THE GRAVITY MODEL AND THE TEST FOR THE REGIONAL INTEGRATION EFFECT: THE CASE OF TANZANIA

Alexander B. Darku

University of Lethbridge, Canada

ABSTRACT

This paper demonstrates that the appropriate econometric technique of testing for the effect of regional integration on bilateral trade is to augment the standard gravity model with country specific dummies instead of regional integration dummies. Using data on bilateral trade between Tanzania and her 23 trading partners over the period 1980-2004, the paper reports three important results. First, contrary to results from the traditional approach, estimates from the new econometric technique indicate that both the EU and the EAC have had moderate trade creation effects on Tanzania's bilateral trade. Second, I find that Tanzania's non-traditional trading partners such as Japan, India, Singapore, Hong Kong and the USA are relatively more opened to Tanzania's exports. Third, the results also indicate that whereas it is difficult for Tanzania's exports to penetrate foreign markets, foreign goods easily penetrate Tanzania's market. The policy implication is that the government should continue with its efforts to strengthen the EAC, and to gain more exports market to the non-traditional trading partners, if the export growth development strategy is to become a reality in Tanzania.

INTRODUCTION

The standard gravity model has increasingly been used to predict international trade flows since it was first introduced by Tinbergen (1964). The model predicts that bilateral trade level is a function of two important economic variables: trade enforcement variables, including a measure of national output of both importing and exporting countries; and trade resistance variables, including distance, and a dummy variable for common border. Output of the exporting country represents the ability to supply and the output of the importing country represents the propensity to demand. Hence, trade flows are expected to be positively related to the exporting and importing countries output. After being popularized by Linneman (1966), the gravity model has been used in many empirical trade studies. These studies have mainly focused on the effect of preferential trade agreements (PTAs)/regional integration (RI) on bilateral trade in almost every sub region of the world. The results so far have been mixed.

Micco *et al*. 2003, Hassan, 2001, Adam *et al*. 2003 and Walsh, 2006 have used the gravity model to examine the effect of EEC/EU and EFTA on bilateral trade. They

concluded that the PTAs have fostered trade among members and between members and non-members. However, evidence of trade diversion for the EEC/EU agreement has been found by Westerlund and Wilhelmsson (2006) and Kien and Hashimoto (2005). Breuss and Egger (1999), and Managi *et al.* (2005) have also showed that the formation of NAFTA has led to increase in intra-PTA trade. On the contrary, Ghosh and Yamarik (2004) and Siliverstovs and Schumacher (2006) found that NAFTA has led to reduction in trade among members. PTAs involving Asian countries have also received a lot of attention in the literature. Those studies have mainly focused on the trade impact of the Association of South East Asian Nation Free Trade Agreement (AFTA), the South Asian Association for Regional Cooperation Preferential Trade Agreement (SAPTA) and the Asia-Pacific Economic Cooperation (APEC). Lee and Park (2002) have argued that ASEAN+3 (China, Japan and Korea) is emerging as a promising regional integration more than other PTAs in the East Asia Region. Rahman (2005), Lee and Park (2005), and Pusterla (2007) have all concluded that AFTA has enhanced trade among members. Similar results have been found for SAPTA. With regards to PTAs among African countries Hannik and Owusu (1998), Cernat (2001) and Pusterla (2007) have found that the formation of COMESA has fostered bilateral trade among members. Hannik and Owusu (1998) and Oguledo (1996) also concluded that beside the positive ECOWAS integration effect, economic growth in the region is the strongest determinant of trade flows. Foroutan and Pritchett (1993) used the gravity model to investigate if the level of intra SSA trade is below what one would expect. Their gravity model predicted very well the low level of intra SSA trade. Kirkpatrick and Watanabe (2005) have studied the impact of African PTAs and have concluded that the formation of EAC, ECOWAS and SADC have had positive impact on intra-bloc trade.

The traditional technique used by the studies discussed above to test for the effect of regional integration on bilateral trade, involves augmenting the basic gravity model with regional integration dummies. This paper demonstrates that the appropriate econometric technique is to augment the standard gravity equation with country specific dummies instead of regional integration dummies. For this purpose, the paper pursues two important objectives. First, it uses the gravity model to test for the effect of two regional integrations, the European Union (EU) and the East Africa Community (EAC) on Tanzania's bilateral trade. These two regional integrations constitute Tanzania's traditional trading partners. Second, within the framework of the gravity model and the application of a new estimation technique, the paper tests for the extent of openness of Tanzania's non-traditional trading partners such as India, Japan, China, Singapore, Hong Kong and the United States.

