Determinants of Agricultural Imports in Sub-Saharan Africa: A Gravity Model

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Abstract
Import dependency on agricultural products in Sub-Saharan Africa (SSA) has been increasing over the last two decades raising a lot of concern on the determinants of agricultural imports and their impact on economic growth. This study examines the determinants of agricultural imports in SSA by applying an augmented gravity model on a panel data for 37 SSA countries over the period 1995-2018. The results show that economic size measured by GDP, arable land endowment, membership to regional trade agreement, cultural proximity measured by sharing of a common language, inflation and governance quality influence agricultural imports positively and are significant. Furthermore, population growth of trading partners, geographical proximity measured by distance between the trading countries, transport costs measured by whether a country is landlocked or not, and agriculture productivity of the importing country negatively influence bilateral agricultural imports flow in SSA. These findings are crucial in understanding agricultural trade flows and formulating sound policies aimed at promoting international agricultural trade for economic growth and development in SSA.

Keywords: Agricultural trade, Agricultural imports, Gravity model, Sub-Saharan Africa
JEL Classification Codes: Q17, C51

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1 Introduction

In Sub-Saharan Africa (SSA), agricultural trade is momentous to the growth of the economies since most countries in the region are agricultural based. Agriculture has the potential to reduce poverty and promotes overall economic growth in the region. Favorable international trade balance is one of the main macroeconomic goals in every economy. Therefore, the importance of international agricultural trade in economic performance cannot be overemphasized. Moreover, agricultural trade enhances agricultural raw materials and food distribution hence it is a channel through which food and nutritional security is promoted both locally and globally.

Over that past three decades, agricultural imports in SSA have been increasing, partially due to the increasing population in the region causing increased domestic demand. The increase in domestic demand for diversified and more quality products resulting from increased incomes coupled with low agricultural productivity has further lead to increase in agricultural imports. High rate of agricultural imports that surpass agricultural exports has been raising concerns on the determinants of agricultural trade in the region since overreliance on agricultural imports threatens the balance of payments, employment in agriculture sector and consequently the potential role of agriculture sector in poverty reduction and economic growth. This concern is particularly due to the significance of agricultural sector vis-à-vis with the increasing food insecurity in the region. Although SSA is agriculturally based and agriculture contributes to about 32 percent of GDP growth on average annually (World Bank, 2008), it is the most food insecure region globally. About 23.2 percent of the total population suffers from chronic food deficiency (FAO et al, 2018).

While the determinants of agricultural exports has been widely studied (Tasfaye, 2014, 2021; Abate and Badiane, 2018; Khiyavi *et al*, 2013; Boansi *et.al*. 2014; Idsardi; 2010), determinants of agricultural imports have not received due attention despite the increasing trend of imports in most economies globally, and their significance on economic growth. Imports enhance absorption of foreign technology which promotes efficiency in domestic production and consequently output growth (Haddad *et al*., 1996). Import-led hypothesis have been tested and supported in other studies (Lawrence and Weinstein, 1999; Awokuse, 2007). In SSA, Fosu (2001) reports that imports are vital to economic growth since his study finds that instability in imports significantly influence economic growth negatively in the region. Mwangi et al, (2020) analyzed the causality between agricultural imports and economic growth in 40 SSA countries over the period 1990-2015. Their study reported that agricultural imports positively and significantly influence agriculture productivity and GDP per capita growth.

The current study therefore aims to provide a thorough understanding of the key determinants of agricultural international trade in SSA with specific interest on agricultural imports. The results show that GDP, arable land endowment, membership to regional trade agreement, cultural proximity, inflation and, governance quality influence agricultural imports positively and are significant. In addition, population growth of trading partners, geographical proximity, transport costs, and agriculture productivity of the importing country negatively influence bilateral agricultural imports flow in SSA. These findings are crucial in formulating sound policies aimed at promoting agricultural imports for economic growth and development in SSA.

The remainder of this study is organized as follows. Section 2 reviews the literature on agricultural international trade. Section 3 presents methodology and sources of data. Section 4 presents estimated results and discussion of the findings. Section 5 gives conclusion and recommendations.

