Why Doesn't Africa Trade Regionally?

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Introduction

Most countries in the world engage in a large share of their agricultural trade with countries that are nearest them. Countries in South Asia, Sub-Saharan Africa and North Africa/Middle East are exceptions to this and largely trade extra-regionally. The Middle East is largely in one band of latitude with limited access to water, and the number of commodities that can be grown is limited. South Asia is also geographically small in size compared to other regions. Sub-Saharan Africa spans a wide range of latitudes, however, so greater diversity of cropping would be expected, and trading within the region to take advantage of that diversity would also be expected.

This paper considers the determinants of trade among countries in order to determine which ones are the most important in determining the source of African agricultural imports. Determining how African nations choose trading partners is the first step in determining whether there are ways in which local trading relationships can be encouraged, possibly enabling more income generating trade activity for African exporters. The next section discusses possible hypotheses that might explain the direction of African agricultural trade. The third section discusses the literature on gravity models, in theory and with respect to African trade. The fourth section discusses the approach and data to be used to determine which of the hypotheses are supported by the trade data. The fifth section discusses the results.

In general, the results indicate that African nations are more likely to trade with countries with a similar diet, suggesting that trade does not occur for product diversity. African countries trade with nations that are strong exporters of agricultural products, suggesting that countries outside the region might have a greater comparative advantage in agricultural goods compared to Africa. Common languages are an important determinant of trade, perhaps suggesting that former colonial relationships persist. Being landlocked also reduces the likelihood of importing, which suggests that ease of transportation to coasts might be important in determining imports. The model underpredicts exports from middle income African countries to other African countries. This suggests that some African exporting countries might have a regional advantage for which the gravity model doesn't account.

HYPOTHESES

Several regions of the world, notably Europe, Latin America, and East Asia and Oceania engage in a great deal of regional agricultural trade[2]. South Asia, the Middle East and Sub-Saharan Africa do not tend to import agricultural goods from regional trading partners. (See Table 1) This lack of interregional trade has been noted for total trade (including all goods) by Longo and Sekkat, 2004 and Carrere, 2004. They further note that gravity models in the literature predict that trade among African nations should be higher.

There are a number of different explanations for this stylized fact:

1. Comparative advantage in particular foods: Sub-Saharan African countries grow similar crops, and have little surplus to market. They might rely on other regions to obtain a more diversified diet. Yeats (1999) constructs regional import indices that indicate that the products which African countries export are very different from the ones that they import (see also Carrere, 2004).

2. Comparative advantage in agriculture: African countries do not produce a surplus of necessary commodities, i.e. grains. African countries must therefore import these necessary commodities from outside the region.

3. African countries have established trading relationships with former colonial powers, and have access to preferential trading agreements. Sandberg and Martin (2001) find, using a gravity model, that colonial trade ties contributed to growth in the Southern African Development Community. Coulibaly and Fontagne (2004) find that language ties, including colonial ties, are significant in determining imports in West Africa, but are not significant for agricultural imports.

4. African countries have many ports that enable trade overseas, but road and train infrastructure between cities is limited, especially in the interior of the continent. Coulibaly and Fontagne (2004), using a gravity model, test the hypothesis that distances and poor road connections hinder West African trade. They find that paved roads as a percentage of roads between two countries is significantly associated with greater overall trade. However, they found that sea distance is negatively associated with agricultural trade, although a shared

[2] For the most part, World Bank regional definitions were used.

borders, and paved roads do not seem to matter. Longo and Sekkat (2004) find that improvements in infrastructure could improve intra-African trade.

THE LITERATURE ON GRAVITY MODELS AND AFRICAN TRADE

To test these hypotheses, a gravity model was used to look at patterns of agricultural imports for the world as a whole, and for Africa. Gravity models are often used to explain trade patterns and have very high explanatory power. Theoretical underpinnings of the gravity model are provided by Feenstra, Markusen and Rose (2001) and Bergstrand (1985). In short, many theoretical models posit that trade between two nations is dependent on income (GDP), and transport costs (a function of distance), which are the two perennial explanatory variables for gravity models of trade between two nations. Large economies, with higher GDP's are expected to export and import larger amounts. Larger distances between nations discourage trade. Most gravity models also use the per capita GDP as a measure of the desire for imports.