There are two principal contributions of this paper. First, earlier empirical studies on SSA countries have used pooled time series data from the perspective of all the countries involved in the study. Hence, the coefficients obtained from their regressions are interpreted as averages for all the countries included in the study. This paper diverges from that approach by using time series data on bilateral trade flows between Tanzania and her 23 major trading partners. Hence, the coefficients are specific to Tanzania. In my opinion, this is the appropriate approach since a country specific study is required to identify opportunities that could be exploited to make the export-led development strategy a reality in Tanzania. The second contribution relates to the econometric techniques used to analyze the effect of regional integration on bilateral trade. The

traditional technique has been criticized by Polak (1996), and Matyas (1997, 1998) who have demonstrated that the technique leads to model misspecification from an econometric point of view, and can lead to incorrect inferences. They, therefore, proposed an alternative technique which involves augmenting the standard gravity equation with local country and target country specific dummies to cater for the regional integration effect. This paper uses a modified version of their alternative technique and demonstrates that the traditional technique leads to incorrect interpretation of the regional integration effect. Since the present study uses time series data on bilateral trade flows between Tanzania and her trading partners, I include only trading partner dummies (target country dummies), and use an appropriate weighting scheme to calculate regional integration effect on bilateral trade. This version of the proposed technique also makes it possible to test for the openness of other trading partners in the sample who do not belong to the EU and the EAC. This paper, therefore, is the first to apply this recommended technique to data exclusively on a developing nation to investigate the effect of regional integration. Beside the application of the gravity model, I also use other statistical measure (trade intensity indices) to determine the nature of variations in Tanzania's bilateral trade levels over the study period. The results from the analysis of these statistical measures are used to complement the results from the econometric analysis of the gravity model.

Since independence in 1964, Tanzania has experimented with numerous trade regimes that have had varying impact on bilateral trade relationship with the rest of the world in general and her major trading partners in particular. After a brief continuation of the liberal regime inherited from the colonial era, an import substitution strategy of development was pursued. This entailed the institution of restrictive measures governing trade and exchange to support the import substitution industrialization efforts. These policy options resulted in an anti-export regime that led to worsening of bilateral trade deficits with major trading partners, including its immediate neighbors (Kenya and Uganda). For the past two decades, development economists have recommended development strategies that call for reduction of trade barriers by opening national economies to foreign competition. The World Bank, The International Monetary Fund (IMF) and the major donor countries have also required developing nations to embark on market-oriented reforms that include trade liberalization as a condition for receiving financial assistance. As a result, Tanzania started an Economic Recovery Program in the mid-1980s, which involved trade liberalization and elimination of cost-price distortions in the exports sector. Furthermore, the government in early 1990s embarked on far-reaching structural adjustment programs including the reorientation of the economy towards building a market-based economic structure.

To complement initiatives in the policy reform front towards pursuing exports growth oriented development strategy, Tanzania has also embarked on other initiatives by integrating its economy, both globally and regionally, to increase competitiveness of exports in the global market place. The country is currently a member of the World Trade Organization (WTO), Southern Africa Development Community (SADC), Cross Border Initiative (CBI), and the East African Community (EAC). These regional integration initiatives are intended to increase bilateral trade among members. Recently, there has been increasing importance of bilateral trading relationship with Asian countries like India, China, Singapore, Hong Kong and Japan. The government is also engaged in talks

with other members of the EAC (Kenya and Uganda) to further strengthen the Community's role in creating more trade in the sub region. Despite these efforts, trade deficits have persisted and the overall external sector performance has gone through periods of modest improvements to periods of intense deterioration. For instance, the trade deficit as a percentage of total trade with Kenya and Uganda combined has increased from 54.2 percent in 1967 to 80.2 percent in 2004. The main results of the study are summarized as follows: First, using country specific dummies to investigate the effect of the two regional integrations, I find that over the sample period of 1980-2004, both the EU and the EAC have had moderate trade creation effect on Tanzania's bilateral trade. The analysis from the application of this new econometric technique provides better results when compared to the traditional technique. Second, I find that Tanzania's emerging significant trading partners such as Japan, India, Singapore, Hong Kong and the USA are relatively more opened to Tanzania's exports. Third, the results also indicate that whereas it is difficult for Tanzania's exports to penetrate foreign markets, foreign goods easily penetrate Tanzania's market.

The rest of the paper is organized as follows. Section 2 provides a brief overview of Tanzania's bilateral trade relationship by using imports and exports intensity indices to measure the pattern and trend of Tanzania's trade relationship with selected major trading partners. Section 3 uses the gravity model and a new econometric technique to examine the trade creation effects of the EU and the EAC and investigate the extent of openness of other trading partners who are not members of the EU and EAC. The section will also examine whether the simple findings of trade intensity pattern shown in section 2 do hold in the contest of the gravity model approach. Section 4 provides the concluding remarks and some policy implications.

AN OVERVIEW OF TANZANIA'S TRADE RELATIONS

Before proceeding with the application of the gravity model to Tanzania's bilateral trade relationship, this section uses simple trade intensity indices (export intensity index and import intensity index) to measure the pattern and trend of bilateral trade between Tanzania and her selected major trading partners. According to Yamazawa (1970), the trade intensity model concentrates on the structure of departures of actual trade flows from trade flows estimated in gravity models. He proved that in a simplified gravity model where bilateral trade is solely determined by the GDPs of country i and j, the index (export or import intensity index) is always equal to unity. An index greater than unity reflects the importance of various factors such as distance, favorable trade agreements, and strong complementarities of comparative advantages in determining trade flows. Hence, the dynamics in these intensities must be consistent with the predictions of the gravity model that captures these factors.