2 Literature Review

2.1 Trends on International agricultural trade

Most countries in the world depend on international trade to meet agricultural demand balances though the rate of dependency on international market varies across countries. Over the period 1990-2019, Africa has been a net importer of food and agricultural products as shown in **Table 1.** Agricultural trade deficits have been increasing over the years and the figures more than doubled over the period 2010-2019. The value of food and agricultural imports increased approximately four folds while exports grew three folds. This increase may be attributed to the rising international food prices and increasing demand resulting from population pressure and income growth . Despite the agricultural trade deficits, Africa has been reported as the second fastest growing continent after Asia globally.

FAO (2011) using data for the period 1960-2007 reports that Africa, despite her agricultural potential, is a net importer of food and of agricultural products. In 2007-2011, 37 African countries were net importers of food while 22 countries were net importers of agricultural raw materials (Blein *et al*., 2013). Odjo and Badiane (2017) report that over the period 1998-2013, Africa's agricultural exports doubled while agricultural imports increased fivefold. They attribute this scenario to the probable loss of competitiveness of Africa's agricultural products such as foodstuffs in the global market.

Table 1: Regional Food and Agricultural products Trade 1990-2019 (Average value in million US$). Source: Authors calculations using FAO data, 2020

	1990-1999			2000-2009			2010-2019		
	Import	Export	Net import	Import	Export	Net import	Import	Export	Net import
Agricultural products									
Africa	18507.6	13540.2	4967.3	34887.7	21488.8	13399.0	79558.5	45712.4	33846.1
SSA	9162.9	11349.4	-2186.5	19352.5	17390.5	1962.0	44709.0	37645.7	7063.2
Asia	112195.2	63712.8	48482.3	188843	111521	77322	451983.8	266848.4	185135.4
Caribbean	3027.1	2804.1	222	5371	2263.3	3107.7	8953.3	3229.1	5724.2
Europe	215245	190612.6	24632.4	342629.6	318530.7	24098.9	560424.6	553711.4	6713.3
North America	43026	66334	-23308	80690.7	97725.2	-17035	142997	182606.5	-39609.5
South America	11357.9	30693.6	-19335.8	18066.4	67618.3	-49552	39639.9	152372.2	-112732
Oceania	4055.5	19350.9	-15295.4	8506.4	29982.6	-21476	17935.1	54367.1	-36432
Food excl. fish									
Africa	14880.6	7861.3	7019.2	28801.4	13699.8	15101.6	66486.7	31300.0	35186.7
SSA	7428.7	6221.1	1207.6	15849.8	10402.0	5447.9	37477.4	24140.6	13336.8
Asia	74293.5	38120.2	36173.3	132577.5	74614.2	57963.3	326903.7	180188	146715.7
Caribbean	2494	2262.8	231.2	4240	1240.3	2999.7	7154.1	1824.3	5329.8
Europe	145688.7	133615.4	12073.3	239453.4	220738.4	18715	397819.3	390644.9	7174.5
North America	26573.4	46119.5	-19546.1	51540.1	74639.7	-23099	93216	144452.4	-51236.4
South America	8375	18797.3	-10422.2	13548.1	48063.7	-34515	29901.4	110558.7	-80657.3
Oceania	2776.5	13521.6	-10745.1	5882.3	22445.6	-16563	12286.3	43589.3	-31303

SSA was a net exporter of agricultural products over the period 1990-1999 but thereafter the region has been net importer of both food and agricultural products. Net imports of agricultural products increased from an average of about US$ 1962.0 million over the period 2000-2009 to about US$ 7063.2 million over the period 2010-2019 while food net imports increased from about US$ 5447.9 million to about US$ 13336.8 million during the same period. Over the period 1961-1980 the value of food export exceeded the value of food imports as shown in **Fig. 1**. This implied a favorable balance of trade in food. For all the period 1991-2017 the value of food imports outstrips the value of food exports implying unfavorable balance of food trade in SSA. Food imports in the region has had an increasing trend over the period 1999-2014 and in 2014 the value of food imports was about $42.8 billion. The trade for agricultural products indicates a favorable balance of trade before 2005 and an unfavorable trade balance for the period 2005-2017 as shown in **Fig. 2.** Total agricultural imports were approximately $43.6 billion in 2011 and peaked in 2015 at about $51.1 billion.

As stated earlier, the increase in the value of imports and exports can be attributed to the increase in the international price of food and oil, the 2007-2008 food crises and the financial crisis in 2011. The persistent unfavorable balance of trade in food and agricultural products in SSA have possible negative implication on economic growth in the region despite the reported significance of agricultural imports.

