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"A GRAVITY MODEL OF EAST AFRICAN TRADE FLOWS AND/OR OPENNESS DETERMINANTS: A PANEL ANALYSIS"

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Abstract

This study gauged the East African Community intra-trade Flows and Openness determinants. We've first of all obviously brought light on how the countries within the EAC trade less amongst themselves than what they do with out-of-block trading partners. Moreover, we found their external trade to be highly exposed to world shocks as they have a high dependency parameter. We also found that, in the EAC, trade openness is mainly determined by domestic population, the prices index and the school enrolment rate. It has also been found that the Random effects is the best way to model the trade openness function within the EAC and this result implies that trade openness behaviour is not remarkably different from each other.

Using a gravity model of intra-block bilateral trade, we found that economic performance and population size are critically important determinants. Moreover, the distance variable revealed to be statistically important in influencing the trade patterns within the EAC. Thus, infrastructure development and production growth are critical for the EAC common market to be a success. Countries in the EAC should produce more and let their people get closer trading relationship in order to benefit the awaited welfare effects for their respective population. The gravity modelling was found sustainable for the intra-block trade within the EAC.

Key words: gravity model, panel data, intra-block trade, trade openness, welfare effects

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1. Introduction

1. 1. Study background

Africa's economy largely relies on its trade flows, and this is specifically the case of the East African Community Countries (Burundi, Kenya, Rwanda, Tanzania and Uganda). Yet, the East African trade flows are still less diversified even though we are getting further in regional integration, economic and monetary union and, ultimately, political federation.

The possible set of determinants affecting or influencing the East African trade flows can vary very largely from comparative advantage, trade policies, economies of scale, domestic and foreign wealth or revenue, participation in customs unions, currency unions, trade agreements, and so on ... The concept and idea of greater regional integration, strengthening on both political and economic affairs, has historically been the long-term aim and purpose of the Organisation for African Unity (OAU) since its creation 1963. This vision has been retained as fundamental by its successor, namely the African Union (AU) since it has been formed in 2002. Similarly to the creation of the European Union building, the construction of an economic and monetary union for the whole Africa is up to now perceived as a crucial and key stage of African Union before attaining a full political union. The African Union considers building genuine monetary unions through the reinforcement of five existing regional economic blocs towards a full monetary and economic and monetary union. Africa tends to free trade and to a more integrated and liberal economy. Hence, it is of a paramount importance to determine what are the factors that really affect the trade flows and structure in Africa; and especially within the East African Community which is perceived as one of the most important pillars of the advancement towards the African Economic Community.

African regional economic communities are, in overall, highly dependent on trade with the outside world (ECA, 2004). For example, the overall direction of trade in 1994–2000 indicates that regional economic communities are highly dependent on trade with the outside world. Community exports to destinations outside Africa averaged

87.5% of total exports while sources outside Africa accounted for an average of 85% of total community imports (ECA, 2004). All these considerations pushed us to investigate what are really the main determinants of African trade flows. Finding the determinants of trade flows will obviously shed light on the potential of gains and losses that East African countries can encounter in their integration process. Moreover, such empirical results are necessary and useful in support of some economic policies (integration strategies, means of facilitating a beneficial openness of the economies, to enhance the impact of the globalization on domestic growth, and so on...). The questions arising from regional integration blocks especially when it comes to African context vary from trade openness determinants and advantages/costs, intra-block trade flows determinants modelling, the best policies to be implemented in order to make the regional integration be successful and benefit to population welfare, the impact of the overlapping effect in regional integration blocks, ...

This analysis intends to investigate empirically what are the main determinants of trade openness within the East African Community on one hand, and what are the main determinants of intra-EAC trade flows on the other hand.

The main purpose of this paper is to investigate what are the main determinants of East African trade flows and/or openness in the context of a globalizing world. Moreover, this research paper aims at finding out, *inter alia,* the importance of the share of intra-East African trade within the member countries, the structure of the intra-EAC trade and the degree of integration of member countries, the best way to model the trade openness and trade flow determinants within the African trade flows and the likely importance of overlapping effect in the EAC integration process.

Meeting the above objectives, it will allow us to state some useful recommendations to be taken into account in the ambitious program of creating an East African economic community and, ultimately, a political federation per se. The remaining parts are organized as follows: in section 2, the trade integration and the intra-block trade within EAC is briefly discussed. Empirical literature along with methodology is presented in section 3. Empirical results and

discussions are contained in section 4. Finally, conclusions and recommendation are summing up in the last section.

2. Trade integration and intra-block trade within the EAC

2.1. The Past, Present and Future of East African Trade

The East Africa has a long history of regional integration. WTO (2006) reports that Kenya and Uganda first formed a customs union in 1917, which the then Tanganyika (Tanzania without Zanzibar) joined in 1927. Subsequently, the three countries had close economic relationships in the East African High Commission (1948-61); the East African Common Services Organization (1961-67); the East African Community (1967-77); and the East African Cooperation (1993-99). Then, since the end of 2006 and effectively the mid – 2007, Burundi and Rwanda joined the Community and a lot of advancements are being made.