Exports Intensities

An export intensity index measures the extent to which the proportion of a country i's export to another country j differs from the proportion of exports from the rest of the world to country j. The index is given as:

$$EX_{ij} = [X_{ij}/X_i]/[(X_{wj} - X_{ij})/(X_w - X_i)] \qquad (1)$$

where EX_{ij} is the exports intensity index of country i with trading partner j, X_{ij} is the exports of country i to trading partner j, X_i is the total exports of country i, X_{wj} is the total world exports to country j, and X_w is the total world exports. The index measures the extent to which country j is over or under-represented as country i's export market. The index will take a value of unity if the proportion of country i's exports to country j is the same as the proportion of the rest of the world's exports to country j. If the value exceeds unity, country j is said to be over-represented as country i's exports market. A value less than unity imply relative under-representation.

TABLE 1. EXPORT INTENSITY INDICES

Year	Germany	UK	Netherlands	USA	Japan	Kenya	Uganda	India
1980	1.22	2.05	1.13	0.25	0.36	0.30	165.36	1.95
1981	1.82	2.72	1.33	0.24	0.37	0.51	99.70	8.77
1982	1.56	1.92	1.66	0.29	0.82	2.58	8.82	2.07
1983	2.05	2.41	2.21	0.17	0.61	2.49	49.07	2.55
1984	2.41	2.27	1.54	0.15	0.56	12.60	56.13	5.88
1985	2.18	2.25	1.38	0.07	0.43	3.55	34.70	1.60
1986	2.71	2.19	1.58	0.15	0.85	7.74	n/a	5.07
1987	1.70	1.49	2.22	0.18	0.66	8.35	n/a	5.11
1988	1.74	1.36	2.28	0.25	0.59	n/a	n/a	0.00
1989	1.13	0.91	1.53	0.16	0.37	13.35	n/a	5.54
1990	1.27	1.62	1.47	0.45	0.57	47.46	n/a	29.58
1991	1.31	1.32	1.45	0.24	0.71	34.74	n/a	10.58
1992	0.96	1.28	1.25	0.17	1.06	38.34	n/a	12.19
1993	1.17	1.37	1.50	0.16	1.30	37.89	71.21	11.61
1994	1.08	1.13	1.57	0.18	1.34	74.21	54.59	11.86
1995	1.16	1.22	1.84	0.23	1.42	68.64	72.53	12.03
1996	1.02	1.04	1.70	0.16	1.21	34.23	54.75	15.30
1997	0.99	1.13	1.29	0.08	1.38	50.70	43.95	11.40
1998	0.92	1.73	2.58	0.13	1.39	77.01	57.99	20.83
1999	1.05	0.80	2.48	0.29	1.84	102.35	48.23	34.85
2000	1.13	0.95	2.39	0.21	1.88	105.41	50.68	45.29
2001	1.08	0.84	3.17	0.34	1.91	109.54	60.15	38.49
2002	1.04	0.88	3.74	0.31	1.76	102.52	58.59	34.85
2003	1.12	0.86	3.82	0.29	1.96	103.67	59.21	36.11
2004	1.16	0.96	3.86	0.32	1.94	105.32	57.36	39.73

Source: Authors' calculation using World Bank Data base and UN Comtrade.

Table 1 presents the exports intensity indices for selected major trading partners. Tanzania's export dependence on the selected EU members (UK, Germany and the Netherlands) is on the average greater than that of her non-EU developed country partners. Though UK was relatively over-represented as Tanzania's exports market in EU during the first half of the 24-year period, the Netherlands maintained a commanding lead during the second half and closed with an index of 3.86 in 2004 compared to 0.96 for UK and 1.16 for Germany. The situation with the USA and Japan is somewhat different. The index with respect to the USA remains consistently below 0.5, though it is marginally higher in 2004 compared to what it was in 1980. With respect to Japan, the index has been trending upwards over the period, and has been greater than one since 1992. Given that exports from the rest of the world to the USA and Japan did not decrease over the period, the increase in the indices indicates that Tanzania's exports to both countries have been on the increase over the period. In the gravity model framework, this increase in intensity is supposed to be picked up by the country specific dummies. The indices between Tanzania and its developing nations major trading partners (especially the neighboring nations) depict changes that are more erratic. The index with respect to Kenya increased from 0.30 in 1980 to 108.32 by 2004, whereas that of Uganda fell from 165.36 in 1980 to 57.36 in 2004. With respect to India, the index increased from 1.95 in 1980 to 39.73 in 2004 reflecting the recent favorable conditions accorded to Tanzania's exports to India. In terms of the gravity model, we should see that factors beyond output, such as distance and other country specific factors are significant in determining Tanzania's imports from these countries.

Import Intensities

Similar to the analysis of exports, an import intensity index measures the extent of Tanzania's import dependence on its trading partners. This index is given as:

$$IM_{ij} = [M_{ij}/M_i]/[(M_{wj} - M_{ij})/(M_w - M_i)] \tag{2}$$

where IM_{ij} is the imports intensity index of country i with trading partner j, M_{ij} is the imports of country i to trading partner j, M_i is the total imports of country i, M_{wj} is the total world imports from country j, and M_w is the total world imports. The index is equal to one if Tanzania's import from a particular country as a proportion of its total imports is the same as the proportion of the rest of the world's imports from that country. If Tanzania is over-dependent on a particular country for its import, then the ratio will be greater than one. On the other hand, if the ratio is less than one, then Tanzania is under-dependent on that country.