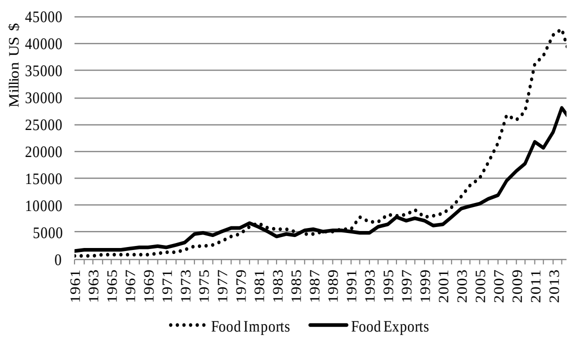

Fig. 1: Value of food imports and exports in SSA (1961-2017). *Source: Authors, 2020*

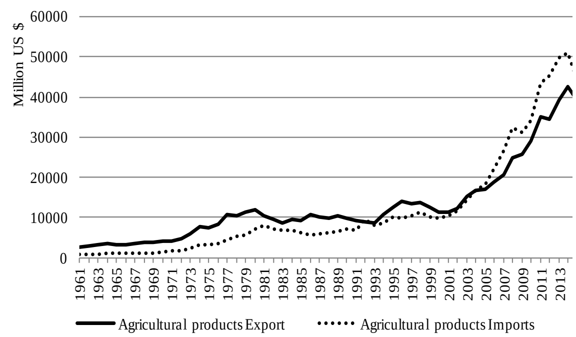

Fig. 2: Value of agricultural imports and exports in SSA (1961-2017). *Source: Authors, 2020*

SSA has had unfavorable balance of agricultural trade in the recent past. Trend on the value of agricultural imports in most countries have been increasing rapidly particularly from around the year 2000 onwards. However, SSA agricultural market is not homogeneous in the sense that each country presents some degree of heterogeneity in terms of agricultural import demands and exports. A few countries are able to meet their import bills while many still find difficulties.

2.2 Determinants of international trade

International trade theories try to explain why trade between countries exists. In theoretical and empirical literature, several factors are cited either as drivers or constraints to international trade. Agricultural trade determinants can be classified into two broad categories; demand side factors and supply side factors. On one hand, demand side factors are those factors that influence demand or the size of the market while on the other hand, supply side factors influence supply potential. Examples of supply side factors include economic size, trade costs and resource endowment while demand side factors include population, trade policies, income changes and domestic agricultural support (Tadesse and Badiane, 2017).

The Ricardian theory and H-O model show that differences in technology which explains labor productivity are the basis of international trade. Innovation and technology differences between countries explain income levels and trade patterns (Prescott, 1998). A country's technological progress could be measured by total factor productivity and, the levels of research and development (Keller, 2010). Technology advancement reduce communication costs thereby increase trade volumes (Fink et al. 2005; Lendle et al. 2012). While in classical theories technology is viewed as an exogenous variable that explain trade, in the real world it is important to note that international trade further shape technological progress.

Natural resource endowment is vital in production of goods and services hence determine trade volumes. Energy, land and water in particular are essential inputs in production and trade (WTO, 2010; Ruta and Venables, 2012). These factors determine comparative advantage of a country and hence the patterns of trade. According to H-O theory, differences in resource endowment lead to net gains in trade since each country will produce and export commodities that intensively use its abundant resource. Arable land and water are essential factors that determine agriculture production and trade. For example, a positive correlation exists between arable land per capital endowment and agricultural exports (WTO, 2013). SSA is well endowed with arable land and fresh water which makes agriculture sector indispensable for economic development.

Investment is another factor that influences international trade. Investment in infrastructure for example transport and information communication technology (ICT) facilitates participation in international trade by reducing trade and transport costs. A positive relationship exists between road network growth and trade share growth (WTO, 2013). Furthermore, increase in capital accumulation relative to labor may shape the comparative advantage of a country by shifting the country from being relatively labor-abundant to relatively capital-abundant.

Transport costs which refer to all shipping costs in international trade are major components of trade costs and they determine the volume of trade. Higher transport costs tend to reduce the volume of international trade (Samuelson, 1954; 1962). This is more likely because transport costs affect the prices of products being traded. Transport costs are mainly determined by a country's geographical characteristics such as access to sea or ocean and infrastructure development.

