Phase 2 SPS certification
- Export of live animals
- Export abattoir

Pre-purchase inspection of animals: Before purchasing animals from a specific area, the private animal health personnel representing the traders must contact the local veterinary officers at *woreda* levels to collect information on the livestock disease situation in the source area. This is done to minimize the risk of purchasing infected or sick animals. Based on the collected information, individual animals should be visually inspected for physical fitness, body condition, hair coat, alertness, salivation, eye discharge, mouth lesions, lameness and any other abnormalities.

The purchased animals are then collected and kept for up to three days at temporary collection sites pending transportation to the Phase 1 SPS certification facility. The temporary holding area must be well fenced to avoid the purchased animals from getting into contact with other domestic livestock, pets or wild animals. The area must also be sited away from livestock markets, trekking routes and high livestock density areas. As feed and water can be sources of disease, animals at the site should be provided with safe

hay and clean water.

Within 1–3 days, animals must be transported to the Phase 1 SPS certification facility using specially designed, disinfected and sealed vehicles. Animals must be loaded, transported and unloaded humanely. Standard operating procedures (SOPs) for animal handling are to be prepared, and training and supervision conducted. Animals leaving purchase sites will be accompanied by animal health certificates to be provided by the animal health inspector representing the private sector.

Karl M. Rich,Brian etal (2008),continue to lists phases in the SPS certification.

Phase 1 SPS facility

Phase 1 facilities will be located closer to sources of cattle, even in the pastoral areas, because the amount and type of feed required during Phase 1 will be less expensive. In fact, it makes sense to have many, relatively low capacity Phase 1 facilities in order to access cattle from different market areas. In addition, decentralizing Phase 1 facilities (even to the point where each facility only takes a single cohort at a time) will reduce risk that an infected animal in one cohort will infect other cohorts being held in the facility at the same time.

The Phase 1 SPS facilities must be organized according to the following criteria:

- As it is very difficult to achieve biological separation within the same facility, the facility will be split into many small facilities with capacities of 100–130 animals.
- The facilities will be established in an area of low livestock density, away from human habitation, game reserves, livestock trekking routes and markets. Phase 1 SPS certification facilities are establishments of small land area which are located near livestock sources.
- The facilities will be double-fenced with 5 cm wire mesh and a 10 m gap between the two fences.
- Based on risk pathway analyses, these facilities will have buffer zones around them where vaccination and surveillance activities will be conducted on major trans boundary animal
- Diseases (TADs) in the surrounding villages. The facilities will have loading and

unloading ramps within paddocks or a specially designated place.

- Feed and water will come from safe sources.
- New addition invalidates the holding period; the holding period will re-start as Day 1 from the day of contact.
- The compound will be managed to avoid water logging.
- The facility will be fitted with inspection crushes for animal inspection, sample collection and other relevant veterinary interventions.
- 'Sick' and 'convalescent' pens will be constructed to isolate sick animals. Foot and tire disinfection and decontamination facilities will be made available at the entrance of the facilities

Karl M. Rich,Brian etal (2008),continue to lists phases in the SPS certification.

Phase 2 SPS facility:

Phase 2 SPS certification facilities are profit centres to be operated by private entrepreneurs. These facilities are potential profit centres because animals leaving Phase 1 will be certified as potential for export and will have greater value for Phase 1 operators.

Phase 2 will be operated by relatively large, well-managed feedlots. The availability and cost of feed will be the major factors which decide where these feedlots are located. Because 8–10 kg of feed are required per kilogram gain, it will generally be cheaper to move cattle closer to feed sources to avoid transporting feed to these facilities. Locating Phase 2 facilities in pastoral areas will not be profitable either.

Therefore, Phase 2 SPS certification facilities will be established in strategic locations that allow good access to feed resources and meat processing abattoirs or along the way to the port of embarkation. Both Phase 1 and Phase 2 facilities are expected gradually to produce about 30,000 tons of boxed, boneless and vacuum-packed export quality meat by the end of 2008.

Cattle will remain in Phase 2 as long as it takes to reach export quality. For example, if export quality meat is produced from 400 kg Borana bulls at 40 months age, then the age and weight of the bulls in the cohort entering the feedlot will determine the number of days on feed. If they weigh 250 kg on entry and gain 1 kg/day, they will be in the feedlot

for 150 days.

Export of live animals

The following activities should be carried out when exporting live animals:

- Animals must be transported in specially designed, properly disinfected and sealed trucks.
- Before loading animals, the certifying animal health officer must check and confirm that animals are individually certified, carry identification numbers or tags, are physically healthy and alert and are not bruised or injured. The inspector should reject non-compliant animals. The animal health inspectors will continue to certify live animals coming out of the two-phase SPS facilities. However, it is very difficult to guarantee that animals will be healthy when they arrive at the destination countries. Hence, the certificates should clearly indicate that animals were healthy when they left the SPS facilities.
- Animals must be humanely loaded, transported and unloaded; SOPs for animal handling are to be prepared and training and supervision conducted. As the trip from Phase 2 SPS certification facilities to the exit port may take several hours, a temporary rest area with secure fencing needs to be organized for watering and feeding the animals. The area must be fenced with wooden or concrete poles and tensile barbed wires to avoid contact with other animals in the area. The fence should be at least 2 meters high. The holding area also needs a ramp for unloading and loading.
- As feed and water can be sources of disease, animals should be provided with safe hay and clean water.

A single-phase SPS certification system for sheep and goats

Unlike cattle, sheep and goats do not go through fattening lots for reconditioning because of problems adapting to changes in feeding regime (hay/concentrate) and their vulnerability to climatic variations. Therefore, a single-phase SPS certification system is recommended for small ruminants for up to two weeks before slaughter or live export, as the incubation period for most important diseases does not exceed 10 days). Upon arrival at the SPS certification facility, sheep and goats should be vaccinated against

important diseases like PPR, sheep and goat pox, pasteurellosis and CCPP and go through a similar monitoring system as cattle. Depending on the requirement, they may be screened individually for brucellosis by Rose Bengal Plate test and randomly for other trade-sensitive diseases.

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1 Research Methods

This proposal is designed to examine the determinants of Ethiopia's live animal export. Accordingly, in this chapter the researcher will briefly discussed the study area, target population, research design and strategy used, data type and source, data collection instruments, and the methods of data Processing and analysis are discussed.

3.2 Description of the Study Area

Ethiopia is the un-colonized country, where the African Union/AU and its predecessor the OAU were emerged. It is the seat of the head quarter of the United Nations Economic Commission for Africa/ECA. In addition to this, several worldwide as well as continental organizations' conferences have been hosting. The country is endowed with several natural resources and gifted with the comfortable ecology. Therefore, it is suitable to live animals. That is why the country is the largest with livestock potential in Africa and the tenth in the world. And it is one of the competitors of live animal export in east Africa. The study will conduct in the period between 2000 and 2017.

3.3 Research Design and Approach

The study identified the major determinant of Ethiopian live animal export with its major trade partners like / Somalia, Djibouti, Egypt, Sudan, Saudi Arabia, United Arab Emirate chain etc/trade minister 2018/, the study was carry out through empirical investigations in the period between 2001-2017 of panel data which is believed that the time duration is enough In this period there are about 15 major countries which have been trading with Ethiopia. All top 15 partner countries was be taken as the study purpose. The study was going to identify the major factors which affect the Ethiopian live animal export with its main trading partners. Therefore, the augmented gravity model approach will employ as it is well known in analyzing the international trade.

The gravity model is widely used in econometric analysis of international trade. For the foreign trade, the gravity model analyses the determinants of bilateral trade flows, the goal being the development of more precise predictions on the bilateral trade (Elana, 2012).

3.4 Sources of Data

The paper entirely depends on secondary panel data for the purpose of empirical investigation. The study period cover the period between 2000 and 2017. The secondary data were mainly obtained from Ministry of Trade and Industry (MOTI), Ministry of Finance (MoF), Central Statistics Authority (CSA), Ministry of Agriculture (MoA) and Ministry of Revenue (MoR). In addition to this, other necessary data were obtained from various international institutions such as World Bank, IMF, FAO and UNCTAD and UN statistics division websites.

The total value of live animal export was obtained from FDRE Minister of Trade and Industry while a data of Ethiopia's and its partner GDP was taken from World Bank data base. Weighted distance was calculated from a data obtained from www.indo.com/distance.

The data in the flow of FDI obtained from UNCTAD data base and data on Ethiopia's total road network was taken from the National bank of Ethiopia/NBE/ annual reports. Bi lateral real effective exchange rate was calculated based on data obtained from World Bank (nominal exchange rate of birr and partner countries currency against US, Ethiopia's and partner countries consumer index. Information regarding Ethiopia's participation in regional trade arrangements and preferential market access extended to Ethiopia was obtained COMESA and WTO website.

3.5 Explanation of the Model

Gravity Model of International Trade:

The decomposition of a country's export performance into foreign market access and export supply capacity requires the use of bilateral trade information in a gravity model. The gravity model offers an explanation of countries' trade flows in terms of exporter and importer country characteristics and 'between country' information, particularly distance (Redding and Venables, 2003).

The gravity model originates from Newtonian physics. Newton's law of gravity in mechanics states that two bodies attract each other proportionally to the product of each body's mass divided by the square of the distance between their respective centers of gravity (Rahman, 2006). The gravity model for trade is analogous to Newton's law. The

analogy is as follows: “the trade flow between two countries is proportional to the product of each country’s ‘economic mass, generally measured by GDP, each to the power of quantities to be determined, divided by the distance between the countries’ respective ‘economic centers of gravity’, generally their capitals, raised to the power of another quantity to be determined” (Christie 2002: 81). Hence, the gravity model is formed on the central idea that income and distance between countries are positive and negative determinants of bilateral trade, respectively (Alemayehu and Atnafu, 2008).

In international trade, the gravity model was first introduced by Tinbergen (1962) and Pöyhönen (1963), mainly to account for the patterns of bilateral trade flows among the European countries (Sohn, 2001). Since then, the gravity model has been used and increasingly improved in empirical studies of international trade flows. In the last decade, the application of gravity models enjoyed a big revival not so much because of its theoretical foundation but because of the opportunity it offers to project bilateral trade relations (Egger, 2002)

Although gravity models have been criticized for their lack of theoretical underpinnings, empirically they seem to perform particularly well and are therefore well suited for policy analysis (Matyas and Harris, 1998). However, according to Matyas and Harris (1998), major drawbacks of earlier studies lie in the nature of the data used and explicit (or implicit) model restrictions: inference was drawn either upon a cross-section of country data in one time period, or upon single time series of data in a country-by-country approach. In order to account for heterogeneity across countries in trade flows, recently gravity models have been generalized and adopted to a panel data setting, where several time series of cross-section data sets were pooled (Matyas and Harris, 1998).

Due to the successive works of various economists the gravity model has gradually developed into a systematic economic model with a strong economic foundation (Sohn, 2001). Works by Krugman and Helpman (1985), Bergstrand (1989), Deardorff (1995) and Evenett and Keller (1998) greatly contributed to the establishment of a theoretical foundation for the gravity model by showing that the gravity equation can be derived from a number of different international trade models (Sohn, 2001). As indicated by Sohn (2001), while Anderson (1979) and Krugman and Helpman (1985) tried to identify the relationship between the bilateral trade flows and the product of two countres’ GDPs

by utilizing the Differentiated Products Model, Deardorff (1995) has shown that the gravity model can be derived from several variants of the Heckscher-Ohlin Model.