The trend of the indices in Table 2 shows that among the selected major EU trading partners, the UK with average index of 2.36 is the most imports dependent partner of Tanzania throughout the period. The Netherlands is second, followed by Germany (with average index values of 1.15 and 0.70, respectively). In addition, the index with respect to Germany has been consistently below one since 1986 and that of the Netherlands has mostly been below one. It could be concluded that, in terms of imports from EU, Tanzania has consistently been over-dependent on UK likely due to colonial ties than any other factors. Once again, the index with respect to USA has consistently

been below one. The average of the index with respect to Japan for the decade of the 1980's exceeded that of the decade of the 1990's and the early 2000's, indicating a reduction of dependence on Japan as a source of imports. The implication is that the recent increase in Tanzania's bilateral trade with Japan is more of an increase in exports rather than increase in imports. The gravity model with country specific dummies that I estimate in the next section is supposed to explain these dynamics.

Table 2. IMPORT INTENSITY INDICES

Year	Germany	UK	Netherlands	USA	Japan	Kenya	Uganda	India
1980	0.97	2.68	1.72	0.54	1.28	11.33	0.54	7.34
1981	1.31	3.05	1.89	0.54	1.68	19.97	0.73	8.02
1982	1.36	2.47	1.96	0.35	1.32	24.35	4.36	5.23
1983	1.23	2.48	1.27	0.30	1.21	19.66	23.08	3.53
1984	1.35	2.67	1.57	0.37	1.25	21.63	79.32	3.38
1985	1.21	3.13	1.26	0.41	1.28	49.65	13.46	3.72
1986	0.62	2.07	1.02	0.46	1.20	74.18	n/a	2.46
1987	0.54	2.87	0.97	0.36	0.99	97.35	n/a	2.02
1988	0.56	2.98	1.01	0.26	0.99	n/a	n/a	0.00
1989	0.47	2.47	0.85	0.20	0.84	74.86	n/a	2.54
1990	0.77	2.41	0.87	0.11	0.70	46.07	n/a	2.52
1991	0.50	1.91	1.16	0.24	0.85	83.86	n/a	7.39
1992	0.74	2.05	0.73	0.23	0.91	96.86	n/a	10.21
1993	0.55	2.58	0.74	0.20	0.84	198.83	6.78	7.72
1994	0.50	1.80	0.60	0.29	0.60	347.51	6.72	7.60
1995	0.37	2.22	0.67	0.44	0.89	498.55	8.43	8.21
1996	0.36	2.08	0.77	0.36	0.79	583.77	14.69	8.97
1997	0.41	1.87	0.76	0.40	0.91	187.68	42.19	19.53
1998	0.50	1.59	1.90	0.45	1.18	205.50	15.79	9.54
1999	0.33	1.47	0.80	0.45	1.00	247.08	18.62	8.62
2000	0.63	2.50	0.98	0.41	0.99	256.23	32.78	9.68
2001	0.95	2.12	1.15	0.54	1.10	301.81	25.94	7.54
2002	0.61	2.40	1.26	0.56	1.15	312.54	36.47	9.34
2003	0.60	2.51	1.19	0.62	1.16	314.82	37.57	9.55
2004	0.63	2.32	1.32	0.64	1.25	321.93	39.01	10.13

Source: Authors' calculation using World Bank Data base and UN Comtrade.

The indices with respect to Kenya and Uganda reveal an interesting pattern when compared to the export indices. Though the import indices with respect to Kenya and Uganda are still the highest, the pattern differs a lot from the corresponding exports intensity indices. In the first place, Tanzania has always been over-dependent on Kenya as the source of imports, either by the level of the index or by comparison to Uganda. Secondly, its trade dependence on Kenya is relatively more of a source of imports rather than a destination for exports, whereas its dependence on Uganda is relatively more of a destination for exports rather than a source of import. In sum, distance and other factors such as common language have played significant role in trade among the EAC countries.

Whether the EAC has led to a significant trade creation effect among members remain an empirical issue that will be addressed using the gravity model. The pattern of changes in imports dependence on India is not different from that of exports, with increasing dependence during the decade of the 1990's. Relatively, Tanzania is more dependent on India for exports than for imports. Like the case of Japan, the recent increase in trade with India comes more from increased access to the Indian market.

There important stylized facts on Tanzania's bilateral trade emerge from the discussion above. First, Tanzania's trade relation with its major EU trading partners are still significant though it has marginally declined over the period, whereas its trade relation with non-traditional trading partners such as Japan, India, and the US has increased over the period. Second, the shifts among the selected EU partners indicate that despite the general EU external trade policies, other country specific factors may still remain significant in determining the intensity of bilateral trade between Tanzania and individual EU members. Third, Tanzania is relatively more over-dependent on its major LDC trading partners than its developed countries trading partners. This interpretation does not translate into volumes of trade with the respective trading partners because the index is very sensitive to the extent to which the rest of the world trade with a particular country. For instance, since UK has a greater trade involvement with the rest of the world than Uganda, one should not be surprised to find relatively very low imports and exports intensity indices for UK compared to those for Uganda.