Demographic changes influence trade patterns through its impact on comparative advantage and influence on composition of imports demand (WTO, 2013). For example, Ageing, migration, increase in labor force participation define a country's comparative advantage and hence trade flows. Countries with higher ageing population relative to working-age population will tend to differ in their imports demand to countries with higher working-age population relative to the ageing population.

Institutions refer to the rules of the game a society (North, 1990). They play an important role in designing and implementing trade policies locally and internationally. Institutions, formal or informal, political and economic have an influence on international trade. A positive correlation exists between trade variables (value of imports and exports) and democracy level of a country (Yu, 2010). This is explained by the fact that more democratic governments have relatively liberal trade policies and tend to enter into trade agreements to facilitate opening up of the economy (Mansfield et al, 2002; 2008; Mansfield and Milner, 2012; WTO, 2013). Therefore, stable governance is fundamental to international trade as it reduces uncertainty that would hinder investment and pollute the business environment. Hence, trade openness is positively and significantly related to a country's governance index. While on one hand institutions affect international trade, on the other hand, a feedback effect exists whereby a country's institutions are shaped by international trade (Eichengreen and Leblang, 2008).

In the recent past, a few studies have used augmented gravity model to analyze the determinants of imports flows in developed and developing countries (Rahman, 2009; Chi and Kilduff, 2010; Wani et al., 2016; von Essen, 2017; Gil, 2020). These studies have cited market size, adherence to trade agreements, per capita income, trade openness, inflation rate, sharing of common border, infrastructure development, resource endowment, geographical proximity, and, population among the factors influencing imports. In the current study, the findings show that most of these factors that influence international trade flows are reported to significantly influence agricultural imports in SSA.

3 Data and methodology

3.1 Methodology

To investigate the factors that determine agricultural imports in SSA, a panel data for 37 SSA countries for the period 1995-2018 was used. The SSA countries used in the analysis are listed **Table A.1**. Countries were selected based on availability of most recent data and an augmented Gravity model was employed. Gravity model has been successfully and widely applied in empirical studies in international trade as it provides robust empirical findings. The traditional gravity model which is based on the Newton's Law of Gravitation was first applied by Tinbergen (1962) to explain trade flows. Tinbergen (1962) proposed that the size of bilateral trade flows between any two countries (i and j) is directly proportional to their economic sizes and inversely proportion to the economic proximity. Economic size is measured by their GDP while economic proximity is measured by the geographical distance between the two countries and captures the trade costs. As such, the traditional gravity model is expressed as;

$$X_{ij} = \theta \frac{Y_i^{\alpha} Y_j^{\beta}}{D_{ij}^{\varphi}} \qquad \textbf{(1)}$$

Where, X_{ij} is a measure of the trade flows, Y_i is the GDP of the importing country i, Y_j is the GDP of the exporting country j and D_{ij} is the distance between country i and country j. Increase in economic sizes promotes trade between the countries while increase in the geographical distance between them increases trade costs thus impedes trade.

Following Anderson and van Wincoop, (2003), and Sandberg et. al., (2006), other variables that influence international trade flows were added into the base model. These variables include; population, natural resource endowment, transport costs, colonial links, sharing of a common language, trade agreements, inflation and institutional quality. Fixed effects were included to control for unobserved time-invariant heterogeneity between countries following Feenstra (2004). Considering these factors and taking logarithms in **Equation 1**, the estimation augmented gravity model is specified as follows:

$$\ln(X_{ijt}) = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln D_{ijt} + \lambda \ln Z'_{[i(j)t]} + \eta_{ij} + \mu_t + \varepsilon_{ijt} \qquad \textbf{(2)}$$

Where, $Z'_{[i(j)t]}$ is a vector of other control variables that determine bilateral trade, η_{ij} is the country fixed effects, μ_t is the time-fixed effects and ε_{ijt} is the idiosyncratic disturbance term. The dependent variable X_{ijt} is a measure of agricultural trade flows. It is the value of agricultural imports of a SSA country from the major agricultural trade partner. Trade partners were selected based on top import partner country and region from which a SSA country imported agricultural products.. For the purpose of this study, agricultural imports comprise the sum of imports of all food items, agricultural inputs and agricultural raw materials. Food items comprise the commodities described in sections 0 (Food and live animals), 1 (Beverages and tobacco), 4 (Animal and vegetable oils, fats and waxes) and division 22 (Oil-seeds and oleaginous fruits). Agricultural raw materials comprise of the commodities described in section 2 (Crude materials, inedible, except fuels) less divisions 22 (Oil-seeds and oleaginous fruits), 27 (Crude fertilizers, other than those of division 56, and crude minerals) and 28 (Metalliferous ores and metal scrap). The value of agricultural imports was calculated based on Standard International Trade Classification (SITC) Revision 4[1]