The (current) Treaty for the Establishment of the East African Community (EAC) was signed on 30 November 1999, and entered into force on 7 July 2000. The present EAC has its origins in the Mediation Agreement for Division of Assets and Liabilities of the original EAC, which collapsed for a variety of political and economic reasons in 1977. In that Mediation Agreement, signed on 14 May 1984, Kenya, Tanzania, and Uganda agreed to explore areas of future cooperation, and to make concrete arrangements for such cooperation. Subsequent meetings of the three Heads of State led to the signing of the Agreement for the Establishment of the Permanent Tripartite Commission (PTC) for East African Cooperation on 30 November 1993. Full fledged cooperation started on 14 March 1996 when the Secretariat of the PTC was launched at the headquarters of the EAC in Arusha, Tanzania.

In addition to the EAC, Burundi, Kenya, Rwanda, Tanzania, and Uganda are also members of the African Economic Community (AEC), the African Union (AU), and the Regional Integration Facilitation Forum (RIFF), and participate in different regional trade agreements. Kenya and Uganda are members of the Inter Governmental Authority on Development (IGAD), Burundi, Kenya Rwanda and Uganda are also members of the Common Market for

Eastern and Southern Africa (COMESA); Tanzania is considering re-entering COMESA after its withdrawal in 2000. Kenya and Tanzania participate in the Indian Ocean Rim-Association for Regional Cooperation (IOR-ARC). Unlike the other members of the EAC, Tanzania is member of the Southern African Development Community (SADC). This overlapping membership poses certain difficulties for the EAC members, mainly because of differences in, inter alia, origin criteria, and intra-regional trade liberalization scenarios under the various agreements. Under the EAC, each member is free to negotiate new bilateral trade agreements, subject to notification to the other members of the EAC.

The key objective of the EAC is to develop policies aimed at widening and deepening cooperation in all fields for the mutual benefit of its members (Article 5 of the EAC Treaty). The EAC is thus to be an economic area (including customs and monetary unions, with harmonized macroeconomic policies, and ultimately a political federation), although no timetable has been established.

However, EAC members have not yet fully implemented some of these provisions. Areas still to be harmonized are mainly: internal taxes, customs procedures, other duties and charges on imports, and fees on production. The EAC certificate of origin is not yet operational whereas the COMESA certificate is currently used.
Under the Protocol, the customs union is to be established progressively over five years from the entry into force of the Protocol, which was signed on 2 March 2004, and entered into force on 1 January 2005. The EAC CET, adopted as from 2005, has three bands (0, 10%, and 25%), although rates above 25% apply to a number of "sensitive" products. EAC members are to review the maximum rate of the CET after 1 January 2010.

The EAC Customs Management Act was enacted on 16 December 2004. It governs the administration of customs, including administrative and operational matters. According to the Act, the day-to-day operations of customs, including collection of revenue, will continue to be managed and administered by the respective national revenue authorities. The revenue authorities in each member state, in conjunction with the ministries responsible for EAC affairs, Finance, Trade and Industry, are responsible for the gradual establishment of

the EAC customs union. Negotiations on trade in services commenced in 2006 as part of the EAC common market. Negotiations are intensively being carried on in order to ensure the implementation of the common market structure and studies are being done on the feasibility and timeline of a monetary cooperation and union framework by 2012.

2.2. The external trade and intra-block trade within the EAC

A) EAC external trade structure by main commodity group

Table 1: Breakdown in the economy's total exports (imports) within the EAC countries

Countries / Sectors	Burundi	Kenya	Rwanda	Tanzania	Uganda
Agricultural products	90,3 (7,5)	45,6 (11)	47,7 (15,8)	41,6 (13)	59,6 (15,3)
Fuels and mining products	2,7 (8,9)	34,9 (29)	24 (17,8)	11,5 (25,5)	6,2 (22,7)
Manufactures	6,7 (79,2)	19,4 (55,1)	8,3 (66,4)	11,9 (61,5)	17,8 (62)
Total of the 3 sectors	99,7 (95,6)	99,9 (95,1)	80 (100)	65 (100)	83,6 (100)
Others	0,3 (4,4)	0,1 (4,9)	20 (0)	35 (0)	16,4 (0)

Source: *Author's own calculations based on trade statistics from UNCTAD (2006)*
Note: numbers in parentheses ( ) are imports

This table indicates that the Burundian exports are concentrated on agricultural products (90,3%) on the one hand, and imports are composed of manufactures (79,2%). Therefore, evidence of Burundian economy's vulnerability to external shocks on trade is enlightened with these observations.

Kenyan exports are more diversified (and thus less concentrated) than are its imports. Broadly speaking, Kenyan external trade structure leads us to confirm that Kenya is making progress in the arena of diversification, either in terms of exports or in terms of imports.

Rwandan external trade structure reveals to be more diversified in terms of exports than in terms of imports. Yet, its vulnerability to

external shocks on trade is not high especially when it comes to exports.

Tanzanian exports are more diversified than its imports and dependency coefficient is significantly lowered in exports structure whereas it's very high in imports structure.

Ugandan external trade structure reveals still high dependency indices both in terms of exports and in terms of imports although this dependency is still higher in imports than in exports (with very slight differences).