THE GRAVITY MODEL AND SOME ECONOMETRIC ISSUES

The analysis of trade intensity indices conducted in the previous section, established three important stylized facts on Tanzania's bilateral trade which serve as the starting point of a rigorous econometrics analysis to determine the characteristics of Tanzania's bilateral trade. In this section, I will examine these stylized facts in the gravity model framework while analyzing the effect of two regional integrations, the EU and the EAC, on Tanzania's bilateral trade. The section will also examine the extent of openness of Tanzania's trading partners who are not members of the EU and the EAC. In light of this, I will empirically show that the appropriate econometric technique of testing for the regional integration effect is to augment the standard gravity equation with country specific dummies instead of the traditional approach which augments the standard gravity model with regional trading block dummies. The variables included in the standard gravity equation are income of both the importing and exporting countries, and distance. Income of the importing country represents the purchasing power or its absorption capacity, while the income for the exporting country represents the country's production and supply capacity. Distance is used as a proxy for transportation cost. The standard gravity equation is given as:

$$Y_{ijt} = \beta_0 + \beta_1 GDP_{it} + \beta_2 GDP_{jt} + \beta_3 DIST_{ij} + ... + U_{ijt} \qquad (3)$$

where Y_{ijt} is the trade variable between country i and country j at time t; GDP_{it} (GDP_{jt}) is a measure of income of country i (j) at time t; $DIST_{ij}$ is the distance between countries i and j, β_i ($i = 1........3$) are parameters of the equation, and U_{ijt} is a

white noise disturbance term. All variables are in logs so the estimated coefficients are interpreted as elasticities[1].

The traditional technique of testing for the trade effect of regional integration involves augmenting equation 3 with regional integration dummies. The equation is given as:

$$Y_{ijt} = \beta_0 + \beta_1 GDP_{it} + \beta_2 GDP_{jt} + \beta_3 DIST_{ij} + Dummy_i + ... + U_{ijt} \qquad (4)$$

where $Dummy_i$ is a dummy variable for the *ith* regional integration. The variable takes on the value of "1" if a country belongs to the regional integration of interest and "0" otherwise. This econometric technique has been criticized by Polak (1996), and Matyas (1997, 1998). They have proposed that when testing for the trade effect of regional integration in the gravity framework, individual local country and target country specific dummies should be included in the equation instead of regional dummies. The proposed econometric specification of the gravity equation with regional integration effect takes the form:

$$Y_{ijt} = \alpha_i + \gamma_j + \beta_1 GDP_{it} + \beta_2 GDP_{jt} + \beta_3 DIST_{ij} + ... + U_{ijt} \qquad (5)$$

where α_i is the local country effect, $i = 1........N$; γ_j is the target country effect, $j = 1........N$; and all other variables are as previously described.[2] In matrix form, equation (5) can be written as:

$$Y = D_N \alpha + D_J \gamma + Z\beta + U \qquad (6)$$

where Y is the $(NxNxT)x1$ vector of observations of the dependent variable, Z is the matrix of observations of the basic gravity model explanatory variables, D_J is $(N^2 xT)x(Nx1)$ matrix of target dummy variables, and D_N is $(I_N \otimes l_{NT})$ matrix of local dummy variables. In a matrix form, equation 4 can be written as:

$$T = D\theta + Z\beta + U \qquad (7)$$

where D is a vector of dummy variables representing membership of a regional integration of interest, θ is the parameter vector of the dummies in D, and Z is as previously defined.

In a simple matrix algebra, it can be shown that the column vectors of D can be expressed as a linear combination of the column vectors of the matrices D_N and D_J. Hence, if any of the parameters on D_N and D_J (denoted as α^* and γ^*) were significant in equation (6) then θ is significant in equation (7). This is simply due to the

misspecification of equation (7) which can lead to incorrect inferences. Hence, it will not be econometrically correct to use the significant of the parameters (θ) to judge the trade creation effect of regional trading blocks.[3] I, therefore, intend to empirically show that the proper econometric technique is to estimate a gravity equation with specific country dummies and use an appropriate weighting scheme to calculate the overall regional trading blocks effects.

Data

The data for this study comprises of bilateral trade flows between Tanzania and 23 major trading partners from 1980 to 2004 (refer to the Appendix for a list of countries included). Not all countries were observed for every year due to missing values. In total there were 541 observations on annual bilateral trade flows. The sample includes developed countries, mostly European Union countries, and developing countries. Various sources of data were used. Bilateral trade data was obtained from the UN-COMTRADE database and data on GDP (which represents income in the gravity equation) was obtained from World Bank database. The distance data, measured as air distance between Tanzania and capital cities of trading partners, was obtained from the University of Michigan Geographic Name Server and Supplementary database of world cities.