The more recent literature recommends the use of fixed effects variables for individual countries, as tariff regimes in individual countries can alter trade flows, consumers might differentiate among goods from various countries, and technology might differ leading to different prices. (Estevadeordal et al., 2003). In practice, Rose and Van Wincoop (2001), in a model using panel data, use fixed effects variables for each country pair. In a cross sectional model, Estevedeordal et al.(2003) use total trade as a dependent variable, with a fixed effect variable used each time a country is involved in the transaction. Matyas (1998) uses exports from one country to another as a dependent variable, and uses fixed effects variables for both importers and exporters, as well

as time periods, using a set of panel data. Eaton and Kortum (2002), using the share of imports from one country to another vs. the share of domestic production in the importing country as the dependent variable, use binary variables for both importing and exporting countries (cross-section). The current research uses imports from one country to another and also uses a fixed effects specification similar to that of Matyas (1998), although the current research is cross-sectional and therefore does not include time fixed effects.

Most of these authors find that including the fixed effects variables alters the other parameter coefficients, and that the fixed effects coefficients are statistically significant. In Esteveordal et al, (2003) per capita GDP loses significance with the inclusions of FE variables. In Matyas (1998), foreign currency reserves and real exchange rate lose their significance with the inclusion of FE variables.

Other specifications of gravity models have been used to examine African trade and the determinants of regional trade. Coulibaly and Fontagne (2004) use a Tobit and OLS gravity models of 8 West African Monetary Union countries. Carrere (2004) uses a gravity model to consider the impact of African customs unions on trade and finds that such unions have a positive effect. Sandberg and Martin (2001) consider the effects of colonial trade, preferential trade and income on the trade flows in the Southern African Development Union, finding that income, common language and colonial ties are significant. Longo and Sekkat use a Tobit gravity model of African trade to look at the effects of political tensions, infrastructure and policy mismanagement on inter-African trade. They find that these factors hinder trade between African nations and do not hinder trade between African and industrialized nations.

The other papers have some similarities and differences from the current research. Coulibaly and Fontagne (2004) consider just the 8 countries of the monetary union, without fixed effects, and use a variety of measures of transport ease between two countries (including sea distance, road distance, total transit over land (to incorporate landlocked countries) and percentage of paved roads between the countries), as well as contrasting the results of a standard gravity model with those of an Armington model of disaggregated trade in various sectors. They also include measures of language. Sandberg and Martin (2001) also look at a subset of countries, explicitly contrasting colonial and non-colonial trade. Carrere (2004) uses a gravity model, panel data, looks at trade among all countries, excluding intra-OECD trade, uses dummies for membership in African currency unions, and uses random effects. Carrere (2004) also uses variables for landlocked, distance and contiguity, and also measures roads, telephones and transport between two countries to determine the effect of transport costs. Longo and Sekkat (2004) look at African trade with other African nations and contrast it with African trade with developed nations. They also look at the effect in infrastructure on trade including a combined index of roads, whether a country is landlocked and how many telephone lines there are.

The current research differs from some of these approaches in that it focuses on agricultural trade. In addition, the current research uses two measures of comparative advantage in agricultural exporting. One such measure is the importer and exporter share of world agricultural trade, indicating real strength in agricultural production. Standard gravity models predict total trade between two countries, not trade in a specific sector. Sectoral gravity models , which include some controls for comparative advantage, are becoming more common in the

literature[3] (See Lai and Zhu, 2004, Harrigan 2001). Coulibaly and Fontagne also look at sectoral equations and one of these sectors is agriculture. Their specification regresses bilateral trade compared to imports from France on distances, prices and GDP compared to that of France. The current research uses variables that resemble the theoretical results (but not the empirical specification) of Lai and Zhu (2004) and the specification of Coulibaly and Fontagne (2004), both of which try to proxy the number of firms as a share of the world's active firms. Coulibaly and Fontagne use the ratio of a country's GDP to France's GDP, while this specification uses a country's share of world agricultural exports and agricultural imports.