Oguledo and MacPhee (1994) have derived the gravity equation from a linear expenditure system. They note that “this new approach is another attempt to answer recent criticism that the theoretical foundation of the gravity model is weak" (as cited in Atnafu (2007).

Feenstra (2002), on his part, notes that the Constant Elasticity of Substitution (CES) monopolistic competition model is an especially convenient way to derive the gravity equation, especially when transport costs and other trade barriers are allowed for. According to Feenstra, Anderson (1979) was the first to derive the gravity equation while taking into account these price differences across countries.

In the following section, it will be shown how the CES monopolistic competition model is useful in deriving a gravity model in order to analyse the export performance of a country.

Theoretical Framework for Modeling Export Performance

Redding and Venables (2003) and Fugazza (2004) developed a theoretical framework using one of the international trade models, i.e. a trade model based on product differentiation derived from a CES demand structure, for estimating the gravity model in order to analyse a country’s export performance. In this paper, I follow their approach to develop a theoretical framework for modeling Ethiopia's live animal export performance. Following Redding and Venables (2003) and Fugazza (2004), the range of products produced in each country i and the demand for differentiated products by country j is modeled by the constant:

$$\mathbf{Uj = [\sum n_i\, x_{ij}(\sigma\text{-}1)/\ \sigma]\sigma/(\sigma\text{-}1)\ ,\sigma > 1}$$

where Uj denotes the utility function of country j; σ is the elasticity of substitution between any pair of products; ni refers to the set of varieties produced in country i; and xijis the consumption in country j of a single product variety from this set.

In this framework, the demand in country j for each variety is given by the form:

$$\mathbf{X_{ij} = p_{ij}\text{-}\sigma\ _E j^{\ G}{}_{\bullet}{}^{(}\sigma\text{-}1)_{(2)}}$$

Where Gj = [∑Ri nipij1-σ]1/1-σ refers to the price index defined over the prices of individual varieties (pij) produced in i and sold in j; Ej is country j's total expenditure on differentiated products; Ej Gj(σ-1) is a scale factor that indicates the position of the demand curve in market j; and σ refers to the own price elasticity of demand across varieties. It is assumed that the producer price piis the same for all varieties produced in country i.

Transport frictions, which reflect the cost of getting a good from country i to country j, are set proportional to producer prices. This cost includes: the cost of getting the product to and from the border in countries i and j (ti and tj respectively) and the cost of getting the product across the border (Tij). While intra-country cost (ti and tj) would reflect internal geography and infrastructure, inter-country cost (Tij) would reflect external geography and policy barriers. Thus price pij = pitiTijtj, which refers to the cost of delivery of a product from country i to market j.

The value of total exports of country i to country j, therefore, take the form

$$\mathbf{n_i p_i x_{ij} = n_i p_i 1\text{-}\sigma_{(t} i^{T} i j^{t_j)} 1\text{-}\sigma_{E} j^{G} j \sigma\text{-}1}$$

This equation of bilateral trade flows provides a theoretical support for estimation of gravity trade model. This equation can be re-written as

$$\mathbf{n_i p_i x_{ij} = [n_i (p_i t_i)^{1\text{-}} \sigma_{](T} i j^{)} 1\text{-}\sigma_{[E} j^{(G} j^{/t_j)} \sigma\text{-}1_{]}}$$

The right hand side of this equation contains both importer and exporter country characteristics. The term $\mathbf{n_i (p_i t_i)^{1-} \sigma}$ reflects supply capacity of the exporting country. It is the product of the number of varieties and their price competitiveness. The last term $\mathbf{E_j (G_j/t_j) \sigma\text{-}1}$ refers to market conditions of country **j**: it depends on the total expenditure in country **j**, on internal transport costs $\mathbf{t_j}$, and on the number of competing varieties and their price expressed in the price index. Denoting market capacity and supply capacity by $\mathbf{M_j}$ and $\mathbf{S_i}$ respectively, so

$$\mathbf{M_j = E_j (G_j/t_j) \sigma\text{-}1, \qquad S_i = n_i (p_i t_i)^{1-} \sigma}$$

Therefore, from equation number 4, bilateral trade flows can be expressed as the product of exporter supply capacity, importer market conditions, and the term $\mathbf{T_{ij} 1\text{-}\sigma}$ which measure bilateral trade costs between them. Hence,

$$n_i p_i \sum x_{ij} = S_i \sum (T_{ij})^{1-\sigma_M} j$$

Considering a country's overall export performance, the total value of exports at the country level can be expressed as :

$$x_i = n_i p_i \sum x_{ij} = S_i \sum (T_{ij})^{1-\sigma_M} j$$

Where the term $\sum (T_{ij})^{1-\sigma_M} j$ refers to country **i**'s foreign market access $\mathbf{FMA_i}$.

Therefore this equation implies that the product of supply capacity and foreign market access gives the total value of a country's exports.

3.6 Model Specification

Empirical Model for the Study

Alelign (2014) in his study on Ethiopia's export performance stated that, it is possible to distinguish between foreign market access and supply capacity determinants of Ethiopia's export performance using the bilateral trade information between Ethiopia and its trading partners. Thus, the value of total exports of Ethiopia to all destinations is given by:

$$X_{ij} = f(SC_i, FMA_{ij}$$

where Xij is the total value of exports from Ethiopia (country i) to its trading partner (country j), SCi is Ethiopia's supply capacity, and FMAij are the market access conditions for Ethiopian exports of Ethiopia's trading partner j.

In section two, I surveyed the most important determinants of a country's export performance as identified in the literature. In this section, these determinants are integrated into the model. For any given point in time, the foreign market access variable can be written as a function:

$$FMA_{ij} = g[GDP_j, POP_j, \sum (T_{ij})^{1-\sigma_l}$$

Where $(T_{ij})^{1-\sigma} = f(DIST_{ij}, PT_{ij}, RTA_{ij})^{1-\sigma}$

FMA contains the importing country **j**'s characteristics such as economic size (GDP), factors affecting costs related to trade flows, i.e. international transport costs as peroxide by distance (DIST), and foreign trade policy (PT ad RTA) barriers (tariff and NTBs).

In the standard specification of the gravity equation, geographical distance is used as

proxy of transport costs or remoteness implying that the coefficient of this variable is expected to have a negative sign. Due to its time invariant nature, definition of the distance is problematic. Although it is not a problem in cross sectional analysis, the variable causes a problem when time dimension is entered in the analysis (i.e. panel-data).

In order to overcome this problem and to make distance a varying variable over time, I use the formula developed by Karagöz and Saray (2008) to calculate weighted distance. The formula is given by:

$$\mathbf{WDIST_{ijt} = (DIST_{ij} \times GDP_{it}) / \Sigma GDP_i}$$

Where WDISTijtis the weighted distance between country i (Ethiopia) and j (Ethiopia's trading partner) in year t; DISTijis the geographical distance between countries i and j; GDPitis GDP of country i in year t; and ΣGDPiis overall sum of the GDPs of country i (the sum covers the period from 2000 to 2017 in this study). On the other hand, supply capacity can be written as a function:

$$\mathbf{SC_i = h\ (GDP_i,\ FDI_i,\ POP_i, LPI_i, DOTRIN_i,\ REER_{i,\ i})}$$

Where GDP is the economic potential of the exporting country, while FDI, POPi,total population of Ethiopia, LPIi is logistic performance index and ,DOTRINi domestic transport infrastructure as well as real exchange rate (RER) affect the exporting country's ability to adjust to the changing global demand patterns

Hence, standing from the above Alelign's(2014) model, in my study the model to analyses Ethiopia's live animal export performance articulated s follows:

$$\ln \mathbf{LIANEXP_{ijt} = \alpha + \beta 1 lnGDP_{it} + \beta 2 lnGDP_{jt} + \beta 3 lnFDI_{it} + \beta 4 lnBREERijt + \beta 5 lnWDIST_{ijt} + \beta 6 ln6pop_{it} + \beta 7 ln6pop_{jt} + \beta 8 lnLPI_{it} + \beta 9 lnDOTRINF_{it} + \beta 10 lncobord_{ijt} + \beta 11 lnPT_{ijt} + \beta 12 lnRTA_{ijt} + U_{ijt}}$$

Where:-

$LIANEXP_{ij}$ is the value of Ethiopian exports to her trading partner j (in USD million) at time t;

GDP_i is the value of Ethiopia's GDP at current market prices (in USD million) at time t;

GDP_j is the value of GDP of country j at current market prices (in USD million) at time t;

FDI_{it} represents FDI stock in Ethiopia (in USD million) at time t;

$BREER_{ij}$ notes the bilateral real effective exchange rate between Ethiopia and here trading partner

$WDIST_{ij}$ represents the weighted distance between Ethiopia and her trading partner j at time t;

POP_i is the total population of Ethiopia at time t ,

POP_j represents the total population of Ethiopian trading partner

LPI_i is the logistic performance index of Ethiopia at time t

$DOTRINF_i$ domestic transport infrastructure the growth rate of asphalt road ratio of Ethiopia at time t ,

$COBORD_{ij}$ represent common border of Ethiopia with here trading partner

PT_{ij} is the preferential trade of Ethiopia with here trading partner

RTA_{ji} represented the regional trade agreement of Ethiopia with her trading partner and

Uijt the stochastic term - a log-normally distributed error with E (lnUij) =0

3.7 Data and Definition of Variables

In order to deduce sound conclusions from the empirical study, it is important to choose an appropriate time period and to include as many countries as possible into the sample. The study covers the period from 1995 to 2007 for a total of 30 trading partners of Ethiopia. The countries are chosen based on their importance for Ethiopia as a trading partner and the data availability for the different variables

1. **Live Animal Export (LIVANIEX)**

The annual values (in USD million) of Ethiopian live animal exports to each of the top 15 trading partners are mainly collected from Minister of Trade data base.

2. **Real Exchange Rate (RER)**

Data on the nominal real exchange rate and price indices are collected from the World

Bank statistical data. In order to calculate the average real exchange rate, I apply the IMF definition of the real exchange rate: real exchange rate as price of domestic currency against foreign currency:

$$\mathbf{RER = E.\ P^*/\ P}$$

Where **E** is the bilateral nominal exchange rate, **P*** is the consumer price index of the foreign country and **P** is the domestic consumer price index (Ethiopia in this case).

Depreciation of the real exchange rate enhances the competitiveness of the domestic goods visa-à- vise foreign goods. On the other hand, an appreciation in real exchange rate will decrease competitiveness of home goods in international markets.

3. Domestic Transport Infrastructure (DOTRINF)

Domestic transport infrastructure is captured by the total road network. Data on total road network was taken from the World Development Indicators database.

A higher rating indicates a better infrastructure. Better infrastructure should lead to higher trade and therefore more exports from Ethiopia. Thus, the coefficient of internal transport infrastructure is expected to be positive.

4. Domestic and Foreign Income (GDP)

Data on GDP of Ethiopia and its trading partners (in million US dollars) are collected from World Economic Outlook Data Base.

Since exports are the difference between domestic supply and domestic demand, they should be affected by the growth in domestic income. When the economy grows, both domestic demand and domestic supply are shifted, and therefore the expected overall effect of domestic income on exports is ambiguous.

The import demand of the foreign countries is determined by their income. The higher income of the importing country the greater the demand for imports and thus for Ethiopia's exports. Hence, the coefficients of Ethiopia's trading partner GDP are expected to have positive signs.