Results and Discussion

I began the empirical estimation of the model by performing two important diagnosis tests. First, some gravity model studies (Yamarik and Ghosh, 2005, Lee and Park, 2005, Tinbergen, 1962 and Poyonen, 1963) assume that the coefficients on the income of importing and exporting countries are the same, and impose the relationship rather than test for it. I proceeded by testing the hypothesis rather than imposing it. For all of the results reported below, the Wald coefficient test overwhelmingly rejected the null hypothesis of equality of the income coefficients between Tanzania and the trading partners. Secondly, I tested for heteroscedasticity in all the regressions using the Breusch-Pagan test, and concluded that the error terms of each regression were correlated with the regressors. I, therefore, corrected the error term of all regressions for heteroscedasticity using White's procedure.[4] Hence, the "t" and the "F-statistics" are asymptotically valid. Table 3 reports the OLS estimates of equation 3 (the standard gravity equation) using all the countries in the sample. I estimated the model separately for imports, exports and total trade (the sum of imports and exports). This was motivated by the observation from the discussion on the trade indices that the pattern of imports and exports differs[5]. The first column contains the results for imports. All variables have the right signs and are significant. An increase in Tanzania's income (GDP_{jt}) leads to increase in purchasing power and an increase in imports. Likewise, an increase in the trading partners' income (GDP_{it}) leads to an increase in exports to Tanzania. Both income coefficients (elasticities) are below 0.5, indicating that Tanzania's imports are less sensitive to its income and that of its trading partners. The distance variable is significant at the 1 percent level. The second and third columns report the result for exports and total trade respectively. The signs are all correct and the variables are significant. Overall, the results support the

predictions of the gravity model for Tanzania. However, based on the F-statistics, the standard model explains less than 32% of the variations in bilateral trade flows between Tanzania and the selected trading partners.

TABLE 3. THE BASIC GRAVITY REGRESSION

Variables	Import	Export	Trade
Constant	-1.24	0.12	1.73
	(-0.47)	(-0.05)	(-0.89)
GDP_{it}	0.33	0.14	0.23
	(7.26)***	(3.67)***	(6.90)***
GDP_{it}	0.47	0.26	0.32
	(1.97)**	(2.01)**	(1.98)**
$Distance_{ij}$	-0.51	-0.24	-0.45
	(-3.06)***	(-1.97)**	(-4.01)***
Number of Observation	541	541	541
Adjusted- R^2	0.27	0.24	0.31
F-statistics	24.28	16.56	31.65

Note: The figures in parenthesis are the absolute values of the t-statistics. **means significance at 5% level and *** means 1 % significance level.

TABLE 4 GRAVITY MODEL WITH REGIONAL DUMMIES

Variables	Import	Export	Trade
Constant	18.48	23.16	17.6
	(3.67)***	(6.66)***	(5.29)***
GDP_{jt}	0.53	0.33	0.37
	(9.55)***	(7.79)***	(10.43)***
GDP_{it}	0.45	0.41	0.27
	(2.01)**	(1.98)**	(1.99)**
$Distance_{ij}$	-2.83	-2.18	-2.33
	(-5.64)***	(-3.67)***	(-7.19)***
EUDUM	-1.18	-0.92	-0.71
	(-6.01)***	(-6.63)***	(-5.93)***
EACDUM	-4.95	-5.96	-4.08
	(-4.35)***	(-7.93)***	(-5.93)***
Number of Observation	541	541	541
Adjusted- R^2	0.28	0.27	0.36
F-statistics	25.92	21.66	33.51

Notes: The figures in parenthesis are the absolute values of the t-statistics. **means significance at 5% level and *** means 1 % significance level.

Tables 5, 6 and 7 present results from the modified new approach for imports, exports, and total trade respectively. It is important to note that in this paper, the implementation of the new technique entails restricting the local country dummy to zero

(α_i=0) since the data used is only from Tanzania's perspective (N=1). On the basis of the Adjusted-R^2 and the F-statistics, all three regressions improved significantly[7]. Hence, the variables included in the regression explain very well the movements in the trade variables. In terms of signs and significance, all the standard gravity variables had the right signs and are significant at the 5 percent level. Once again, the income elasticities were below unity and less than the distance elasticity. An interesting pattern emerges from the coefficients of the GDP variables. From table 5, a percentage increase in Tanzania's GDP leads to 0.65 percent increase in imports from her major trading partners. The information from table 6 indicate that a percentage increase in foreign GDP leads to only 0.29 percentage increase in Tanzania's exports. These results indicate that whereas Tanzania has difficulty in penetrating foreign market, it is relatively easy for foreign goods to penetrate Tanzania's market.