In synthesis, the figures here above (table n°1) indicate that the Burundian economy is the most highly exposed to external shocks considering both exports dependency and imports dependency or concentration coefficients. In terms of exports, Tanzania is the less dependent (or less concentrated) whereas Kenya is the less dependent (less concentrated) in terms of imports.

B) EAC external trade structure by main destination and origin

The five EAC members trade more with the rest of the world than they do within the community. Table n°2 shows which countries are in the top five partners (in exports and in imports) of each one of the five countries of the EAC.

In the external trade of Burundi, only Kenya and Rwanda figure in the top five destinations of its exports (with a total share of only 7,1% and 3,6% respectively) while only Kenya and Tanzania are in the top five origins of its imports (with a total share of only 12,2% and 4,9% respectively). We also draw from these figures the fact that Burundi's exports destinations are less diversified than its imports origins.

For Kenyan external trade structure, we observe that only Uganda and Tanzania are counted amongst the top five destinations of its exports (with a total share of only 17,5% and 8% respectively) on the one hand, and on the other hand, no EAC member counts amongst the top five origins of its imports. The figures also indicate that Kenya exports destinations are somewhat as equally diversified as its imports origins.

Analyzing Rwandese external trade structure, we draw the following facts: Kenya, Uganda and Tanzania are counted amongst the top five destinations of its exports (with a total share of 41,0%; 26,6% and 8,0% respectively) on the one hand, and the same three countries count amongst the top five origins of its imports (with a total share of 28,4%; 7,6% and 5,6% respectively). It's also noticeable that Rwandese exports destinations are slightly less diversified than its imports origins.

Turning to Tanzanian external trade, one may observe that only Kenya figures in the top five destinations of its exports (with a total share of only 5,8%) whereas no EAC member counts amongst the top five origins of its imports. Tanzanian exports destinations are less diversified than its imports origins.

Considering the external trade of Uganda, we do notice that only Kenya counts amongst the top five destinations of its exports (with a total share of only 9,1%) on the one hand, and that the same only country (Kenya) counts amongst the top five origins of its imports (with a total share of only 15,7%). Ugandan exports destinations are less diversified than its imports origins.

In overall, the above figures and analyses lead us to say that the Rwandese economy seems to be the more integrated within the EAC market in terms of main trade partners and the less integrated seems to be Tanzania. Moreover, in terms of trading partnership in exports destinations, Kenyan economy is the most diversified and Burundi is the less diversified. We also conclude that in terms of imports origins, the Tanzanian economy is the most diversified whereas the Rwandese economy is the least diversified amongst the EAC members.

Table 2: Top five exports' destinations and top five imports' origins, EAC, 2006

	Top 5 main destination	***value***	***Top 5 main origin***	***Value***
Burundi	Switzerland	36,2	European Union (25)	34,2
	United Arab Emirates	25,3	Kenya	12,2
	European Union (25)	20,2	Japan	8,8
	Kenya	7,1	Turkey	8,1

	Rwanda	3,6	Tanzania	4,9
	Total Top Five	92,4	*Total Top Five*	68,2
	Others	7,6	Others	31,8
Kenya	European Union (25)	28	European Union (25)	25
	Uganda	17,5	United Arab Emirates	11
	Tanzania	8	South Africa	9,8
	Pakistan	5,4	Saudi Arabia	9
	Egypt	3,1	Japan	6,1
	Total Top Five	62	*Total Top Five*	60,9
	Others	38	Others	39,1
Rwanda	Kenya	41	Kenya	28,4
	Uganda	26,6	European Union (25)	25,9
	European Union (25)	8,6	Uganda	7,6
	Tanzania	8	United Arab Emirates	7,6
	DRC	4,1	Tanzania	5,6
	Total Top Five	88,3	*Total Top Five*	75,1
	Others	11,7	Others	24,9
Tanzania	European Union (25)	23,2	European Union (25)	17,3
	Switzerland	21,7	South Africa	12,3
	South Africa	14,3	United Arab Emirates	11,3
	China	8,9	Bahrain	9,2
	Kenya	5,8	China	7
	Total Top Five	73,9	*Total Top Five*	57,1
	Others	26,1	Others	42,9
Uganda	European Union (25)	27,4	European Union (25)	18,8
	United Arab Emirates	19,4	Kenya	15,7
	Sudan	9,5	United Arab Emirates	12,7
	Kenya	9,1	India	8,2
	Switzerland	4,7	Japan	6,8
	Total Top Five	70,1	*Total Top Five*	62,2
	Others	29,9	Others	37,8

Source: *Author's own calculations based on trade statistics from EAC website*

3. Empirical Literature Review and Methodology

3. 1. Theoretical Literature Review

There is an abundant literature on this topic. Rose K. Andrew (2006) stated that there are 34 studies which estimate effects of currency unions on trade, and summing over all 34 using "meta-analysis" gives large positive effect (trade rises by between 30% and 90%).
Two countries sharing a common currency trade three times as much as they would with different currencies according to Rose (2000). She used a gravity equation on a very ample cross-section of countries and Rose (2002) uses a time-series rather than a cross-section approach. Sergio de Nardis and Claudio Vicarelli (2003, page 10) proposed the panel estimation in order to take into account the spatial dimension and the temporal dimension.