5. Distance (WDIST)

Data on the distance between Ethiopia and her trade partners are collected based on the distance between Addis Ababa and capital at Ethiopia's trading partners. These data are available from www.indo.com/distance.

Based on distance data and GDP as measured according to item 4 above I calculate the weighted distance between Ethiopia and its trading partners for each year in the observation period.

6. Preferential Trade (PT)

Trade policy is a measure of the degree of tariff and non-tariff barriers that trading partners apply. Trade policy in this study is represented by Preferential Trade (PT), which is taken from the World Trade Organization (WTO).

7. Foreign Direct Investment (FDI)

Data on FDI stock is taken from UNCTAD World Investment Report 2018. FDI could represent a measure of production development in the export sector. It can be expected to contribute to the enhancing of a country's competitiveness on international markets by increasing the technological content of exports. FDI is included in this study as stock since FDI stock measures its productive capacity. As it is believed that transformation of the composition of exports increases with FDI, the sign of this variable is expected to be positive.

8. Preferential Trade (PTij)

This includes the AGOWA which gives to the LDC preferential opportunities by their developed trade partners. This encourage to the LDC to participate more in trade activities. A data on PT is treated in a way that 1 is given for those countries that have PT while 0 is given for those countries that have not PT with Ethiopia.

9. Population of Exporter Countries (POP_i)

The total population of exporter countries, in this case Ethiopia is assumed to have a great contribution in enlarging the supply of exported commodities because of the supply of labor and raw materials.

10. Population of Trade Partners (POPj)

Trade partner's population may have to increase or create the demand to import different items from the trade partner, in this case Ethiopia

CHAPTER FOUR

4. RESULTS AND DISCUSIONS

4.1 Performance Ethiopian Live Animal Export

"In Ethiopia livestock plays an important role in the national economy. Ethiopia is an important and major competitor in the live animal trade markets. Through both formal and informal trade channels, Ethiopia is a major supplier of live animals to neighboring and other international markets. Similarly, the number of live animals export has increased dramatically in last two decades(AGP- LMD, 2013; NBE, 2007).

Although Ethiopia owns a significantly large livestock population, the sector has remained underdeveloped and its potential has not been efficiently and effectively used. According to Belachew and Jemberu, (2003), the country to export its livestock to the Middle East and make further improvement to enter other markets; there are internal and external challenges that Ethiopia should be dealt with in order to realize these benefits. it is vivid that absence of commercial animal health services, Non-existence of appropriate trucking equipment, Lack of sufficient air-cargo capacity, Underdeveloped feed industry, and Lack of commercial fattening and holding facilities are an internal and computation and absence of clear market information are external bottleneck of Ethiopian live animal export.

Regarding to the general market drawback of the sector low productivity of the animals and the absence of market-oriented production systems, in adequacy of the volume of market surplus are among the list. In addition, the different live animals supplied to the market by pastoralists and farmers do not meet the quality attributes required by diverse market as indicated by Adina and Elizabeth (2006).

4.1.1 Trends in Live Animal Export

Performance of live animal

Live animal is one of the commodity of which Ethiopia is exporting to the world market. As we can show from the table presented below, the volume of Ethiopian live animal export is fluctuated from year to year. The growth rate of the live animal export has been declined in 2001 less that of 2000 by 61%. The income also decreased from 1,333,568.69 US$ to 513,333.15 US$. But starting from 2002 it began to initiate.

The period between 2001 up to 2005, it was the time when the live animal export growth rate was aggravated. In 2004 and 2005 it increased by 249 % and 487 % respectively. The income in the same manner had also increased by 3,831,014.54 and 22,524,930.51 USD in the mentioned years.

Later after it began to decrease in 2006, the value of live animal export reached more than US$ 169,280,891.58 million in 2014. The value shows a nearly 48 % growth rate as compared to the value of agricultural export obtained in 2009. But in 2016 and 2007 it began to decrease to -78 and 11 percent respectively. Totally the annual growth of Ethiopian LAE is about 59 %, with its fluctuation.

Table 4.1 Value of Ethiopia's live animal export growth rate (2000-2017)

Year	Annual Live animal Export (USD)	Growth (%)
2000	1,333,568.69	
2001	513,333.15	-61.51
2002	555,434.13	8.20
2003	1,097,318.09	97.56
2004	3,831,014.54	249.13
2005	22,524,930.51	487.96
2006	30,641,760.96	36.03
2007	40,072,207.40	30.78
2008	46,553,778.49	16.17
2009	60,798,878.50	30.60
2010	128,207,145.50	110.87
2011	187,712,601.82	46.41
2012	179,413,554.27	-4.42
2013	180,761,041.01	0.75
2014	169,280,891.58	-6.35
2015	160,446,634.41	-5.22
2016	90,743,446.72	-43.44
2017	96,832,727.09	6.71
Annual growth of Live Animal Export		

Source: Owen competition based data obtained from (MOTI)

Generally, from the table we can understand that even though the country had get a lot

from the trade, the trend of the trade was not regulate it fluctuated from time to time. This may be cause of the supply side factors like illegal trade, low productivity of the animals and the absence of market-oriented production systems, in adequacy of the volume of market surplus are among the list. In addition, the different live animals supplied to the market by pastoralists and farmers do not meet the quality attributes required by diverse market, as well as external factor like the general market drawback of the sector.

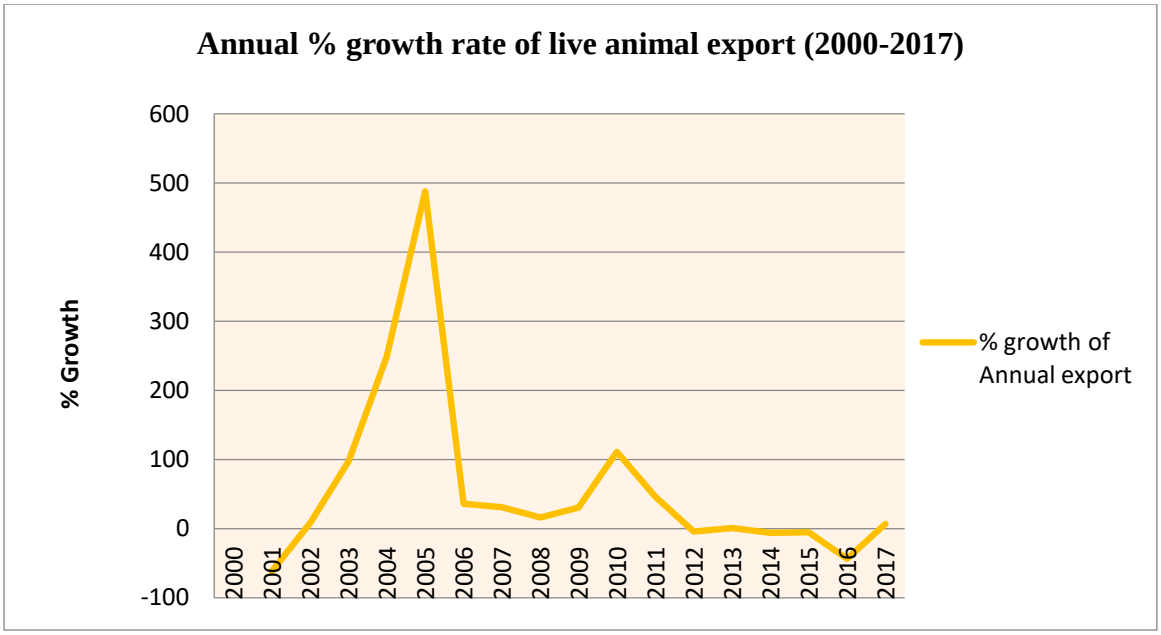

Figure 4.1 Trends in the annual growth rate of live animal export from the agricultural export (2000-2017).

Source: Own competition based on the MoT data

Share of live animal export to total export

In the table below, the total share of Ethiopian live animal export to the total value of export has been depicted. When we see the share of live animal export to the countries total export in the table below, it shows the same stand with its growth rate. Between 2000 and 2001 there was high export volume difference. In the former year the share of the live animal export to the total export was 0.28 % and in the later year (2001) the share has been declined to the percentage of 0.11. It decreased from1333568.69 to 513,333.15 US$ out of the total export value which is 481,779,928.76 and 453,172,903.98 in the respective years. In the period between 2006 and 2007, Ethiopia's total value of live animal export was shown high growth rate than the past

and the later years including in the study. In 2006 the percentage share reaches to 30,641,760.96 US$ (3.07 %) from the total value of 999,387,458.24 USD. In 2007 the percentage share increased to 3.39 % which is 40,072,207.40 USD. Even though the live animal export value reached 169,280,891.58 USD in 2014, its share remains smaller. This is because of the average growth of total export and live animal export is not balanced. Live animal export growth had slow and fluctuated growth rate.

Table 0.2: Share of Ethiopia's live animal export to total export (2000-2017)

Year	Total Export (USD)	Live Animal Export(USD)	% Share To Total Export
2000	481,779,928.76	1,333,568.69	0.28
2001	453,172,903.98	513,333.15	0.11
2002	473,423,435.09	555,434.13	0.12
2003	642,122,522.99	1,097,318.09	0.17
2004	553,370,737.07	3,831,014.54	0.69
2005	896,631,487.67	22,524,930.51	2.51
2006	999,387,458.24	30,641,760.96	3.07
2007	1,183,268,582.46	40,072,207.40	3.39
2008	1,542,860,713.62	46,553,778.49	3.02
2009	1,493,635,742.93	60,798,878.50	4.07
2010	2,147,314,404.94	128,207,145.50	5.97
2011	2,542,304,496.32	187712601.8	7.38
2012	2,741,297,675.80	179,413,554.27	6.54
2013	2,591,041,908.59	180,761,041.01	6.98
2014	2,977,916,071.87	169,280,891.58	5.68
2015	2,697,079,937.16	160,446,634.41	5.95
2016	2,615,930,716.16	90,743,446.72	3.47
2017	2,894,986,203.18	96,832,727.09	3.34
total	**29,927,524,926.85**	**1,213,715,586.35**	**4.06**

Source: Own competition based on the MoTI data

Generally, live animal export has significant contribution to the overall countries development, especially in generating foreign currency. However the commodity has shown fluctuated as well as slow growth rate. This is because of internal supply factor and external market condition.