The current research also considers similarity of diet as a potential indicator of comparative advantage,i.e., if countries have similar diets, it might signal comparative advantage in similar goods, indicating a need to go abroad for variety. Further, the current research is able to contrast a sample of 100 countries with that of 31 African countries to see if certain factors affect African trade more than they affect trade in the rest of the world[4].

THE MODEL

A standard OLS loglinear gravity specification was used, with the GDP of both importer (impgdp) and exporter (impgdp), distance between the two countries(distance), GDP per capita for both importer (imgdppc) and exporter (exgdppc), a binary variable for a common language, and a binary variable indicating whether the countries share a border as explanatory variables (contiguous). Additional explanatory variables included the log share of agricultural imports in

[3] Many papers use factor endowments and monopolistic competition models to control for comparative advantage in sectoral gravity models.

world trade of the importer (avgimshare) and the share of world agricultural exports by the exporter (avgexshare). These latter two variables helped to control for comparative advantage in the agricultural sector. A binary variable for similarity of diet was also used. Fixed effects variables for individual countries were also used, so that the equation included a binary variable for each exporter and one for each importer. These variables took a value of one if the country in the observation was the importer and zero if the importer was a different country. The equation used is thus

$$\ln(imports_{ij}) = \alpha + \beta_1 \ln(dist) + \beta_2 \ln(imgdp) + \beta_3 \ln(\exp gdp) + \beta_4 \ln(imgdppc) + \beta_5 \ln(\exp gdppc) + \beta_6 CommonLanguage) + \beta_7 Landlocked) + \beta_8 \ln(avgexshare) + \beta_9 \ln(avgimshare) + \beta_{10} SameDiet \beta_{11} Contiguous + \sum_i \beta_i D_i + \sum_j \beta_j D_j$$

where the D's are binary variables for each importer and each exporter.

Bilateral agricultural import figures for 1999 from UNCTAD were used as the dependent variable. The data was aggregated to reflect USDA definitions of "agricultural products".Per capita GDP data were obtained from the World Bank World Development Indicators. FAO Distance data were from a dataset computed by Haveman, as referenced on the Macalester College website. Common diet was a binary variable indicating that for the two countries in the bilateral trade pair, the same grain had the largest share in their diet, the same meat had the largest share in their diet, and the same protein source (usually meat, pulses, grain, or dairy) had the largest share in their diet, according to the FAO Food Balance Sheets for 1999.

Regressions were performed on the agricultural imports of a sample of African countries (imports from 100 countries worldwide). Regressions were also performed on the agricultural imports of a sample of 100 countries from around the world, including Sub-Saharan African

[4] Longo and Sekkat do compare their coefficients with average results within the literature.

countries from the same 100 nations, in order to obtain benchmarks for the importance of coefficients. Additionally, two separate sub-samples for Africa were considered: the set of all 31 Sub-Saharan African nations for which there was complete data, and the set of low income (as defined by the World Bank) African countries. On average, the R squared values were around .7 for the sample of 100 countries, and around .55 for African countries without fixed effects, and around .7 when fixed effects variables were included.

RESULTS

Regression Coefficients

The results are outlined in Table 2.

If Hypothesis 1 is correct, one would expect to see that countries with similar diets do not trade very much. One would expect them to import from countries that produce different types of goods. Similarity of diet, however, has a positive coefficient, indicating that African countries are more likely to import goods from countries with similar diets, while this relationship did not hold true for the rest of the world. This suggests that a desire for variety in the diet might not be a reason why African countries import from outside the region.