Independent variables include; a measure of economic size of the trading economies that is GDP for the importing country which is also a measure of market demand and GDP for the exporting country reflecting supply potential (Idsardi, 2010). A positive sign of the coefficient of GDP is expected. Population of the trading economies is included as a measure of the market size (Sakyi and Afesorgbor, 2019). The expected effect of population is ambiguous as it depends to a large extent on government policies and relative prices between the trading countries among other factors. On one hand, population increase in the exporting country may impact agricultural imports in the importing country negatively. On the other hand, population increase in the importing country is likely to impact agricultural imports positively particularly in the case of dumping.

Trade costs are measured by the geographical distance between the capital cities of the trading countries (Distij). Distance has also been used as a proxy of transport costs in the works of Hoarau and Didier (2014). Geographical distance is expected to influence agricultural imports negatively. Other variables added to the model as a proxy for transport costs include dummy for landlocked following the works of Limão and Venables (2001), Portugal-Perez and Wilson (2008) and Tesfaye (2014). We considered a case where both the importing country and the exporting country are landlocked (DummyLLf) taking the value 1 and 0 otherwise, and the case where either of the trading countries is landlocked (DummyLLp). When either of the trading countries is landlocked, these impedes international trade hence a negative effect on agricultural imports is expected.

Cultural proximity which reflects transaction costs involved in trade was measured by dummy variable for common colonial links (Dummycol) and dummy variable for common language (Dummylang) as applied by Sandberg et al., (2006). Dummycol takes the value 1 when the trading countries share colonial relationship and 0 otherwise while Dummylang takes the value 1 when the trading countries share a common language and 0 otherwise. Sharing of common colonial links and/or language affects bilateral trade positively therefore a positive sign is expected.

Land and fresh water are important resources in agriculture production and as determinants of agricultural trade flows (Biggeri and Sanfilippo, 2009). Arable land in particular influences agricultural input demand and agriculture output. Consequently, arable land influence agricultural imports and exports. Arable land per person was therefore included in the model as a measure of natural resource endowment. In addition, agriculture productivity measured by value of agriculture output per hectare was included in the model as

[1] See Standard International Trade Classification Revision 4 available at https://unstats.un.org/unsd/publication/SeriesM/SeriesM_34rev4E.pdf

a proxy of agriculture technology. Arable land endowment and agriculture productivity affects agricultural trade positively thus a positive impact on agricultural imports is expected.

A dummy variable for membership to a regional trade agreement (RTA) or economic partnership agreement (EPA) labeled (DummyRTAEPAs) was added to capture the effect of regional trade agreements on agricultural imports. Although European Union (EU) is African's top trading partner in agricultural products, intra and inter-regional agricultural trade is evident in SSA (Traore and Sakyi, 2017). The study therefore considered membership to any of the following regional trade agreements; Common Market for Eastern and Southern Africa (COMESA), Central African Economic and Monetary Community (CEMAC), East African Community (EAC), Economic Community of West African States (ECOWAS), Economic Community of Central African States (ECCAS) and Southern African Development Community (SADC). In addition, membership to Cotonou agreement which is a cooperation agreement between organization of Africa, Caribbean, and Pacific states (ACP) and the EU (ACP-EU) was also considered. ACP states who are signatory to the Cotonue agreement provide duty free market access for EU exports hence membership to this agreement is likely to influence SSA's agricultural imports. DummyRTAEPAs takes the value 1 when the trading countries are both members of any of the listed regional trade agreement and/or Cotonue agreement and 0 otherwise. Trade agreements influence international trade flows positively as they reduce transaction costs and facilitate free trade.