The **gravity model of trade** in international economics, similar to other gravity models in social science, predicts bilateral trade flows based on the economic sizes of (often using GDP measurements) and distance between two units. The model was first used by Jan Tinbergen in 1962. The basic theoretical model for trade between two countries (i and j) takes the form of:

$$F_{ij} = G * \frac{M_i * M_j}{D_{ij}}$$

Where F is the trade flow, M is the economic mass of each country, D is the distance and G is a constant. Using logarithms, the equation can be converted to a linear form for econometric analysis. The model has also been used in international relations to evaluate the impact of treaties and alliances on trade, and it has been used to test the effectiveness of trade agreements and organizations such as NAFTA, WTO, EU, and so on....
Gravity models are mathematical models based on an analogy with Newton's gravitational law (in Physics) and they are also used to account for aggregate human behaviours related to spatial interaction such as migration and traffic flows. In regards to trade, the gravity model states that the volume of trade can be estimated as an increasing function of the national incomes of trading partners, and a decreasing

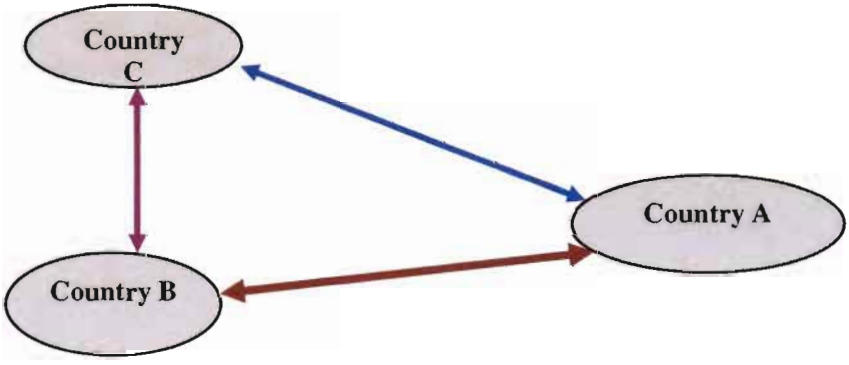
function of the distance between them. The gravity model has its origins in the law of gravitation developed by Newton. Jan Tinbergen (1962) is credited for his study of international trade flows using a gravity model. His seminal paper has just shed light on a new way to understand what is going on in trade flows taking into account the distance between countries participating in the trade.

3. 2. Empirical Literature Review

The gravity methodology provides an intuitive framework for analyzing trade flows.
Gravity models also have the ability to incorporate the characteristics of each country as an individual unit regardless of its size. The methodology has been widely used in the investigation of trade patterns in varying contexts over the past four decades (Sandberg, 2004).

Initially, the foundation of gravity models is that distance and size do matter for (determine) bilateral trade.

$$ln\,(Tradeij) = C + a\,ln(GDPi) + b\,ln(GDPj) + c\,ln(distanceij) + \boldsymbol{u}ij$$



The augmented gravity model takes into account the following facts:

- Higher income countries trade more. Richer countries trade more amongst themselves than they do with poor ones and as it happens amongst these poor countries themselves.

- Other common characteristics may influence trade flows direction and intensity: common language, colonial links, institutions, infrastructures, and so on…

Ln(Tradeijt)=b1 ln(Distanceij)+b2 ln(GDPiGDPj)t +b3 (other control variables) + c1 Bothinijt +c2 Oneinijt + uijt

The origin of gravity model analysis in international trade is generally attributed to Tinbergen (1962) and Pöyhönen (1963a,b) who independently and concurrently explored similar models. Since then, the gravity model has become a popular instrument in empirical foreign trade analysis. The basic idea behind this model is that bilateral trade from one country to another (as the dependent variable) can be explained by factors that capture the potential of a country to export goods and services, factors that capture the propensity of a country to import goods and services, and any other forces that either attract or inhibit bilateral trade, in one way or another.

Data sample

The data used in this paper was mainly gathered directly from the statistics of the East African Community database, from the various reports of UNCTAD on the EAC, from the CEPII's Database on geographical and other common characteristics of countries, and so on...
These data cover the period from 1976 until 2007. However, estimations are done after dropping out the missing data and unavailable series so that the dataset is adjusted to 1978 – 2006 and only 254 observations (with cross sections) are taken into account in the gravity estimation.

Variables and expected effects

Initially, we had a large set of variables which in turn was reduced to a reduced set according to data availability and statistical significance of estimated coefficients. We just describe the variables comprised in the estimated models.

The trade openness model

Trade openness is defined as the proportion of total trade in the country's GDP.
We used the total population size as a determinant of openness, and the expected sign is a positive one.
We also applied the inflation rate (using the consumption price index as a proxy), and a negative sign is expected.
The other determinant found to be crucial is the school enrolment rate and the expected sign is positive.

The gravity models of trade flows determinants

In both models (exports, imports and total trade), we used somehow the same variables and the following variables have been proved to be empirically the most important determinants.