If Hypothesis 2 is correct, one would expect positive coefficients for the variables representing comparative advantage in agricultural production. The coefficients for variables representing comparative advantage for the exporter of a good were positive and significantly associated with the size of an African country's imports. The importer's share of world imports was not

significant when fixed effects variables were included. However, the size of the coefficients for Africa were smaller than for the 100 country sample, indicating that comparative advantage might be somewhat less important in determining Africa's imports than those of other countries.

The common language variable was positive and significantly associated with imports for African countries, suggesting that Hypothesis 3, that former colonial relationships might still be significant in establishing trade patterns, was correct. The coefficient was the same size as that of the sample of 100 countries for some specifications, but was substantiallly smaller than the coefficient for the sample of 100 countries when fixed effects variables were included. This might suggest that part of the effects of a common language are correlated with country specific characteristics. The finding of significance here is similar to the results of Sandberg and Martin (2001) in confirming colonial relationships, but doesn't necessarily suggest that the language ties are more important for African nations than for other countries. Coulibaly and Fontagne (2004) also find that language ties have importance for trade beyond the ties of former colonial relationships, but they don't find language to be important for agricultural products.

Testing Hypothesis 4 uses a less straightforward test, since several variables imperfectly measure the ease of transport between African nations and their trading partners. Having one landlocked party to the transaction was negatively associated with trade for African countries without fixed effects[5]. The coefficients for this variable were larger for both sample of African countries than for the sample of 100 countries. Lack of access to ports might indeed have an effect on trade.

[5] The landlocked variable is highly correlated with some of the fixed effects variables and thus is rendered less meaningful in the fixed effects specifications.

Coulibaly and Fontagne (2004) also find that a high land transit distance (their measure of the disadvantage of being landlocked) has a negative impact on total trade, but not on agrucltural trade. They also note that European landlocked countries tend to trade less than other countries, but by a lower margin than African landlocked countries.

If transport were just as easy between African countries as it is among other countries, one would expect contiguity to be positively related to African imports, and distance to be negatively related to imports. This is certainly true. One would also expect the coefficients to be the same size for the model using African countries as they are for the sample of 100 countries. If per mile costs are higher for Africa, one would expect to see larger coefficients for contiguity and distance. If transport costs between African nations are higher, one would expect that contiguity would be less positively associated with trade in Africa, than for the world as a whole.

As Table 2 indicates, contiguity coefficients were just as large for African imports as they were for the sample as a whole, and in fact were larger when fixed effects were included. Distance coefficients were somewhat smaller. This partially contrasts with the results of Coulibaly and Fontagne (2004), who found that sea distances were very negatively correlated with agricultural trade, but a shared border was not significant. While it is not clear whether transport costs are more significant in African trade, this particular specification does not seem to support the notion that it is more difficult for contiguous African nations to trade than it is for other contiguous nations to trade.

It appears as though access to good ports might be important for African nations. However, the positive reasonably-sized effect of contiguity on trade suggesting that transport between contiguous African nations is not more difficult than transport between other nations.

Most of the previous studies have found distance to be negatively significant and infrastructure between two countries to be significant in determining trading patterns. It is possible that even if infrastructure is poor between African countries, it might be worse between Africa and elsewhere, thus making contiguity more important than it would otherwise be.

Predicted Values

In order to consider the possibility of other omitted variables, predicted trade values from the gravity model were compared with actual values. Trade was overpredicted by the model for most observations, as Longo and Sekkat (2004) note to be true for the literature as a whole. However, trade was underpredicted by the model on average. The model often underpredicted lower income African countries' imports from exporting countries such as South Africa, Kenya, Tanzania, Zimbabwe, and Uganda, as well as a number of European nations, and these underpredicted amounts were so large that they swamped the large number of slightly overpredicted observations. Some higher income countries in Africa are managing to send goods to lower income countries. Yeats (1999) finds that South Africa, for instance, is a major regional exporter to other African nations. This also suggests that African net exporters of agricultural products might have a regional comparative advantage greater than that predicted even by their closeness to other African nations or the other predictors of trade, including similarity of diet and comparative advantage.