Institutions have been theoretically and empirically proved to influence international trade (Mansfield et. al., 2000; Yu, 2010). Poor governance and insecurity in SSA threatens agriculture sector productivity and market. To capture the effect of institution quality, a governance index was added into the model. Previous studies have used various variables as proxy for institutional quality such as corruption control, rule of law, democracy and political stability (Yu, 2010; Tesfaye, 2014; Braha et al., 2016; von Essen, 2017). In this study, a governance index was computed using principal component analysis (PCA) based on the six Worldwide governance indicators which include; corruption control, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and, voice and accountability developed by Kaufmann et al., 2010. The governance index captures the six dimensions thereby covers the quality of institutional efficiency comprehensively. Good governance affects international trade positively while bad governance creates insecurity, uncertainty and, increases transaction costs thereby limiting trade flows (Mansfield *et. al.*, 2000; Anderson and Marcouiller, 2002). The coefficient of governance index is therefore expected to be positive.

3.2 Data and descriptive statistics

Data was mainly collected from the United Nations Conference on Trade and Development Statistics (UNCTADSTAT), World Bank database, the Food and Agriculture Organization Corporate Statistical Database (FAOSTAT), French Research Center in International Economics database (CEPII), International Monetary Fund (IMF) and World Development Indicators (WDI). **Table 2** shows a summary of variables description and the sources of data used in the analysis. Expected sign of each of the variables in the model is given based on economic theory and intuition.

Table 2: Variable description and data sources. Source: Authors, 2020

Variable	Definition	Code	Expected sign	Data source
Agricultural trade flows	Total value of agricultural imports of country i from j in US$	$agricM_{ijt}$		UNCTADSTAT
Supply potential	GDP of the exporting country j based on constant 2010 US $	GDP_{jt}	+	World Bank
Market demand potential	GDP of the exporting country j based on constant 2010 US $	GDP_{it}	+	World Bank
Market size 1	Exporting country's total population	Pop_{jt}	+/-	World Bank
Market size 2	Importing country's total population	Pop_{it}	+/-	World Bank
Natural resource endowment	Importing country's arable land in ha per person.	$Arablelpc_{it}$	+	FAOSTAT
Trade costs	Distance between capital cities of country i and j in miles	$Dist_{ij}$	-	CEPII
Transport cost	Dummy variable for access to sea/ocean	DummyLL	-	CEPII
Cultural proximity 1	Dummy variable for common colonial links	Dummycol	+	CEPII
Cultural proximity 2	Dummy variable for common language	Dummylang	+	CEPII
Trade agreements	Dummy variable for membership to trade /economic agreement	DummyRTAEPAs	+	CEPII
Inflation	Annual consumer price index	Inflation	+	IMF
Institutional quality	Governance index	Govindex	+	WDI, Computed

Table 3 presents the summary of descriptive statistics. As stated earlier, the dataset comprises of 37 SSA countries observed over the period 1995-2018. Between and within statistics are not presented but are available. Mean agricultural imports over the period is about US$138827.4 million.

Table 3: Summary of descriptive statistics. Source: Authors calculations, 2020

Variable	Obs.	Mean	Std. Dev.	Min	Max
$agricM_{ij}$	888	138827.4	188475.2	1318	1284084
GDP_i	888	2.82e+10	7.40e+10	1.22e+08	4.69e+11
GDPj	888	1.14e+12	1.09e+12	3.67e+09	3.17e+12
$GDPpc_i$	888	2125.246	2691.966	210.8042	14417.06
$GDPpc_j$	888	18166.5	16007.87	548.5882	79234.96
Pop_i	888	1.52e+07	2.51e+07	75304	1.96e+08
Pop_j	888	6.25e+07	5.24e+07	7089487	2.09e+08
$Dist_{ij}$	888	2062.327	1385.826	84.48	5952.97
$Arablelpc_i$	888	.2504145	.1880102	.0015843	1.475626
$Govindex_i$	888	-1.16e-08	.9794981	-2.395147	2.92593

4 Results and discussion

Table 4 reports a summary of the results of the estimated augmented Gravity model. In Column 1 of **Table 4** results of the base gravity model are reported. Coefficients of the logarithm of GDP of the importing (exporting) country are positive and significant at the 0.01 level. Both the GDP of the importing (exporting) country significantly influence agricultural imports of the importing country positively. However, the coefficient of logarithm of geographical distance between the importing and the exporting country is negative and significant at the 0.01 level. This implies that geographical distance which reflects the costs involved in trade influence imports of agricultural products negatively and significantly. The coefficient of logarithm of population of the importing (exporting) is negative and significant at the 0.01 level. Population is a measure of the market size. An increase in population of the exporting country expands the domestic market and the export share may decreases depending on enforced government policies such as export bans and relative prices in the trading partner.. This consequently leads to a reduction in agricultural imports in the importing country. The results agree with the economic intuition behind the gravity model and are consistent with the findings of previous studies for example, Ouma, (2017).