The coefficients of the country specific dummies could be interpreted as the extent of the openness of the trading partners (in terms of the exports regression), the extent of Tanzania's openness to the partners (in terms of the imports regression), and finally the extent of openness relationship between Tanzania and each partner (in terms of total trade regression). They could also be interpreted as a regional integration effect so long as the appropriate weighting scheme is used to take the weighted average of individual trading partners belonging to a particular regional integration. The dummy for Kenya is significant in the import, export, and trade regressions, confirming the significance of Kenya as Tanzania's trading partner, just as the import and export intensity indices showed. The dummy for Uganda is consistently negative and not significantly different from zero in all three regressions. Using the average proportion of trade over the entire period as the weight for these two EAC members and their dummy coefficients from the total trade regression, I obtained 0.284 as the effect of EAC on Tanzania's bilateral trade. This suggests that the EAC has had a moderate trade creation effect on Tanzania's bilateral trade with other members of the EAC. The effect is relatively small when compared with those of other developing nations, such as India, China, Singapore and Hong Kong (3.36, 0.58, 1.27 and 0.93 respectively). However, such results must be interpreted with caution since the volume of unofficial trade among the EAC members is large enough to affect the results of any empirical study of trade relationship within the community. Most of the EU countries' dummies are positive and significant. In the import regression, Tanzania is relatively less open to France, Portugal, Greece, and Spain. On the other hand, Finland, Denmark, Sweden and Italy are relatively closed to Tanzania in terms of exports. The UK, Germany and the Netherlands are the most open EU economies to Tanzania in terms of providing markets for Tanzania's exports as well as providing sources of Tanzania's imports. Using the average proportion of trade over the entire period as the weight for the EU members, and the coefficients from the total trade regression, the overall EU effect on Tanzania's total trade is 0.2825. The results clearly demonstrate the superiority, in terms of model specification, of including country specific variables in the gravity model when investigating the effect of regional integration on bilateral trade.

Japan and the USA are the two most opened economies to Tanzania, as they have the greatest coefficient in the exports regression. However, China is relatively closed to Tanzania since the China specific dummy coefficient in the export regression is negative and significant. Tanzania's propensity to import is the highest with India,

followed by UK. The total trade propensity is also the highest with India, with a coefficient almost twice as large as that of the UK which is the next highest. Other non-EU countries that have open trade relationships with Tanzania are China, Singapore and Hong Kong as their respective country dummy coefficients in the total trade regression are positive and significant.

CONCLUSION AND POLICY IMPLICATIONS

The increasing desire of many developing nations to pursue an export growth development strategy has led to increased emphasize on regional integration among developing countries. Most of the countries have also pursued trade policies that are supposed to open national economies to foreign competition and to grant them increased access to the ever-expanding international market. This has generated many studies, the results of which are intended for policy formulation and analysis. In this paper, I presented a model that shows the impact of two regional integrations (the EAC and the EU) on Tanzania's bilateral trade flows and also identify the extent of openness of trade between Tanzania and other non-EAC and EU counties. I applied the technique suggested by Matyas (1997 and 1998) to determine the impact of regional integration on trade. In doing so, I verified whether the conclusions reached by Matyas (1997 and 1998) on the use of country specific dummies are specific to his data sets or if they indeed reflect the true specification of the model for the identification of the regional integration effect. Whereas Matyas (1997 and 1998) used pooled time series data, I used only time series data on bilateral trade between Tanzania and her major trading partners. Hence, the coefficients I obtained are relevant for only Tanzania. This version of the proposed technique also makes it possible to test for the extent of openness trade relationship between Tanzania and other trading partners who are not members of the trading blocks I considered.

The main findings from the empirical analysis can be summarized as follows. Contrary to popular view on intra-African trade, Tanzania's trade with other EAC members shows a remarkable trade involvement, as depicted by the imports and exports intensities. Both intensities are higher for Kenya and Uganda (individually) than all other countries in the sample. This could also be a reflection of a combination of other factors such as proximity and linguistic ties. With the recent implementation of the custom union and the planned implementation of monetary union within the EAC, there is hope for further increases in bilateral trade relationships with other EAC members. Using the new estimation technique, I find that over the sample period both the EU and the EAC had moderate positive effects on Tanzania's bilateral trade. The results are consistent with those obtained from the analysis of trade intensities. However, results from the traditional approach suggested that both the EU and the EAC have had negative effect on Tanzania's bilateral trade. These results indicate that using the proper technique is crucial to measure accurately the effect of regional integration on trade. In addition, the overall econometric fit of the new technique explains the variation in bilateral trade balances much better than that of the traditional technique. Hence, direct inclusion of regional integration dummy variables in regression of trade variables should be avoided and specific country dummies should be alternatively analyzed for the role of regional integration in bilateral trade.

TABLE 5. GRAVITY MODEL WITH COUNTRY DUMMIES-IMPORTS

Variables	Parameter Estimates	t-Statistics
Constant	-3.65	(-0.68)
GDP_{jt}	0.65	(8.53)***
GDP_{it}	0.38	(2.81)***
$Distance_{ij}$	-0.68	(1.98)**
UKDUM	1.73	(6.06)***
GERDUM	0.88	(2.70)***
ITDUM	0.81	(2.16)**
USADUM	-0.31	(-1.00)
JPNDUM	0.08	(0.21)
CHNDUM	0.73	(3.36)***
NETHDUM	1.36	(5.24)***
INDDUM	4.44	(9.53)***
UGADUM	-0.72	(-0.58)
KENDUM	1.31	(2.35)**
SWITDUM	0.07	(0.27)
SWEDUM	1.21	(4.92)***
SPNDUM	-1.55	(-5.25)***
GRCDUM	-2.01	(-5.06)***
PRTDUM	-1.87	(-6.84)***
DNKDUM	1.21	(4.75)***
FINDUM	0.61	(2.45)**
FRNDUM	-0.34	(-1.12)
MALDUM	-0.17	(-0.63)
SGPDUM	1.61	(5.80)***
AUSDUM	-0.42	(-1.85)
HKGDUM	0.87	(3.87)***
Number of Observation	519	
Adjusted- R^2	0.81	
F-statistic	102.15	