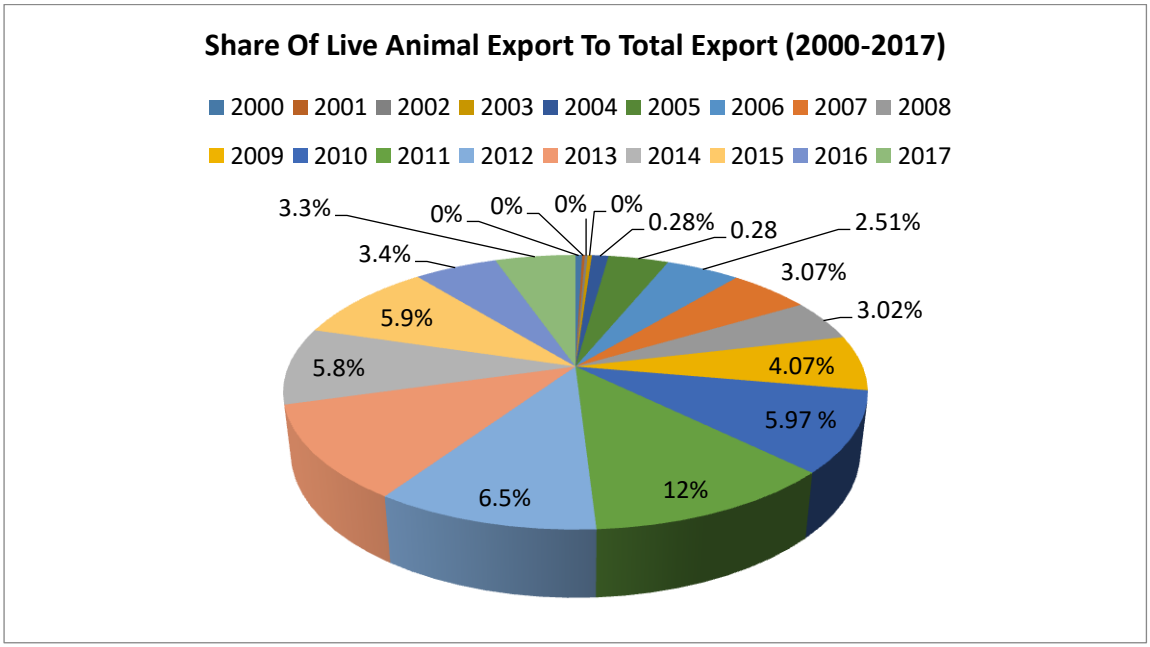

Figure 4.2: Share of live animal export to total export (2000-2017)

Source: Own competition based on the MoTI data

In the table below, the total share of Ethiopian live animal export to the total value of agricultural export has been depicted. When we see the share of live animal export to the countries agricultural export in the table below, it shows the same stand with its growth rate. Between 2000 and 2001 there was high export volume difference. In the former year the share of the live animal export to the agricultural export was 0.30 % and in the later year(2001) the share has been declined to the percentage of 0.13it decreased from1333568.69 to 513,333.15 US$ out of the total agricultural export value which is 439,091,744.97 and 400,512,592.12 in the respective years. In the period between 2006 and 2007, Ethiopia's total value of live animal export was shown high growth than the past and later years including in the study. In 2006 the percentage share reaches to 30,641,760.96 US$ (3.30%) from the total value of 929,187,505.85 US. In 2007 the percentage share increased to 3.68 % which is 40,072,207.40 USD. Even though the live animal export value reached 169,280,891.58 USD in 2014, its share remains smaller. This is because of the average growth of agricultural export and live animal export is not balanced. Live animal export growth had slow and fluctuated growth rate.

Table 4.3 Share of Ethiopia's live animal export to agricultural sector (2000-2017)

	Agricultural export (USD)	Live animal export (USD)	% Share to agricultural export
Year			
2000	439091745	1333568.69	0.3
2001	400512592.1	513333.15	0.13
2002	425468111.5	555434.13	0.13
2003	620952236.1	1097318.09	0.18
2004	460878268	3831014.54	0.83
2005	833940689.9	22524930.5	2.7
2006	929187505.9	30641761	3.3
2007	1089318849	40072207.4	3.68
2008	1425941719	46553778.5	3.26
2009	1374959931	60798878.5	4.42
2010	1917921258	128207146	6.68
2011	2320847749	187712602	8.09
2012	2477007196	179413554	7.24
2013	2337357100	180761041	7.73
2014	2700166709	169280892	6.27
2015	2401040300	160446634	6.68
2016	2354028048	90743446.7	3.85
2017	2785454187	96832727.1	3.48
Total	27294074196	1401320267	4.45

Source: Own competition based on the MoTI data

We can generalize that the live animal export has significant contribution to the overall countries development, especially in generating foreign currency. However the commodity has shown fluctuated as well as slow growth rate. This is because of internal supply factor and external market condition.

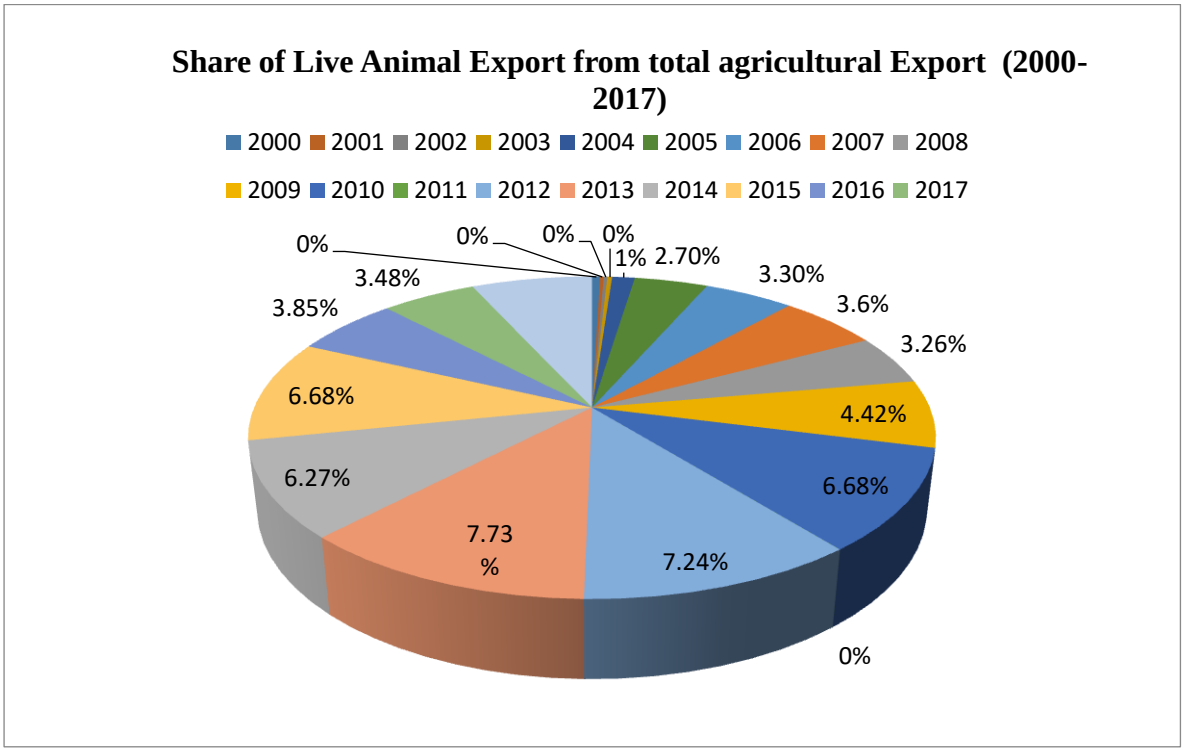

Figure 4.3 Share of live animal export to agricultural export (2000-2017)

Source: Own competition based on the MoTI data

Major destination for Ethiopian Live Animal Export

Ethiopia has exporting its live animals to above 35 her trade partners though out the world for the long period of time. Among these destinations 15 of them are the major trade partner of Ethiopian live animal export. They cover/bought about 98.8 % of the total volume of Ethiopian live animal export. Bahrain, Djibouti, Egypt, Libya, Saudi Arabia, Somalia, Sudan, are among the top 15 trade destination of live animal export of the country. Furthermore, three of them (i.e., Djibouti, Egypt, Sudan and Somalia) have a big share in the trade.

From the total volume of live animal export, 78 % of it gone to the above four countries As we can understand from the table below, starting from 2000 – 2017, from the total value 1,213,715,586.35 USD, Somalia imported 32.5 % (394,908,007.54) of Ethiopian live animal export. Next to Somalia, Egypt, Sudan and Djibouti have significant share in the trade, which is 21%, 10%, 14 and 10 respectively.

***Table* 4.4 Major destination for Ethiopian Live animal export (2000-2017)**

NO	country	TOTAL LAE USD	USD	% of share
1	Bahrein	1,213,715,586.35	7,342,900.95	0.6
2	Dijoubuti	1,213,715,586.35	126,233,388.78	10.4
3	Egypt	1,213,715,586.35	260,408,361.41	21.46
4	Lybya	1,213,715,586.35	19,470,918.41	1.6
5	Saudi Arebia	1,213,715,586.35	103,086,550.57	8.49
6	Somalia	1,213,715,586.35	394,908,007.54	32.54
7	Sudan	1,213,715,586.35	171,228,023.98	14.11
8	United State	1,213,715,586.35	28,205.93	0
9	Yemen	1,213,715,586.35	87,971,776.37	7.25
10	Italy	1,213,715,586.35	408,790.65	0.03
11	Spain	1,213,715,586.35	200,208.59	0.02
12	Qatar	1,213,715,586.35	497,611.41	0.04
13	Oman	1,213,715,586.35	12,069,738.17	0.99
14	Jordan	1,213,715,586.35	8,406,467.69	0.69
15	Lebanon	1,213,715,586.35	7,669,874.88	0.63
16	Total	**1,213,715,586.35**	**1,199,930,825.35**	**98.86**

Source: Owen competition based on data obtained from (MOTI)

To sum up, the major LAE destinations of Ethiopia are to Djibouti, Egypt, Libya, Saudi Arabia, Somalia, Sudan etc. from among them Somalia have a big share than the other following Egypt and Sudan. this is may be because of their share of common border and near far from the other. Here the issue of illegal trade which flow out from Ethiopia has significant as literature as well as government report indicated.

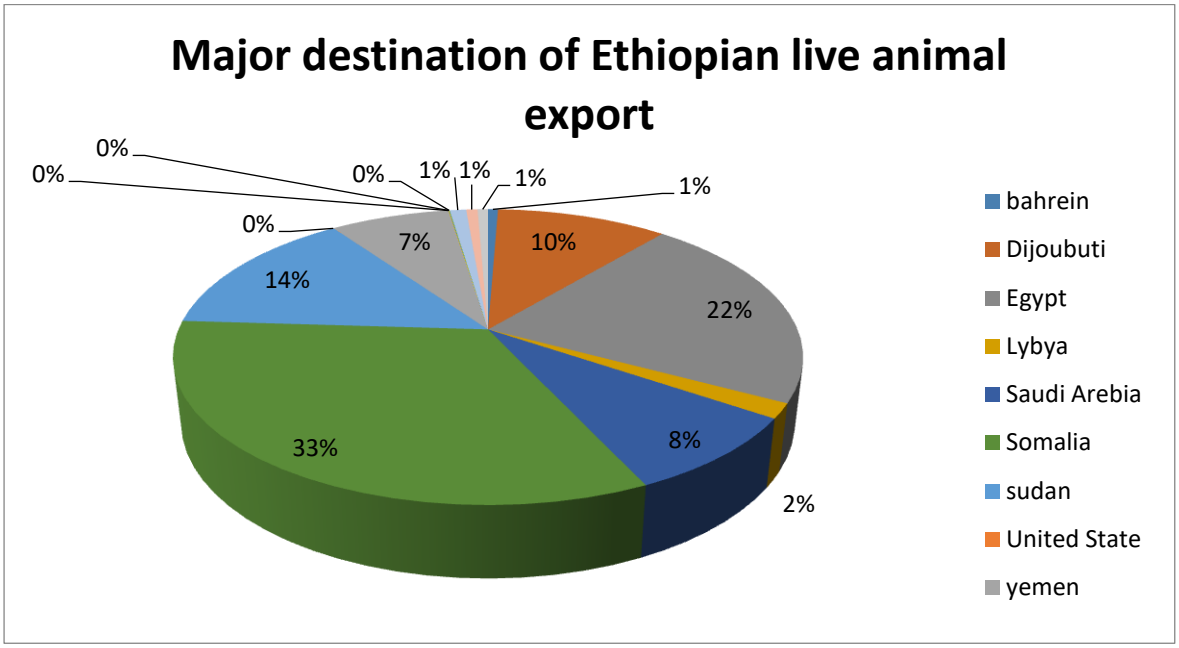

Figure 4.4 destination of live animal export (2000-2017)

Source: Own competition based data obtained from MoTI

4.2 Estimation result of the Gravity model

4.2.1 Diagnostic tests

Multicollinearity referees to the situation where two or more of the predictors in a regression model are moderately or highly correlated. It implies that one can be linearly predicted from the others with a substantial degree of accuracy. In presence of multicollinearity, the coefficient estimates of the multiple regressions may change erratically in response to small changes in the model or the data. It also limits the research conclusions to drawn.