Table 4: Summary results of the estimated Gravity Model

VARIABLES	$LagricM_{ij}$ (1)	$LagricM_{ij}$ (2)	$LagricM_{ij}$ (3)	$LagricM_{ij}$ (4)	$LagricM_{ij}$ (5)
$LGDP_i$	0.887***	0.926***	0.929***	0.933***	
	(0.0265)	(0.0273)	(0.0298)	(0.0309)	
$LGDP_j$	0.369***	0.323***	0.301***	0.274***	
	(0.0274)	(0.0284)	(0.0325)	(0.0347)	
$LPop_i$	-0.326***	-0.422***	-0.409***	-0.445***	0.488***
	(0.0259)	(0.0317)	(0.0347)	(0.0371)	(0.0223)
$LPop_j$	-0.432***	-0.407***	-0.359***	-0.318***	-0.0446
	(0.0436)	(0.0433)	(0.0490)	(0.0532)	(0.0378)
$Lndist_{ij}$	-0.700***	-0.654***	-0.617***	-0.572***	-0.572***
	(0.0340)	(0.0347)	(0.0414)	(0.0433)	(0.0433)
$LarableLpc_i$		0.198***	0.197***	0.245***	0.241***
		(0.0390)	(0.0423)	(0.0464)	(0.0465)
DummyLLf			-0.0150	-0.0491	-0.0484
			(0.119)	(0.127)	(0.127)
DummyLL p			-0.0576	-0.0619	-0.0590
			(0.0820)	(0.0871)	(0.0871)
DummyRTAEPAs			0.313***	0.324***	0.323***
			(0.0727)	(0.0760)	(0.0760)
Dummycol			0.0191	0.0817	0.0941
			(0.108)	(0.118)	(0.118)
Dummylang			0.104	0.0454**	0.0567
			(0.110)	(0.119)	(0.119)
$Linflation_i$				0.0884***	0.0887***
				(0.0207)	(0.0207)
$Govindex_i$				0.0264*	0.0276
				(0.0246)	(0.0246)
Lnagricvperha				-0.262***	-0.263***
				(0.0537)	(0.0537)
$LGDPpc_i$					0.932***
					(0.0308)
$LGDPpc_j$					0.276***
					(0.0349)
Observations	888	888	888	888	888
Number of countries	37	37	37	37	37
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

A measure of natural resource endowment is included in the base model. The results are reported in column 2 of **Table 4**. The coefficient of logarithm of arable land is positive and significant at the 0.01 level. This implies that arable land of the importing country influence agricultural imports positively and significantly. The negative relationship between arable land and agricultural imports, which include agricultural inputs, could be explained by the fact that countries with large arable land in SSA demand more agricultural inputs such as farm machinery, seeds, and fertilizers which in the current situation are mostly imported due to limited capacity to produce such inputs in most of SSA countries.

More variables (measure of transport costs, trade agreements, cultural proximity, inflation, governance quality, and agriculture productivity) were included and the results are presented in columns 3 and 4 of **Table 4**. Transport costs are reflected by a dummy variable for landlocked. The coefficient of dummy landlocked is negative though not significant. When either the importing or exporting country is landlocked transports costs are likely to be higher thereby slowing down the imports of agricultural products in SSA. However transport cost do not significantly influence agricultural imports since food which forms a larger share in agricultural imports is a necessity.

The coefficients of dummies for common colonial relationship and common language are positive and significant at the 0.05 level in the case of common language. Cultural proximity reduces transaction costs in international trade hence it promotes imports flow. This implies that SSA countries tend to import agricultural products from countries that share colonial links and/or common language. The coefficient for DummyRTAEPAs is positive and significant at the 0.01 level. RTAs and EPAs promote bilateral agricultural trade due to the fact that trade agreements further reduce transaction cost through promotion of free trade among member states. The findings on the effect of trade agreements are consistent with the findings of Korinek and Melatos (2009) who report that regional trade agreements increases trade of agricultural products among member states.