The explained variables have been exports from country i to country j, imports of country i from country j, and total trade (exports added to imports) taking place between country i and country j.

We captured the economic importance of a country with the GDP. For the GDP variables we expect a positive coefficient and this is obvious as GDP measures the economic size of a country. A higher GDP in a country is therefore in line with a higher demand for imports. Also does an increasing economic size of a country well account for a higher export as bigger countries tend to trade relatively more. This might be explained by possibly lower supply side constraints as well as a further integration into the global economy due to economies of scale which will be reached earlier in bigger than in smaller countries (Bretschger 2002).

We used the distance between the capital cities of the five EAC member countries in order to capture the effect of transport costs due to distance. Therefore, a negative sign is expected.

Apart from the distance we controlled for several other geographical factors, but only the fact of sharing a common border has proven to be statistically significant. In fact, sharing a common border nevertheless can make a difference through eased personal interactions, lower

transport costs and usually an increased cultural understanding prevails between neighbouring countries. These factors can lead to traditionally build up trading relations which in turn foster trade. Therefore a positive influence is expected.

We also controlled for the EAC membership by including a dummy variable for a single membership being 1 when one of the two countries is already a member of the EAC and 0 otherwise. Since obstacles to trade are removed a classical argumentation would lead to expect a positive impact on the trade once one of the trading partners. This actually represents the unilateral liberalization, which should in line with the foregoing argumentation have a positive coefficient.

4. Estimation Results and Discussions

4. 1. The trade openness model

The fixed effects model

A look at the results obtained (see table 3 and appendix 1) let us state that the coefficients reveal that trade openness within EAC members depends:

Positively on population size: the more populated the countries get, the more open to trade that the countries become and the estimated coefficient (with a positive sign, indicating a positive effect on trade openness) reveals to be statistically significant individually with only 0,01% of type I error probability. These estimations are in line with our expected sign coefficients and effects.

Negatively on general index of prices: the higher the prices within the countries, the less open to trade that the countries become and the estimated coefficient (with a negative sign, indicating a negative effect on trade openness) reveals to be statistically significant individually with only 0,69% of type I error probability. Again, the expected sign is confirmed by the estimated coefficient.

School enrolment rate: the school enrolment rate reveals to have a negative sign, thus implying a negative effect on trade openness within the EAC member countries. This estimated coefficient has an unexpected sign. This counterintuitive result may be accordingly

interpreted as sign of a still dramatically low enrolment rate within these countries so that its somehow improvements are considered of not only no significant positive impact, but also of negative impact. This estimated coefficient reveals to be statistically significant individually with only 0,000% of type I error probability.

The overall significance is also validated by the r-squared adjusted or not adjusted (more than 66% in both cases) and by the Fisher-test statistic which is significantly in favour of overall significance (with a 0,0000% probability of committing the type I error).

Table 3: Results of the Fixed Effects Model of Trade Openness Determinants within the EAC

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.261059	0.021581	12.09684	0.0000
POP?	0.007625	0.001918	3.976329	0.0001
IPC?	-5.25E-05	1.91E-05	-2.748587	0.0069
TS?	-0.006292	0.001465	-4.293789	0.0000
Fixed Effects (Cross)				
_BUR--C	0.038773			
_KEN--C	0.146595			
_RWA--C	-0.045442			
_TAN--C	-0.097350			
_OUG--C	-0.073450			

R-squared	0.694087	Mean dependent var	0.344333
Adjusted R-squared	0.677092	S.D. dependent var	0.142453
S.E. of regression	0.076944	Sum squared resid	0.745976
F-statistic	40.84027	Durbin-Watson stat	0.785549
Prob(F-statistic)	0.000000		

The random effects model

When considering the random effects modelling, the results are almost the same as in the fixed effects modelling. The coefficients reveal that trade openness within EAC members depend:

Positively on population size: the more populated the countries get, the more open to trade that the countries become and the estimated coefficient (with a positive sign, indicating a positive effect on trade openness) reveals to be statistically significant individually with only 0,34% of type I error probability. These estimations are in line with our expected sign coefficients and effects.

Negatively on general index of prices: the higher the prices within the countries, the less open to trade that the countries become and the estimated coefficient (with a negative sign, indicating a negative effect on trade openness) reveals to be statistically significant individually with only 4,87% of type I error probability. Again, the expected sign is confirmed by the estimated coefficient.

School enrolment rate: the school enrolment rate reveals to have a negative sign, thus implying a negative effect on trade openness within the EAC member countries. This estimated coefficient has an unexpected sign. This counterintuitive result may be accordingly interpreted as sign of a still dramatically low enrolment rate within these countries so that its somehow improvements are considered of not only no significant positive impact, but also of negative impact. This estimated coefficient reveals to be statistically significant individually with only 0,18% of type I error probability.

The overall significativity is not accepted when rigorously considering the R-squared adjusted or not adjusted (less than 50% in both cases) but when we take into account the Fisher-test statistic, we find it to be significantly in favour of global significativity (with only 0,15% probability of committing the type I error).