A number of detection method whether there exist multicollinarity. From them a Variance Inflation Factor (VIF) is frequently applied. In this diagnostic test, a VIF value above 10 indicates the existence of a multicollinearity problem. Similarly, in this study to check for multicollinearity, VIF test is applied. As indicated in Annex 4, a VIF test result indicates that there exists no multicolllinearity among the variables included in the model.

In statistics, normality tests are used to determine if a data set is well-modeled by a normal distribution and to compute how likely it is for a random variable underlying

the data set to be normally distributed. Prediction intervals are calculated based on the assumption that the residuals are normally distributed. If the residuals are non-normal, the prediction intervals may be inaccurate. There are several methods available for assessing whether data are normally distributed or not .i.e. graphical and statistical.

Here a test for normality of the residual was performed with the aid of graphical or numerical methods. For graphical method histogram and for numeric method skewness/kurtosis test was used.

The presence of hetroskedaasticity test was also performed. Heteroskedasticity occurs when the variance of the error terms differ across observations. It means that the variance of residuals should not increase with fitted values of response variable. The main reason to check presence of heteroskedasticity is to know if the model built is unable to explain some pattern in the response the independent variable that eventually shows up in the residuals. In a presence of heteroskedasticity, the result will be inefficient and unstable regression.

There are graphical and statistical tests for checking hetrocdasitcity. Similarly both in this study both graphical and numerical method was applied. For numeric method Breusch-Pagan / Cook-Weisberg test while for graphical method residual-versus-fitted plot were applied. The result shown in Annex 7 and 8 indicates that there exists hetrocdasitcity. To deal with this problem, a robust regression is applied.

Serial correlation/autocorrelation is the violation of assumption stating the error term is uncorrelated with each other. It referees to the relationship between a given variable and itself over various time intervals and found in repeating patterns, when the level of a variable affects its future level. When serial correlation exists, it causes the estimated variances of the regression coefficients to be biased and this leads to unreliable hypothesis testing. In addition in a presence of serial correlation, the t-statistics will actually appear be more significant than they really it should be.

There are various tests exist to check whether there exists serial correlation. However, in this study, Wooldridge test for autocorrelation was applied. As shown in Annex 9, the result indicates that there exists serial correlation in the model. To deal with problem GLS regression technique is applied.

In probability theory and statistics, a unit root is a feature of some stochastic processes

that can cause problems in statistical inference involving panel and time series models. A linear stochastic process has a unit root if 1 is a root of the process's characteristic equation. There are a variety of different tests with panel data.

There are various alternative methods are available for a unit root test. In this study however, Im-pesaran-shin root test was applied. As indicated in Annex 10, the result confirmed that the data is stationary.

Fixed vs Random effect estimators

Generally, there are three main methods that can be used to estimate panel data. Those estimation methods are pooled OLS, fixed effect and random effect estimation methods. Those methods were frequently used to estimate Gravity model of international trade.

A fixed effects model is a statistical model that represents the observed quantities in terms of explanatory variables that are treated as if the quantities were non-random. In this estimator, time independent effects will be imposing for each entity that is possibly correlated with the repressors. On the other hand, random effect estimator assumes that the data being analyzed are drawn from a hierarchy of different populations whose differences relate to that hierarchy

In order to decide which estimator is an appropriate estimator, it is needed to consider results of the available test and more importantly the properties of the data included in the model. In this case due to the draw backs exist in a pooled OLS estimator such as bias due to omitted variable and not taking in to account for individual heterogeneity, a fixed or random effect methods remained ideal choices to estimate an augmented Gravity model. However, given the time invariant nature of some of the variables included in the model, it is found to be difficult and also inappropriate to choose a fixed effect method to estimate the gravity model than random effect estimator in this study.

Shepherd (2012), in it’s a user guide to the Gravity model of international trade stated that, the fixed effect estimation method is simple to implement and is just an application of standard OLS.

However, it has one important drawback i.e. it needs to drop from the model any

variables that are collinear with the fixed effects. This restriction means that it is not possible to estimate a fixed effects model that also includes data that only vary by exporter (constant across all importers) or by importer (constant across all exporters). The panel data econometrics literature provides an alternative to fixed effects estimation that still accounts for unobserved heterogeneity, but allows the inclusion of variables that would be collinear with the fixed effects. This alternative is the random effects model.

On the other hand, according Anukoonwattaka & Beverelli (2013), one of the main disadvantages of using fixed effect estimator is that it cannot estimate coefficient of time invariant variables. According to their explanation in fixed effect estimator it is not possible estimate time invariant variables such as distance, common border, common language etc. that do not vary over time.

Similarly Torres Reyna (2007) stated that, one important side effect of the features of fixed-effects estimator is that it cannot be used to investigate time-invariant independent variables. Because of this if there is acceptable reason that the differences across entities have some influence on the dependent variable it is possible and also advisable to use random effects.

Random effect estimator is an appropriate in situations where the (random) intercept of each cross sectional unit is uncorrelated with the repressors. Another advantage of random effect estimator is that we can introduce variables such as gender, religion, and ethnicity, which remain constant for a given subject. In fixed effect estimator we cannot do that because all such variables are collinear with the subject-specific intercept. Moreover, if we use the within-group estimator or first-difference estimator, all such time-invariance will be swept out. (Gujarati & Porter, 2009)

Thus given the above stated limitation of a fixed effect estimator's inability to directly estimate time invariant variables, this study found that a random effect estimator is an appropriate method than fixed effect estimator given the nature variables included in the model. Accordingly, a Breusch and Pagan test was carried out in order to ensure that random effect is appropriate estimator than Pooled OLS estimator in this study

4.2.2 Interpretation of the Results

As can be seen from Table 4.5, Wald chi2 shows that the overall model is ok.