Conclusions

Several factors seem to contribute to Africa's extra-regional trading patterns. Comparative advantage in necessary commodities, former colonial relationships, and access to ports appear to be among them. Diversity of diet seems to be less important. However, with the exception of being landlocked, the size of the effects of these significant factors does not seem to be greater for African imports than for imports by other countries.

Additionally, the fact that there are a few African countries which are more successful than one would predict at exporting with Africa suggests that there are more factors outside the standard gravity models that are affecting African trade, and gravity models seem to fit Africa less well than they fit the rest of the world. The lower R-squared values for the model of Africa, compared to the model of world agricultural trade as a whole, provide more supporting evidence for this conclusion. Further research into specific characteristics of successful regional exporters would probably shed more light on this phenomenon.

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Table 1. Percentage of a region's agricultural imports that originate from the US, the EU or the region itself

	Percent of Agricultural Imports from the US	Percent of Agricultural Imports from the EU	Percent of Agricultural Imports from region
Europe	4.19%	66.35%	74.06%
Africa	10.10%	36.34%	15.16%
Middle East	12.92%	33.04%	4.62%
East Asia	24.64%	12.42%	45.63%
Latin America and the Caribbean	41.33%	10.42%	36.33%
South Asia	5.62%	8.74%	9.71%

Source: UNCTAD data modified by ERS, 1999

Table 2 Results of regression analysis (t-statistics are in parentheses)

	Whole Sample	Whole Sample - Fixed Effects	African Importers	African Importers - Fixed Effects	Low Income African Importers	Low Income African Importers - Fixed Effects
Intercept	9.424	21.756	-5.131	-70.403	-1.094	-73.840
	(9.000)**	(3.530)**	(-2.500)*	(-2.050)*	(-0.480)	(-2.140)*
Lndist2	-1.061	-1.205	-0.795	-0.877	-0.824	-0.846
	(-37.850)**	(-39.330)**	(-13.560)**	(-12.470)**	(-13.650)**	(-11.490)**
Lnimpgdppc	0.146	0.268	0.013	2.035	-0.177	2.151
	(9.280)**	(3.560)**	(0.320)	(1.690)*	(-2.450)*	(1.780)*
Lnexpgdppc	0.043	0.042	0.155	0.323	0.161	0.354
	(2.760)**	(0.670)	(5.290)**	(3.240)**	(5.310)**	(3.420)**
Lnimpgdp	0.275	-0.186	0.473	2.269	0.342	2.358
	(9.200)**	(-1.020)	(7.800)**	(2.680)**	(5.040)**	(2.770)**
Lnexpgdp	0.312	0.283	0.405	0.028	0.418	0.000
	(17.770)**	(5.370)**	(12.740)**	(0.340)	(12.650)**	(0.000)
Common Language	0.944	0.898	0.967	0.464	0.906	0.423
	(18.430)**	(16.710)**	(11.780)**	(5.620)**	(10.570)**	(4.910)**
Landlocked	-0.101	0.166	-0.473	0.229	-0.509	0.178
	(-2.240)*	(1.930)*	(-5.490)**	(1.600)	(-5.680)**	(1.200)
Lnavgexshare	0.919	0.513	0.649	0.324	0.629	0.346
	(56.950)**	(10.470)**	(21.890)**	(4.090)**	(20.420)**	(4.190)**
Lnavgimshare	0.853	1.364	0.384	-1.706	0.419	-1.840
	(23.630)**	(6.740)**	(5.610)**	(-1.560)	(5.910)**	(-1.680)*
Samediet	0.103	-0.045	0.691	0.485	0.679	0.494
	(1.220)	(-0.570)	(3.970)**	(3.290)**	(3.810)**	(3.240)**
Contiguous	0.661	0.571	0.651	0.990	0.630	0.904
	(4.680)**	(4.300)**	(2.750)**	(4.480)**	(2.620)**	(4.270)**
R-squared	0.728	0.771	0.571	0.716	0.559	0.701