Table 4: Results of the Random Effects Model of Trade Openness Determinants within the East African Community

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.263369	0.044646	5.899007	0.0000
POP?	0.006294	0.002107	2.986694	0.0034
IPC?	-6.00E-05	3.02E-05	-1.989874	0.0487
TS?	-0.005151	0.001616	-3.188069	0.0018
Random Effects (Cross)				
_BUR--C	0.036183			
_KEN--C	0.142132			
_RWA--C	-0.047520			
_TAN--C	-0.069172			
_OUG--C	-0.061623			

R-squared	0.111353	Mean dependent var	0.052814
Adjusted R-squared	0.090846	S.D. dependent var	0.081103
S.E. of regression	0.077394	Sum squared resid	0.778672
F-statistic	5.429923	Durbin-Watson stat	0.642714
Prob(F-statistic)	0.001501		

Fixed versus Random Effects: the Hausman Test Application

When we consider discriminating between random and fixed effects, we apply the well-known Hausman test. The results are in favour of random effects rather than fixed ones. As the computed probability of committing type I error (22,57%) is higher than any usual level (1%, 5% or 10%).

Table 5: Results of the Random against Fixed Effects Test (Hausman Test)

Correlated Random Effects - Hausman Test
Pool: PANEL
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	4.353621	3	0.2257

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
POP?	0.007015	0.006294	0.000001	0.4728
IPC?	-0.000057	-0.000060	0.000000	0.1400
TS?	-0.006070	-0.005151	0.000000	0.1448

In conclusion, we consider that within the EAC member countries, trade openness determinants are mainly the population size (with expected positive sign), the prices index (with expected negative sign) and the school enrolment rate (with unexpected negative sign). Moreover, the random effects are proven (through the Hausman test) to be the best and most robust estimators of this trade openness determinants.

4. 2. The gravity model of trade flows determinants

Intra-EAC Exports modelling

After taking into account the first order autocorrelation (see table 10 and appendix 4), the estimated gravity model of exports functions within the EAC member countries reveal that the exports growth rate is dependent:

Positively on the exporting country's economic growth rate (the coefficient is statistically significant at 0,1%). This result implies that the more growing is the domestic economy, the more will the country export to his trading partners within the community).

Positively on the importing country's economic growth rate (the coefficient is statistically significant only at 36,37%; this simply means that it's not statistically significant at usual levels: 1%; 5% and 10%).

Positively on the exporting country's population growth rate (the coefficient is statistically significant only at 52,79%; this simply means that it's not statistically significant at conventional levels: 1%; 5% and 10%).

Positively on the importing country's population growth rate (the coefficient is statistically significant at 7,09%). This result implies that the more growing is the importing country's population, the more will the given country export to this trading partner within the community).

Negatively on the distance separating the trading countries' capital cities. The longer the distance, the less intensive will be the exports from one country to another within the community. This implies that transport costs are still high and constitute an important obstacle to trade development within the EAC. The coefficient is statistically significant at 0,02%).

Positively on the EAC membership factor (the estimated coefficient is positive and statistically significant at 6,92%). If one of the trading partners is already a member of the EAC, the exports growth rate increases accordingly.

On a global level, the gravity model of intra-EAC exports reveals itself to be statistically consistent as the adjusted or not adjusted R-squared is statistically significant (more than 85% of explanation power in both cases) and the Fisher-test statistic does corroborate this conclusion. In addition, the distance factor (which constitutes the foundation of the gravity terminology) is statistically negative.

Table 6: Results of the Gravity Model of intra-EAC Exports Determinants

Dependent Variable: LNXIJ
Included observations: 253 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-18.47803	7.326272	-2.522160	0.0123
LPIBI	0.815020	0.245588	3.318645	0.0010
LPIBJ	0.167846	0.184472	0.909871	0.3638
LPOPI	0.284722	0.450406	0.632145	0.5279
LPOPJ	0.555318	0.306121	1.814049	0.0709
DISTIJ	-0.001888	0.000498	-3.794112	0.0002
EACIIJJ	0.219233	0.120134	1.824909	0.0692
AR(1)	0.807828	0.038998	20.71438	0.0000

R-squared	0.861150	Mean dependent var	2.663762
Adjusted R-squared	0.857182	S.D. dependent var	1.583466
S.E. of regression	0.598411	Akaike info criterion	1.842031
Sum squared resid	87.73337	Schwarz criterion	1.953759
Log likelihood	-225.0169	Hannan-Quinn criter.	1.886983
F-statistic	217.0699	Durbin-Watson stat	2.060641
Prob(F-statistic)	0.000000		

Intra-EAC Imports modelling

After taking into account the first order autocorrelation (see table 11), the estimated gravity model of imports functions within the EAC member countries exhibits the following main result: imports growth rate is dependent:

Positively on the importing country's economic growth rate (nevertheless the coefficient is not statistically significant, it's very far from being significant, the type I error being very high 92,75%). this

simply means that it's not statistically significant at usual levels: 1%; 5% and 10%).

Positively on the exporting country's economic growth rate (the coefficient is statistically significant only at 0,0000%. This result implies that the more growing is the foreign country's economy, the more will the country export to his trading partners within the community, and therefore, will the home country's imports grow accordingly).