Table 4.5 Random effect GLS regression

```
Random-effects GLS regression                Number of obs     =        70
Group variable: COUNID                       Number of groups  =        15

R-sq:  within  = 0.1745                      Obs per group: min =         3
       between = 0.3818                                     avg =       4.7
       overall = 0.3353                                     max =         5

                                             Wald chi2(10)     =     17.50
corr(u_i, X)   = 0 (assumed)                 Prob > chi2       =    0.0641

------------------------------------------------------------------------------
ln_LIANEXPij |      Coef.        Std. Err.       z        P>|z|          [95% Conf. Interval]
-------------+----------------------------------------------------------------
ln_GDPj |       2.917758       1.172419    -2.49       0.013**      - 5.215657    -.6198585
ln_FDIi |       1.082186        .9476738    -1.14       0.253        -2.939593    .7752205
ln_BREERij |   . 5940609       . 4258799     1.39       0.163         -.2406484    1.42877
ln_WDISTij |  -.4431275        .2188577     2.02       0.043**      .0141744     .8720807
ln_POPj |       3.497653       1.321168     2.65       0.008***      9082114      6.087095
ln_TROADNETi | .4502027      2.548135      0.18       0.040**        4.54405      5.444455
ln_LPI |          14.40975     12.24152     1.18       0.239        -9.583194     38.4027
 COBORDij |      2.595796     3.840335    -0.68       0.499         -10.12271    4.931121
PTji |           5.415871     5.820801     -0.93      0.352         -16.82443    5.992689
RTAij |          2.758419     3.139008    -0.88       0.380         -8.910761    3.393923
_cons |         27.92374      24.83658    1.12        0.261         -20.75507    76.60255
-------------+----------------------------------------------------------------
    sigma_u |  4.2738394
    sigma_e |  3.7906719
       rho |  .55969852   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Note: - ***significance at 99 %

**significant at 95 %

Source: Own estimation (2019)

As we can understand from the above presented regression result, partner country's Gross domestic Product (GDPj), weighted distance between Ethiopia and partner country (WDISTij) and total road network(TRONETi), partners country's population(POPj) found to be a significant factors affecting Ethiopia's live animal export in the period between 2000 and 2017. Partner country's Gross domestic Product (GDPj), weighted distance between Ethiopia and partner country (WDISTij) and total road network (TRONETi) are found to be significant at 95. On the other side, partner country's population (POPj) significant at 99 levels. Meanwhile, bilateral real effective

exchange rate between birr and partner's currency (BREERij), foreign direct investment (FDI) and Ethiopia's sharing of common border with partner country (COBORDij), preferential trade (PT) and regionaltrade agreement (RTA) are found to be insignificant in affecting Ethiopia's live animal export in the indicated period. Ethiopian Gross Domestic Product (GDPi) and Ethiopian population (POPi) has been dropped because of the existence of milticollinierity problem.

Partner Country's Gross Domestic Product (GDPj)

As can be understood from the result, partner country's Gross Domestic Product (GDPj) foud to be significant at 95 % and has a positive impact on the performance of Ethiopia's live animal export. Holding other things constant, 1% increases in Ethiopia's partner GDP would bring more than 2.9 % increase in the country's live animal export.

The result is consistent with studies conducted such as by Yisak (2009)which was studied on the factors determined Ethiopian export .The study indicates that partners countries GDP and population size have positive and significant impact on country's export performance. The study further indicates that Ethiopia's population size, Real exchange rate and Everything But Arms initiative (GSP by EU) found to be insignificant in affecting the Ethiopia export in the stated period.

Weighted Distance between Ethiopia and Partner Country (WDISTij)

The distance between Ethiopia and partner countries is find to be significant at 95 % and negative. This indicates that the distance between Ethiopia and its partner has negative impact on live animal trade.

As can be understood from result, keeping other thing held constant, a 1% difference in weighted distance between Ethiopia and partner country will decrease Ethiopian live animal export by more than 0.4%. Yisak (2009), Abdulaziz (2013) found the same result in their attempt to investigate factor determining Ethiopia's export performance.

Partners Country's Population (POPi)

Partners country's population is also find to be significant at 99 and positive. This also indicates that the Ethiopian trade partner's population has positive impact on Ethiopian live animal export. Other things remain constant, as 1% change in the population of partners country would affect Ethiopian live animal export by 3.4 %.

Similar result has been found as Karamuriro & Karukuza (2015) examined factors affecting export flows between Uganda and its trading partners in the period between 1980 and 2012 (panel data) through employing an augmented gravity model of trade estimated by a fixed effects (within) regression, random-effects GLS regression and instrumental variables GMM regression. The study revealed that based on GMM regression

Total Road Network (TRONET)

Total road network of the importer's country(Ethiopia) is found to be significant and positive. This indicate that the variable affect Ethiopian live animal export positively. Other things remain constant; the 1 % change in the total road network could affect live animal export by 0.4 %.

However, as stated above the estimation result indicates that bilateral real effective exchange rate between Ethiopia and partner country's currency is find to be in significant. Therefore it has not effect on the exports of live animal of Ethiopia. Similar result shown in the Kenya in the study of

Harrison Yego 2017. The result shown that The exchange rate of Kenya was insignificant and therefore not considered as a determinant of livestock exports. This implied that other factors were more important in influencing the export of livestock products from Kenya. The exchange rate of the national currency of Kenya was positive and insignificant. It is therefore not a significant determinant of livestock Kenyan exports. This may be explained by the fact that most agricultural and food products are relatively more price inelastic by nature.

Ethiopia's sharing of common border with partner country's country and Ethiopia's membership of a regional trade arrangement (i.e COMESA) as well as the inflow of foreign direct investment to Ethiopia (FDIi) found to be statistically insignificant.

Taye (2006) employed gravity model with panel data using 30 Ethiopia's trading partners for the period 1995-2007 to study the determinants of Ethiopia's export performance. The model was estimated with the Generalized Two Stages Least Squares (G2SLS) method. The findings of the study suggest that the real exchange rate and FDI have no statistically significant effect on Ethiopia's export performance. In addition to this my finding is similar with finding studded by Yisak (2009). However, a result found by Alelign (2014), Alemayehu (2015) was against these findings.

Exporters GDP and population, in this case Ethiopia, has droped because of the existence of multicoliniarity. However, According to the study of Mr. Harrison Kimutal YAGOT (2017) on his stud of " the analysis of Kenyan live stock export : gravity approach " the importer's GDP was positive but insignificant. Although positive, it cannot be said to be an explanatory variable to Kenyan livestock exports. The market size of the trading partner's economy is not of importance to the exports of livestock products.

To sum up, as can be understood from the result, among factors included under market access conditions (external factor) partner country's gross product (GDPi) and partners' country population (POPi) found to be significant in affecting Ethiopia's LAE export. However, factors included under supply side conditions (internal factors), a weighted distance between Ethiopia and partner countries found to be significant in affecting Ethiopia's Agriculture export. This might indicate that, the performance of Ethiopia's agricultural export is mainly affect by internal factors than external factors.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In this study, variables for Ethiopia's gross domestic product, partner country's gross domestic Product, weighted distance between Ethiopia and partner country, Ethiopia's domestic transport infrastructure(total road network), the inflow of foreign direct investment, bilateral real effective exchange rate between Birr and partner's currencies', Ethiopia's membership of a regional trade arrangement preferential trade and logistic performance were investigated whether they determine Ethiopia live animal export performance in the stated period.

The analysis indicates that on average, live animal export covers nearly 4.06 of Ethiopia's total export generally and 4.5 % of agricultural export in the period between 2000 and 2017. In similar period, 15 major trade partner of Ethiopian live animal export for instance Bahrain, Djibouti, Egypt, Libya, Saudi Arabia, Somalia, Sudan, Qatar Kuwait etc, cover/bought about 98.8 % of the total volume of Ethiopian live animal export in the period between 2000-2017. The descriptive analysis also indicated that from the total volume of live animal export, 78 % of it imported by four countries which are Somalia, Egypt, Sudan and Djibouti. Therefore, according to the result the closest trade partners of Ethiopian on Ethiopia's live animal export have a great share in the trade.

On the other side, the empirical results implied that growth of Ethiopia's and partner country's gross domestic product (indicating the expansion of the economic size), total road network as well as partner countries' population have a positive and significant impact on the performance of Ethiopia's live animal export in the indicated period. Similarly, the weighted distance between Ethiopia and partner countries is found to be significant but negative. This indicates that the distance between Ethiopia and its partner has negative impact on live animal trade. Therefore, the nearest countries like Somalia and Djibouti has relatively significant advantage than the farthest countries in the live animal export of Ethiopia.

Bilateral real effective exchange rate between birr and partner's currency (BREERij), foreign direct investment (FDI) and Ethiopia's sharing of common border with partner country (COBORDij), preferential trade(PT), logistic performance and regional trade

agreement(RTA) are found to be insignificant in affecting Ethiopia's live animal export in the indicated period.

5.2 Recommendations

The study provides the following recommendations that can be considered to improve the country's agricultural export:

- Since the country is endowed with the live animal resources it can help to the countries overall development. Therefore, to achieve this government should sustain the economic growth.
- The government should emphasis in expanding the road network of the country
- The most populous countries have great share in the country's live animal export. The government should focus on those partners so as to enlarge the market.
- The distance between Ethiopia and its partner has important effect on the this trade. Therefore the government ought to focus on this in constructing trade partners.
- Finally, most studies conducted regarding Ethiopia's export performance using a gravity model approach is mostly conducted at an aggregate level. Thus investigating factors determining the performance of Ethiopia's major Agricultural export (focusing on such as sesame, coffee, livestock etc.) using a gravity model approach could be a possible area of future research.

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APENDICS

Annex-1: Value of Ethiopia's live animal export annual growth rate(2000-2017)

live animal export growth trend		
year	Annual Live animal Export	% growth
2000	1,333,568.69	
2001	513,333.15	-61.5068085
2002	555,434.13	8.20149254
2003	1,097,318.09	97.5604362
2004	3,831,014.54	249.125251
2005	22,524,930.51	487.962543
2006	30,641,760.96	36.0348745
2007	40,072,207.40	30.7764506
2008	46,553,778.49	16.1747293
2009	60,798,878.50	30.5992349
2010	128,207,145.50	110.870905
2011	187,712,601.82	46.4135256
2012	179,413,554.27	-4.42114566
2013	180,761,041.01	0.75105069
2014	169,280,891.58	-6.3510086

live animal export growth trend		
		9
2015	160,446,634.41	-5.21869721
2016	90,743,446.72	-43.4432221
2017	96,832,727.09	6.7104354
Annual growth of Live Animal Export		58.8376498

Source: Owen competition from Minister of Trade data /MoT 20018/

Annex-2 : share of of Ethiopia's live animal export to total export (2000-2017)

Year	Total Export (USD)	Live Animal Export(USD)	% Share To Total Export
2000	481,779,928.76	1,333,568.69	0.28
2001	453,172,903.98	513,333.15	0.11
2002	473,423,435.09	555,434.13	0.12
2003	642,122,522.99	1,097,318.09	0.17
2004	553,370,737.07	3,831,014.54	0.69
2005	896,631,487.67	22,524,930.51	2.51
2006	999,387,458.24	30,641,760.96	3.07
2007	1,183,268,582.46	40,072,207.40	3.39
2008	1,542,860,713.62	46,553,778.49	3.02
2009	1,493,635,742.93	60,798,878.50	4.07
2010	2,147,314,404.94	128,207,145.50	5.97
2011	2,542,304,496.32	187712601.8	7.38
2012	2,741,297,675.80	179,413,554.27	6.54
2013	2,591,041,908.59	180,761,041.01	6.98
2014	2,977,916,071.87	169,280,891.58	5.68
2015	2,697,079,937.16	160,446,634.41	5.95
2016	2,615,930,716.16	90,743,446.72	3.47
2017	2,894,986,203.18	96,832,727.09	3.34
total	**29,927,524,926.85**	**1,213,715,586.35**	**4.06**

Source: Owen competition from Minister of Trade data /MoT 20018

Annex-3 : share of of Ethiopia's live animal export to agricultural sector (2000-2017)

year	agricultural export	live animal export	share to agricultural export
2000	439091745	1333568.69	0.3
2001	400512592.1	513333.15	0.13
2002	425468111.5	555434.13	0.13
2003	620952236.1	1097318.09	0.18
2004	460878268	3831014.54	0.83
2005	833940689.9	22524930.5	2.7
2006	929187505.9	30641761	3.3
2007	1089318849	40072207.4	3.68
2008	1425941719	46553778.5	3.26
2009	1374959931	60798878.5	4.42
2010	1917921258	128207146	6.68
2011	2320847749	187712602	0
2012	2477007196	179413554	7.24
2013	2337357100	180761041	7.73
2014	2700166709	169280892	6.27
2015	2401040300	160446634	6.68
2016	2354028048	90743446.7	3.85
2017	2785454187	96832727.1	3.48
total	27294074196	1401320267	4.45

Source: Owen competition from Minister of Trade data /MoT 20018

Annex-4 : Major destination of Ethiopian Live animal export (2000-2017)

	country	TOTAL LAE USD	USD	% of share
1	Bahrein	1,213,715,586.35	7,342,900.95	0.6
2	Dijoubuti	1,213,715,586.35	126,233,388.78	10.4
3	Egypt	1,213,715,586.35	260,408,361.41	21.46
4	Lybya	1,213,715,586.35	19,470,918.41	1.6
5	Saudi Arebia	1,213,715,586.35	103,086,550.57	8.49

6	Somalia	1,213,715,586.35	394,908,007.54	32.54
7	Sudan	1,213,715,586.35	171,228,023.98	14.11
8	United State	1,213,715,586.35	28,205.93	0
9	Yemen	1,213,715,586.35	87,971,776.37	7.25
10	Italy	1,213,715,586.35	408,790.65	0.03
11	Spain	1,213,715,586.35	200,208.59	0.02
12	Qatar	1,213,715,586.35	497,611.41	0.04
13	Oman	1,213,715,586.35	12,069,738.17	0.99
14	Jordan	1,213,715,586.35	8,406,467.69	0.69
15	Lebanon	1,213,715,586.35	7,669,874.88	0.63
16	Total	**1,213,715,586.35**	**1,199,930,825.35**	**98.86**

Source: Owen competition from Minister of Trade data /MoT 20018

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. xtset COUNID Year, yearly

panel variable: COUNID (strongly balanced)

time variable: Year, 2000 to 2017

delta: 1 year

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. reg ln_LIANEXPij ln_GDPj ln_GDPi ln_FDIi ln_BREERij ln_WDISTij ln_POPi ln_POPj ln_TROADNETi ln_LPI COB

> ORDij PTji RTAij

note: ln_POPi omitted because of collinearity

Source | SS df MS Number of obs = 70

----------+---------- F(11, 58) = 2.76

Model | 1058.04949 11 96.186317 Prob > F = 0.0060

Residual | 2021.37216 58 34.8512442 R-squared = 0.3436

----------+---------- Adj R-squared = 0.2191

Total | 3079.42165 69 44.6292993 Root MSE = 5.9035

--
ln_LIANEXPij | Coef. Std. Err. t P>|t| [95% Conf. Interval]
-------------+--
ln_GDPj | 2.574587 .8318895 -3.09 0.003 -4.239795 -.9093797
ln_GDPi | 3.121425 9.187324 -0.34 0.735 -21.51185 15.269
ln_FDIi | 5592635 1.559138 -0.36 0.721 -3.680217 2.56169

ln_BREERij	.493196	.3056211	1.61	0.112	-.1185711 1.104963
ln_WDISTij	.2460638	.2939585	0.84	0.406	-.3423581 .8344858
ln_POPi	0 (omitted)				
ln_POPj	3.130437	.8586756	3.65	0.001	1.411611 4.849263
ln_TROADNETi	3.831969	9.879765	0.39	0.700	-15.94453 23.60847
ln_LPI	5.897302	19.09383	0.31	0.759	-32.32316 44.11776
COBORDij	2.452158	2.30373	-1.06	0.292	-7.063574 2.159258
PTji	5.827458	3.419855	-1.70	0.094	-12.67304 1.018126
RTAij	2.780309	1.874865	-1.48	0.144	-6.53326 .9726415
_cons	61.48126	117.206	0.52	0.602	-173.132 296.0946

--

. vif

Variable	VIF	1/VIF
ln_GDPi	34.52	0.028969
ln_TROADNETi	29.49	0.033914
ln_GDPj	8.13	0.123041

ln_FDIi | 6.43 0.155595

ln_POPj | 4.09 0.244299

PTji | 2.88 0.347656

ln_BREERij | 2.47 0.404239

ln_LPI | 1.86 0.538022

COBORDij | 1.71 0.586323

ln_WDISTij | 1.41 0.709634

RTAij | 1.40 0.716230

----------+----------

Mean VIF | 8.58

. pwcorr ln_GDPj ln_GDPi ln_FDIi ln_BREERij ln_WDISTij ln_POPi ln_POPj ln_TROADNETi ln_LPI COBORDij PTji

> RTAij

| ln_GDPj ln_GDPi ln_FDIi ln_BRE~j ln_WDI~j ln_POPi ln_POPj

----------+----------

ln_GDPj | 1.0000

ln_GDPi | 0.1719 1.0000

ln_FDIi | 0.0927 0.6759 1.0000

ln_BREERij | 0.5773 0.0728 -0.0053 1.0000

ln_WDISTij | 0.3658 0.4781 0.2588 0.2811 1.0000

ln_POPi | 0.1703 0.9876 0.7358 0.0666 0.4698 1.0000

ln_POPj | 0.6935 0.0991 0.0730 0.1846 0.0081 0.0996 1.0000

ln_TROADNETi | 0.1559 0.9533 0.8157 0.0542 0.4671 0.9616 0.0967

ln_LPI | 0.0192 0.3077 0.5334 -0.0258 -0.1454 0.3357 0.0213

COBORDij | -0.0360 0.0000 0.0000 -0.1876 -0.1671 -0.0001 0.3193

PTji | 0.7350 -0.0000 0.0000 0.3387 0.1566 -0.0001 0.6133

RTAij | -0.2398 -0.0000 -0.0000 0.0608 -0.1828 0.0001 0.0394

| ln_TRO~i ln_LPI COBORDij PTji RTAij

----------+---

ln_TROADNETi | 1.0000

ln_LPI | 0.3253 1.0000

COBORDij | 0.0000 -0.0000 1.0000

PTji | 0.0000 -0.0000 0.2942 1.0000

RTAij | 0.0000 -0.0000 0.0754 -0.2365 1.0000

. reg ln_LIANEXPij ln_GDPj ln_GDPi ln_FDIi ln_BREERij ln_WDISTij ln_POPj ln_TROADNETi ln_LPI COBORDij PT

> ji RTAij

Source | SS df MS Number of obs = 70

----------+---------- F(11, 58) = 2.76

Model | 1058.04949 11 96.186317 Prob > F = 0.0060

Residual | 2021.37216 58 34.8512442 R-squared = 0.3436

----------+---------- Adj R-squared = 0.2191

Total | 3079.42165 69 44.6292993 Root MSE = 5.9035

--

ln_LIANEXPij | Coef. Std. Err. t P>|t| [95% Conf. Interval]

----------+---

ln_GDPj | -2.574587 .8318895 -3.09 0.003 -4.239795 -.9093797

ln_GDPi | -3.121425 9.187324 -0.34 0.735 -21.51185 15.269

ln_FDIi | -.5592635 1.559138 -0.36 0.721 -3.680217 2.56169

ln_BREERij | .493196 .3056211 1.61 0.112 -.1185711 1.104963

ln_WDISTij | .2460638 .2939585 0.84 0.406 -.3423581 .8344858

ln_POPj | 3.130437 .8586756 3.65 0.001 1.411611 4.849263

ln_TROADNETi | 3.831969 9.879765 0.39 0.700 -15.94453 23.60847

ln_LPI | 5.897302 19.09383 0.31 0.759 -32.32316 44.11776

COBORDij | -2.452158 2.30373 -1.06 0.292 -7.063574 2.159258

PTji | -5.827458 3.419855 -1.70 0.094 -12.67304 1.018126

RTAij | -2.780309 1.874865 -1.48 0.144 -6.53326 .9726415

_cons | 61.48126 117.206 0.52 0.602 -173.132 296.0946

. vif

Variable | VIF 1/VIF

----------+----------------------

ln_GDPi | 34.52 0.028969

ln_TROADNETi | 29.49 0.033914

ln_GDPj | 8.13 0.123041

ln_FDIi | 6.43 0.155595

ln_POPj | 4.09 0.244299

PTji | 2.88 0.347656

ln_BREERij | 2.47 0.404239

ln_LPI | 1.86 0.538022

COBORDij | 1.71 0.586323

ln_WDISTij | 1.41 0.709634

RTAij | 1.40 0.716230

----------+----------------------

Mean VIF | 8.58

. pwcorr ln_GDPj ln_GDPi ln_FDIi ln_BREERij ln_WDISTij ln_POPj ln_TROADNETi ln_LPI COBORDij PTji RTAij

| ln_GDPj ln_GDPi ln_FDIi ln_BRE~j ln_WDI~j ln_POPj ln_TRO~i

---

ln_GDPj | 1.0000

ln_GDPi | 0.1719 1.0000

ln_FDIi | 0.0927 0.6759 1.0000

ln_BREERij | 0.5773 0.0728 -0.0053 1.0000

ln_WDISTij | 0.3658 0.4781 0.2588 0.2811 1.0000

ln_POPj | 0.6935 0.0991 0.0730 0.1846 0.0081 1.0000

ln_TROADNETi | 0.1559 0.9533 0.8157 0.0542 0.4671 0.0967 1.0000

ln_LPI | 0.0192 0.3077 0.5334 -0.0258 -0.1454 0.0213 0.3253

COBORDij | -0.0360 0.0000 0.0000 -0.1876 -0.1671 0.3193 0.0000

PTji | 0.7350 -0.0000 0.0000 0.3387 0.1566 0.6133 0.0000

RTAij | -0.2398 -0.0000 -0.0000 0.0608 -0.1828 0.0394 0.0000

| ln_LPI COBORDij PTji RTAij

---

ln_LPI | 1.0000

COBORDij | -0.0000 1.0000

PTji | -0.0000 0.2942 1.0000

RTAij | -0.0000 0.0754 -0.2365 1.0000

. reg ln_LIANEXPij ln_GDPj ln_FDIi ln_BREERij ln_WDISTij ln_POPj ln_TROADNETi ln_LPI COBORDij PTji RTAij

Source | SS df MS Number of obs = 70

----------+---------- F(10, 59) = 3.07

Model | 1054.02652 10 105.402652 Prob > F = 0.0033

Residual | 2025.39513 59 34.328731 R-squared = 0.3423

----------+---------- Adj R-squared = 0.2308

Total | 3079.42165 69 44.6292993 Root MSE = 5.8591

--

ln_LIANEXPij | Coef. Std. Err. t P>|t| [95% Conf. Interval]

----------+---

ln_GDPj | -2.568719 .8254519 -3.11 0.003 -4.220444 -.9169935

ln_FDIi | -.7820744 1.403865 -0.56 0.580 -3.591202 2.027053

ln_BREERij | .4918145 .3032946 1.62 0.110 -.1150765 1.098706

ln_WDISTij | .2463058 .2917457 0.84 0.402 -.337476 .8300877

ln_POPj | 3.127765 .8521786 3.67 0.001 1.422559 4.83297

ln_TROADNETi | .7310781 3.754358 0.19 0.846 -6.781376 8.243532

ln_LPI | 7.867925 18.05467 0.44 0.665 -28.25939 43.99524

COBORDij | -2.411666 2.283333 -1.06 0.295 -6.980606 2.157273

PTji | -5.856736 3.393044 -1.73 0.090 -12.6462 .9327298

RTAij | -2.756247 1.85943 -1.48 0.144 -6.476957 .964463

_cons | 22.86909 28.44561 0.80 0.425 -34.05044 79.78862

--

Annex 4 MULTICOLINIARITY TEST