Inflation coefficient is positive and significant at the 0.01 level. Inflation therefore, significantly increases imports of agricultural products. Food inflation comprises a large share in inflation of these countries. Hence when a country is experiencing shortage in food commodities for example due to bad weather, the shortage pushes food prices and inflation up. It is during this time that agricultural imports increases.
Governance index coefficient is positive and significant at the 0.1 level. Good governance which implies political stability and democracy promotes trade by creating a healthy environment for doing business. It facilitates creation of trade agreements and partnerships which open up the economy to the external world. As such, improving governance and institutional quality promotes bilateral trade of agricultural products. Coefficient for agriculture value per hectare is negative and significant at the 0.01 level. Agriculture productivity in the importing country is inversely related to agricultural imports. Hence, agriculture productivity significantly reduces agricultural imports.

Finally, as a robustness check, we dropped logarithm of GDP for both importing and exporting countries and included logarithm of GDP per capita for both countries. As the results in column 4 of **Table 4** shows, logarithm of GDP per capita is positive and significant at the 0.01 level. Hence increase in GDP per capita of the importing country increases agricultural imports significantly. As GDP per capita increases tastes and preferences also changes, towards quality, differentiated and more prestigious goods which stimulates imports. For example demand for processed food stuffs increases much of which is imported from the international market. There is not much difference in both magnitude and significance of the coefficients of other variables. Therefore, the augmented Gravity model applied gave robust findings.

5 Conclusions and recommendations

The objective of this study was to identify the determinants of agricultural imports flow in SSA. Agricultural imports in the region have been increasing over the recent past, raising concerns on their sustainability owing to the increasing population in the region and the increasing international food commodity prices. Using a panel data of 37 SSA countries observed over the period 1995-2018, an augmented gravity model was applied to study determinants of agricultural imports. Imports of all food items and agricultural raw materials were considered. The results show that economic size measured by GDP, arable land endowment, membership to regional trade agreement, cultural proximity measured by sharing of a common language, inflation and governance quality are directly proportion to the flow of agricultural imports in SSA and are significant. Furthermore, population growth of trading partners, geographical proximity measured by distance between the trading countries, transport costs measured by whether a country is landlocked or not, and agriculture productivity of the importing country negatively influence bilateral agricultural imports flow in SSA. These findings are crucial in understanding agricultural trade flows and formulating sound policies aimed at promoting international agricultural trade for economic development in SSA. Since regional integration coupled with sound governance and institutions play a vital role in promoting agricultural imports in the region, governance reforms which aim at promoting political stability, democracy and corruption control should be put at the forefront of agricultural trade development agenda. Given the rising population in the region, boosting domestic agriculture production to meet local demand would be appropriate in order to complement imports and cushion against possible international market shocks. Hence, expansion of agricultural land, agriculture mechanization and adoption of modern agriculture technology should be put at the heart of agriculture development agenda. Trade agreements should be encouraged among countries that share common languages, colonial links and/or geographical regions as this significantly reduces transaction costs and fosters international trade among members. Governments should encourage agricultural foreign direct investment which facilitates importation of foreign agricultural technology that will foster production of agricultural products that would otherwise be imported. Furthermore, technology enhances production efficiency of products that meet the changing needs of the society as the income grows. This in turn enhances local availability of quality commodities at lower prices. Though agriculture is the engine of growth in many SSA countries, the sector have not been receiving due attention from the governments. The value of government expenditure as a percentage of total expenditure is relatively low in most of the countries and expenditure on agriculture has been decreasing over the years. More government expenditure need be allocated to agriculture sector in SSA in order to facilitate agricultural research and development which will go a long way in promoting agricultural domestic production, import substitution and export promotion.

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Appendix

Table A.1: List of countries

Oil exporters	Middle income non-oil exporters	Low-income non-oil exporters	
Angola	Cote d'Ivoire	Burkina Faso	Zimbabwe
Chad	South Africa	Burundi	Central Africa re
Cameroon	Ghana	Guinea	Madagascar
Congo	Kenya	Malawi	Somalia
Nigeria	Zambia	Mali	Comoros
Sudan	Mauritania	Mozambique	Liberia
Gabon	Mauritius	Niger	Senegal
	Namibia	Rwanda	Sierra Leone
	Lesotho	Gambia	
	Botswana	Benin	
		Togo	
		Uganda	