Positively on the importing country's population growth rate (the coefficient is statistically significant only at 52,47%; this simply means that it's not statistically significant at usual levels: 1%; 5% and 10%).

Negatively on the distance separating the trading countries' capital cities. The longer the distance, the less intensive will be the imports of one country from each other within the EAC. This implies that transport costs are still high and constitute an important obstacle to trade development within the Community. But still, the coefficient is statistically significant only at 11,41%).

Positively on the EAC membership factor (the estimated coefficient is positive but not statistically significant with a type I error probability of 38,69%). If the two trading partners are both already members of the EAC, the imports growth rate increases accordingly.

On a global level, the gravity model of intra-EAC imports is therefore assumed to be statistically consistent as the adjusted or not adjusted R-squared is statistically significant (more than 86% of explanation power in both cases) and the Fisher-test statistic does corroborate this conclusion (with a very low probability of non significance). In addition, the distance factor (which constitutes the foundation of the gravity terminology) is negative although it's not statistically significant.

Table 7: Results of the Gravity Model of intra-EAC Imports Determinants

Dependent Variable: LNMIJ
Included observations: 249 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-12.40292	6.678346	-1.857184	0.0645
LPIBI	0.024272	0.266341	0.091132	0.9275
LPIBJ	1.115982	0.090120	12.38325	0.0000
LPOPI	0.321085	0.504066	0.636989	0.5247
DISTIJ	-0.000848	0.000535	-1.585588	0.1141
EACIJ	0.212400	0.245029	0.866835	0.3869
AR(1)	0.820040	0.037695	21.75439	0.0000

R-squared	0.867077	Mean dependent var	1.920546
Adjusted R-squared	0.863781	S.D. dependent var	1.728177
S.E. of regression	0.637832	Akaike info criterion	1.966227
Sum squared resid	98.45286	Schwarz criterion	2.065111
Log likelihood	-237.7952	Hannan-Quinn criter.	2.006029
F-statistic	263.1005	Durbin-Watson stat	2.104143
Prob(F-statistic)	0.000000		

Inverted AR Roots .82

Intra-EAC total trade modelling

We have estimated an overall trade function within the community. After iterative procedures and step-wise elimination, we've come to take into account the first order autocorrelation (see table 8), the estimated gravity model of total trade (exports summed with imports) functions within the EAC member countries reveal that the intra-community overall trade growth rate is dependent:

Positively on the total community's economic growth rate (the coefficient is statistically significant at 0,11%). This result implies that

the more growing are the community' economies, the more growing will be the intra-block total trade within the EAC).

Positively on the total community's population growth rate (the coefficient is statistically significant at 0,63%). This is a proof of the so important magnitude of the common market as it's intended to be implemented within the EAC. The more integrated, and the more the total population growth, the more opportunities will be offered to manufactures and industries in terms of market size.

Negatively on the distance separating the trading countries' capital cities. The longer the distance, the less intensive will be the exports from one country to another within the community. This implies that transport costs are still high and constitute an impediment to trade development within the EAC. The coefficient is statistically significant at 0,20%).

Positively on the country's contingency factor (the estimated coefficient of the contingency dummy variable is positive and statistically significant at 0,02%). If one of the trading partners is already a member of the EAC, the exports growth rate increases accordingly.

On overall, the gravity model of intra-EAC exports reveals itself to be statistically consistent as the adjusted or not adjusted R-squared is statistically significant (more than 86% of explanation power in both cases) and the Fisher-test statistic does corroborate this conclusion. Moreover, the distance factor constituting the foundation of the gravity theory ground is statistically negative.

Table 8: Results of the Gravity Model of intra-EAC total Trade Determinants

Dependent Variable: LTOTTRADEIJ
Included observations: 253 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-35.87954	8.289482	-4.328321	0.0000
LPIBTOT	1.002394	0.302324	3.315625	0.0011
LPOPTOT	1.731647	0.628160	2.756698	0.0063
DISTIJ	-0.002110	0.000675	-3.125411	0.0020
DUMMYCON	0.951576	0.252803	3.764095	0.0002
AR(1)	0.839751	0.035707	23.51775	0.0000

R-squared	0.864915	Mean dependent var	3.203199
Adjusted R-squared	0.862181	S.D. dependent var	1.676745
S.E. of regression	0.622475	Akaike info criterion	1.913203
Sum squared resid	95.70630	Schwarz criterion	1.996998
Log likelihood	-236.0201	Hannan-Quinn criter.	1.946916
F-statistic	316.2966	Durbin-Watson stat	1.993512
Prob(F-statistic)	0.000000		

Conclusions

Efforts have been made and are still being made to make the EAC members countries open up their respective economies towards more trade. The analysis and tests conducted revealed that the trade openness is highly dependent on population size and also subject to prices stability. Moreover, the intra-community trade growth rate was revealed to be at low levels and related to distance, to the economic growth within the EAC as a whole, to the population growth rate, to geographic proximity (common borders effect). The gravity modelling also supports strongly our hypothesis.