```
. vif

    Variable |      VIF       1/VIF
-------------+----------------------
      ln_GDPj |     8.12    0.123095
      ln_FDIi |     5.29    0.189039
 ln_TROADNETi |     4.32    0.231333
      ln_POPj |     4.09    0.244319
        PTji |     2.87    0.347877
   ln_BREERij |     2.47    0.404311
    COBORDij |     1.70    0.587897
       ln_LPI |     1.69    0.592716
  ln_WDISTij |     1.41    0.709638
       RTAij |     1.39    0.717253
```

Annex 5 NORMALITY TEST:

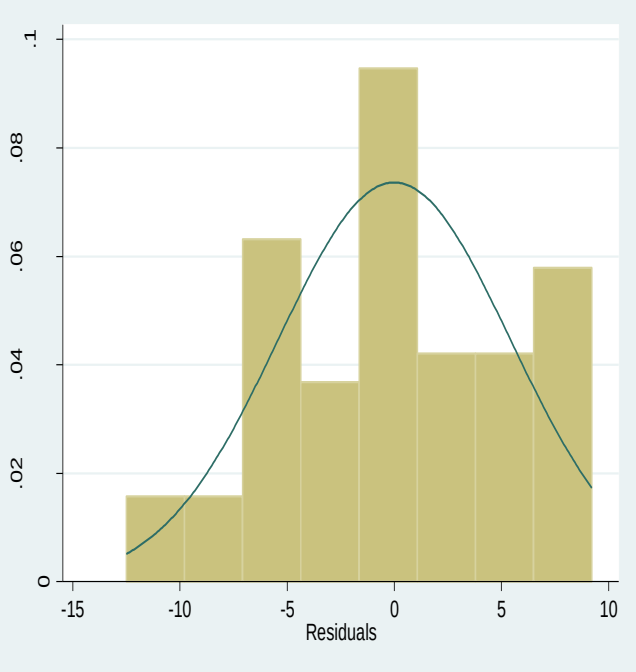
1: swilk r

```
. swilk r

                    Shapiro-Wilk W test for normal data

    Variable |   Obs        W           V       z       Prob>z
-------------+--------------------------------------------------
           r |    70    0.97078       1.798    1.276    0.10096   COBORDij |
270      0.0000       0.3223       47.24       0.0000
          PTji |   270      0.0000       0.0000          .        0.0000
         RTAij |   270      0.0000       0.0000       50.35       0.0000
```

2: sktest r

```
                    Skewness/Kurtosis tests for Normality
                                                    ------- joint ------
    Variable |   Obs      Pr(Skewness)   Pr(Kurtosis)   adj chi2(2)
Prob>chi2
-------------+------------------------------------------------------------
           r |    70      0.4408         0.1933         2.37         0.3050
```

3-



Annex 6 Heteroscedasticity:

. hettest ln_GDPj ln_FDIi ln_BREERij ln_WDISTij ln_POPj ln_TROADNETi ln_LPI COBORDij PTji RTAij

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

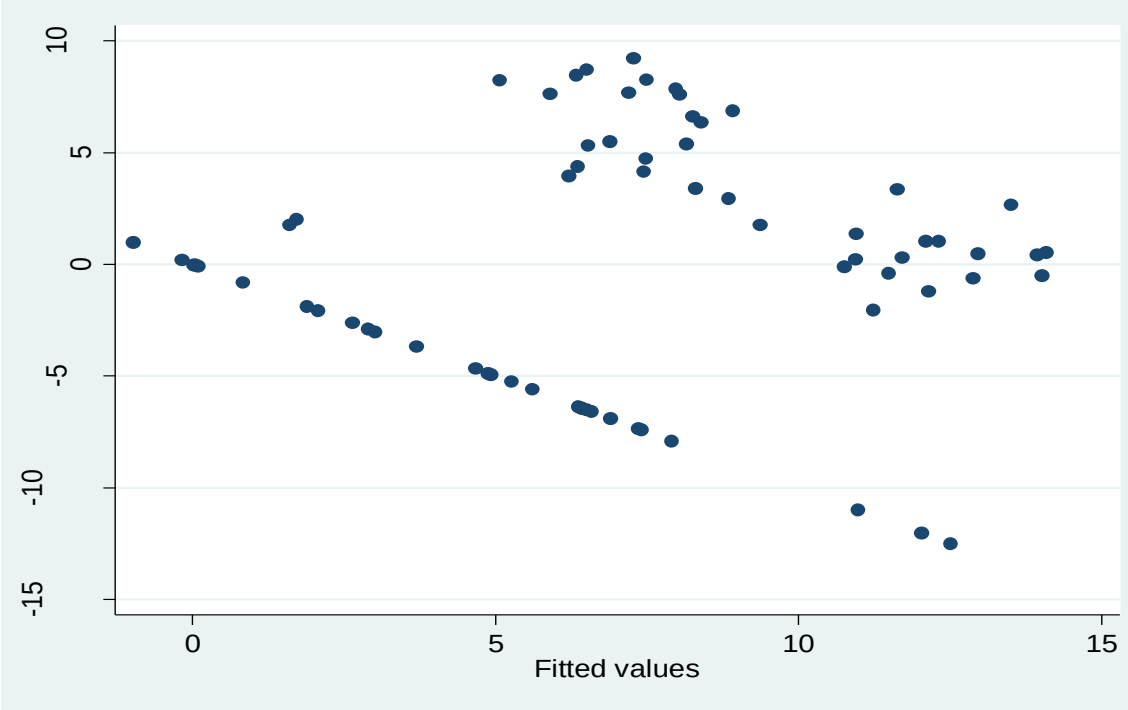
Ho: Constant variance

Variables: ln_GDPj ln_FDIi ln_BREERij ln_WDISTij ln_POPj ln_TROADNETi ln_LPI COBORDij PTji

RTAij

chi2(10) = 11.98

Prob > chi2 = 0.2864



Annex-7: Serial correlation /Autocorrelation test:

. xtserial ln_LIANEXPij ln_GDPj ln_FDIi ln_BREERij ln_WDISTij ln_POPj ln_TROADNETi COBORDij

Wooldridge test for autocorrelation in panel data

H0: no first-order autocorrelation

F(1, 14) = 1.661

Prob > F = 0.2184

Source: Own estimation (2019)

Annex 8 : Unit root

xtunitroot ips ln_LIANEXPij

Im-Pesaran-Shin unit-root test for ln_LIANEXPij

Ho: All panels contain unit roots **Number of panels = 15**

Ha: Some panels are stationary **Number of periods = 18**

AR parameter: Panel-specific **Asymptotics: T,N -> Infinity**

Panel means: Included **sequentially**

Time trend: Not included

ADF regressions: No lags included

Fixed-N exact critical values

	Statistic	p-value	1%	5%	10%
t-bar	-2.5808		-2.080	-1.910	-1.820
t-tilde-bar	-2.1336				
Z-t-tilde-bar	-3.8457	0.0001			

Im-Pesaran-Shin unit-root test for ln_FDIi

Ho: All panels contain unit roots **Number of panels = 15**

Ha: Some panels are stationary **Number of periods = 18**

AR parameter: Panel-specific **Asymptotics: T,N -> Infinity**

Panel means: Included **sequentially**

Time trend: Not included

ADF regressions: No lags included

Fixed-N exact critical values

	Statistic	p-value	1%	5%	10%
t-bar	-0.9567		-2.080	-1.910	-1.820
t-tilde-bar	-0.9592				
Z-t-tilde-bar	2.1204	0.9830			

xtunitroot ips ln_BREERij

Im-Pesaran-Shin unit-root test for ln_BREERij

Ho: All panels contain unit roots **Number of panels = 15**

Ha: Some panels are stationary **Avg. number of periods = 15.67**

AR parameter: Panel-specific **Asymptotics: T,N -> Infinity**

Panel means: Included **sequentially**

Time trend: Not included

ADF regressions: No lags included

Fixed-N exact critical values

	Statistic	p-value	1%	5%	10%

---

t-bar -2.4744 (Not available)

t-tilde-bar -1.7291

Z-t-tilde-bar -1.9397 0.0262

. xtunitroot ips ln_POPj

Im-Pesaran-Shin unit-root test for ln_POPj

Ho: All panels contain unit roots Number of panels = 15

Ha: Some panels are stationary Number of periods = 18

AR parameter: Panel-specific Asymptotics: T,N -> Infinity

Panel means: Included sequentially

Time trend: Not included

ADF regressions: No lags included

Fixed-N exact critical values

Statistic p-value 1% 5% 10%

---

t-bar -1.4317 -2.080 -1.910 -1.820

t-tilde-bar -0.7772

Z-t-tilde-bar 3.0449 0.9988

. xtreg ln_LIANEXPij ln_GDPj ln_FDIi ln_BREERij ln_WDISTij ln_POPj ln_TROADNETi ln_LPI COBORDij PTji RTAij, fe

note: COBORDij omitted because of collinearity

note: PTji omitted because of collinearity

note: RTAij omitted because of collinearity

Fixed-effects (within) regression Number of obs = 70

Group variable: COUNID Number of groups = 15

R-sq: within = 0.1807 Obs per group: min = 3

between = 0.0508 avg = 4.7

overall = 0.0542 max = 5

F(7,48) = 1.51

corr(u_i, Xb) = -0.7880 Prob > F = 0.1856

--

ln_LIANEXPij | Coef. Std. Err. t P>|t| [95% Conf. Interval]

-------------+--

ln_GDPj | -3.845103 2.313029 -1.66 0.103 -8.49576 .8055544

ln_FDIi | -1.267675 .9797096 -1.29 0.202 -3.237513 .7021636

ln_BREERij | .5934765 .8398425 0.71 0.483 -1.09514 2.282093

ln_WDISTij | .4646624 .2227854 2.09 0.042 .0167224 .9126024

ln_POPj | 8.05467 7.032051 1.15 0.258 -6.084216 22.19356

ln_TROADNETi | -.0258138 2.957475 -0.01 0.993 -5.972215 5.920587

ln_LPI | 15.87794 12.18058 1.30 0.199 -8.612753 40.36863

COBORDij | 0 (omitted)

PTji | 0 (omitted)

RTAij | 0 (omitted)

_cons | -16.87143 92.46238 -0.18 0.856 -202.7795 169.0367

----------+----------

sigma_u | 9.373894

sigma_e | 3.7906719

rho | .85945499 (fraction of variance due to u_i)

--

F test that all u_i=0: F(14, 48) = 8.06 Prob > F = 0.0000

. estimates store FE

. xtreg ln_LIANEXPij ln_GDPj ln_FDIi ln_BREERij ln_WDISTij ln_POPj ln_TROADNETi ln_LPI COBORDij PTji RTAij, re

Random-effects GLS regression Number of obs = 70

Group variable: COUNID Number of groups = 15

R-sq: within = 0.1745 Obs per group: min = 3

between = 0.3818 avg = 4.7

overall = 0.3353 max = 5

Wald chi2(10) = 17.50

corr(u_i, X) = 0 (assumed) Prob > chi2 = 0.0641

--

ln_LIANEXPij | Coef. Std. Err. z P>|z| [95% Conf. Interval]

-------------+--

ln_GDPj | -2.917758 1.172419 -2.49 0.013 -5.215657 -.6198585

ln_FDIi | -1.082186 .9476738 -1.14 0.253 -2.939593 .7752205

ln_BREERij | .5940609 .4258799 1.39 0.163 -.2406484 1.42877

ln_WDISTij | .4431275 .2188577 2.02 0.043 .0141744 .8720807

ln_POPj | 3.497653 1.321168 2.65 0.008 .9082114 6.087095

ln_TROADNETi | .4502027 2.548135 0.18 0.860 -4.54405 5.444455

ln_LPI | 14.40975 12.24152 1.18 0.239 -9.583194 38.4027

COBORDij | -2.595796 3.840335 -0.68 0.499 -10.12271 4.931121

PTji | -5.415871 5.820801 -0.93 0.352 -16.82443 5.992689

RTAij | -2.758419 3.139008 -0.88 0.380 -8.910761 3.393923

_cons | 27.92374 24.83658 1.12 0.261 -20.75507 76.60255

------------+--

sigma_u | 4.2738394

sigma_e | 3.7906719

rho | .55969852 (fraction of variance due to u_i)

--

. estimates store RE

. hausman FE RE

---- Coefficients ----

| (b) (B) (b-B) sqrt(diag(V_b-V_B))

| FE RE Difference S.E.

------------+--

ln_GDPj | -3.845103 -2.917758 -.9273452 1.993875

ln_FDIi | -1.267675 -1.082186 -.1854886 .2484858

ln_BREERij | .5934765 .5940609 -.0005844 .7238519

ln_WDISTij | .4646624 .4431275 .0215349 .041649

ln_POPj | 8.05467 3.497653 4.557017 6.906827

ln_TROADNETi | -.0258138 .4502027 -.4760165 1.501221

ln_LPI | 15.87794 14.40975 1.468187 .

--

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)

= 2.98

Prob>chi2 = 0.8870

(V_b-V_B is not positive definite)

. xtreg ln_LIANEXPij ln_GDPj ln_FDIi ln_BREERij ln_WDISTij ln_POPj ln_TROADNETi ln_LPI COBORDij PTji RTA

> ij, re sa vce(robust).

Annex 9 Random-effects GLS regression

xtreg ln_LIANEXPij ln_GDPj ln_FDIi ln_BREERij ln_WDISTij ln_POPj ln_TROADNETi ln_LPI COBORDij PTji RTA

> ij, re

```
Random-effects GLS regression                   Number of obs     =        70
Group variable: COUNID                          Number of groups  =        15

R-sq:  within  = 0.1745                         Obs per group: min =         3
       between = 0.3818                                        avg =       4.7
       overall = 0.3353                                        max =         5

                                                Wald chi2(10)     =     17.50
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =    0.0641

------------------------------------------------------------------------------
ln_LIANEXPij |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 ln_GDPj |       2.917758   1.172419    -2.49   0.013    -  5.215657   -.6198585
 ln_FDIi |       1.082186    .9476738   -1.14   0.253      -2.939593    .7752205
 ln_BREERij |   . 5940609    . 4258799    1.39   0.163      -.2406484    1.42877
  ln_WDISTij |  -.4431275    .2188577    2.02   0.043     . 0141744    .8720807
ln_POPj |        3.497653   1.321168    2.65   0.008      .9082114    6.087095
ln_TROADNETi | .4502027    2.548135     0.18   0.040      4.54405     5.444455
ln_LPI |          14.40975   12.24152    1.18   0.239      -9.583194   38.4027
 COBORDij |       2.595796   3.840335   -0.68   0.499      -10.12271   4.931121
PTji |            5.415871   5.820801   -0.93   0.352      -16.82443   5.992689
RTAij |           2.758419   3.139008   -0.88   0.380      -8.910761   3.393923
_cons |           27.92374   24.83658    1.12   0.261      -20.75507   76.60255
-------------+----------------------------------------------------------------
    sigma_u |  4.2738394
    sigma_e |  3.7906719
        rho |  .55969852   (fraction of variance due to u_i)
```