Recommendations

Policy implications and recommendation which I have drawn from these analyses can be summarized in the following formulations:

- The EAC secretariat and head of states should concentrate more at implementing common and shared infrastructures projects first;
- Horizontal and production integration is highly recommended within the block (EAC);
- Economic growth and wealth creation should be set as priorities of the integration process as their proxies' variables revealed to be strong and statistically significant.
- Advancements towards a common market will surely improve the integration process and generate the expected openness to trade and also the intra-community trade will accordingly grow.

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VII. Appendices

Appendix 1: Random against Fixed Effects: The Hausman Test

Correlated Random Effects - Hausman Test
Pool: PANEL
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	4.353621	3	0.2257

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
POP?	0.007015	0.006294	0.000001	0.4728
IPC?	-0.000057	-0.000060	0.000000	0.1400
TS?	-0.006070	-0.005151	0.000000	0.1448

Cross-section random effects test equation:
Dependent Variable: TO?
Method: Panel Least Squares
Date: 11/22/08 Time: 01:10
Sample (adjusted): 1978 2006
Included observations: 29 after adjustments
Cross-sections included: 5
Total pool (unbalanced) observations: 134

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.268594	0.027169	9.885972	0.0000
POP?	0.007015	0.002335	3.004963	0.0032
IPC?	-5.73E-05	3.02E-05	-1.896828	0.0601
TS?	-0.006070	0.001734	-3.499907	0.0006

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.540207	Mean dependent var	0.294546
Adjusted R-squared	0.514663	S.D. dependent var	0.110518
S.E. of regression	0.076994	Akaike info criterion	-2.232336
Sum squared resid	0.746936	Schwarz criterion	-2.059330
Log likelihood	157.5665	Hannan-Quinn criter.	-2.162032

F-statistic	21.14807	Durbin-Watson stat	0.685748
Prob(F-statistic)	0.000000		

Appendix 2: Gravity Model of intra-EAC total Trade Determinants

Dependent Variable: LTOTTRADEIJ

Method: Least Squares

Date: 11/20/08 Time: 22:28

Sample (adjusted): 2 254

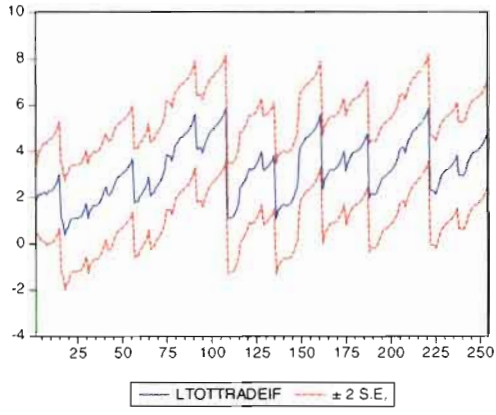
Included observations: 253 after adjustments

Convergence achieved after 10 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-35.87954	8.289482	-4.328321	0.0000
LPIBTOT	1.002394	0.302324	3.315625	0.0011
LPOPTOT	1.731647	0.628160	2.756698	0.0063
DISTIJ	-0.002110	0.000675	-3.125411	0.0020
DUMMYCON	0.951576	0.252803	3.764095	0.0002
AR(1)	0.839751	0.035707	23.51775	0.0000

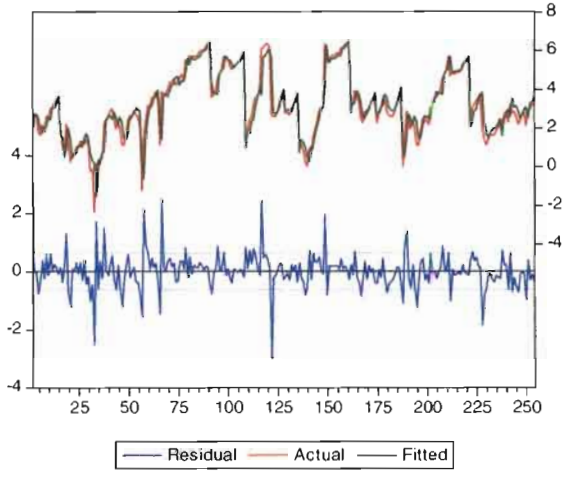
R-squared	0.864915	Mean dependent var	3.203199
Adjusted R-squared	0.862181	S.D. dependent var	1.676745
S.E. of regression	0.622475	Akaike info criterion	1.913203
Sum squared resid	95.70630	Schwarz criterion	1.996998
Log likelihood	-236.0201	Hannan-Quinn criter.	1.946916
F-statistic	316.2966	Durbin-Watson stat	1.993512
Prob(F-statistic)	0.000000		

Inverted AR Roots	.84



Forecast: LTOTTRADEIF
Actual: LTOTTRADEIJ
Forecast sample: 1 254
Adjusted sample: 2 254
Included observations: 253

Root Mean Squared Error	1.116821
Mean Absolute Error	0.884771
Mean Abs. Percent Error	50.56962
Theil Inequality Coefficient	0.159073
Bias Proportion	0.000763
Variance Proportion	0.149165
Covariance Proportion	0.850072



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