Notes: The figures in parenthesis are the absolute values of the t-statistics. **means significance at 5% level and *** means 1 % significance level. UKDUM, GERDUM, ITDUM, USADUM, JPNDUM, CHNDUM, NETHDUM, INDDUM, UGADUM, KENDUM, SWITDUM, SWEDUM, SPNDUM, GRCDUM, PRTDUM, DNKDUM, FINDUM, FRNDUM, MALDUM, SGPDUM, AUSDUM, and HNKDUM represent country dummy variables for United Kingdom, Germany, Italy, USA, Japan, China, The Netherlands, India Uganda, Kenya, Switzerland, Sweden, Spain, Greece, Portugal, Denmark, Finland, France, Malaysia, Singapore, Australia, and Hong Kong respectively.

TABLE 6. GRAVITY MODEL WITH COUNTRY DUMMIES-EXPORTS

Variables	Parameter Estimates	t-Statistics
Constant	3.43	(6.93)***
GDP_{it}	0.31	(3.95)***
GDP_{it}	0.29	(2.17)**
$Distance_{ii}$	-4.31	(-7.78)***
UKDUM	1.18	(4.37)***
GERDUM	1.85	(3.80)***
ITDUM	-0.91	(-2.57)***
USADUM	1.86	(6.11)***
JPNDUM	2.11	(8.06)***
CHNDUM	-0.48	(-2.22)**
NETHDUM	0.98	(4.11)***
INDDUM	1.53	(3.60)***
UGADUM	-3.7	(-1.84)
KENDUM	0.42	(-3.94)***
SWITDUM	-1.05	(-4.01)***
SWEDUM	-1.54	(-6.84)***
SPNDUM	-1.36	(-4.98)***
GRCDUM	-2.86	(-7.66)***
PRTDUM	0.43	(1.76)
DNKDUM	-0.75	(-3.23)***
FINDUM	-0.32	(-1.42)
FRNDUM	-0.86	(-2.93)***
MALDUM	-0.66	(-2.63)***
SGPDUM	0.64	(2.57)***
AUSDUM	0.07	(0.31)
HKGDUM	1.11	(5.19)***
Number of Observation	519	
Adiusted- R^2	0.76	
F-statistics	88.54	

Notes: The figures in parenthesis are the absolute values of the t-statistics. **means significance at 5% level and *** means 1 % significance level. UKDUM, GERDUM, ITDUM, USADUM, JPNDUM, CHNDUM, NETHDUM, INDDUM, UGADUM, KENDUM, SWITDUM, SWEDUM, SPNDUM, GRCDUM, PRTDUM, DNKDUM, FINDUM, FRNDUM, MALDUM, SGPDUM, AUSDUM, and HNKDUM represent country dummy variables for United Kingdom, Germany, Italy, USA, Japan, China, The Netherlands, India Uganda, Kenya, Switzerland, Sweden, Spain, Greece, Portugal, Denmark, Finland, France, Malaysia, Singapore, Australia, and Hong Kong respectively.

TABLE 7. GRAVITY MODEL WITH COUNTRY DUMMIES-TOTAL TRADE

Variables	Parameter Estimates	t-Statistics
Constant	5.44	(1.36)
GDP_{it}	0.46	(7.56)***
GDP_{it}	0.28	(2.61)***
$Distance_{ij}$	-1.19	(-2.69)***
UKDUM	1.71	(7.88)***
GERDUM	1.21	(4.84)***
ITDUM	0.61	(2.11)**
USADUM	0.38	(1.73)
JPNDUM	0.69	(3.34)***
CHNDUM	0.58	(3.36)***
NETHDUM	1.31	(6.77)***
INDDUM	3.36	(9.82)***
UGADUM	-1.34	(-1.48)
KENDUM	0.65	(2.24)**
SWITDUM	-0.11	(-0.49)
SWEDUM	0.68	(3.77)***
SPNDUM	-1.21	(-5.50)***
GRCDUM	-1.72	(-5.75)***
PRTDUM	0.17	(0.86)
DNKDUM	0.71	(3.77)***
FINDUM	0.29	(1.62)
FRNDUM	-0.27	(-1.16)
MALDUM	-0.21	(-1.05)
SGPDUM	1.27	(6.31)***
AUSDUM	-0.41	(-2.26)***
HKGDUM	0.93	(5.45)***
Number of Observation	519	
Adiusted- R^2	0.97	
F-statistics	86.59	

Notes: The figures in parenthesis are the absolute values of the t-statistics. **means significance at 5% level and *** means 1 % significance level. UKDUM, GERDUM, ITDUM, USADUM, JPNDUM, CHNDUM, NETHDUM, INDDUM, UGADUM, KENDUM, SWITDUM, SWEDUM, SPNDUM, GRCDUM, PRTDUM, DNKDUM, FINDUM, FRNDUM, MALDUM, SGPDUM, AUSDUM, and HNKDUM represent country dummy variables for United Kingdom, Germany, Italy, USA, Japan, China, The Netherlands, India Uganda, Kenya, Switzerland, Sweden, Spain, Greece, Portugal, Denmark, Finland, France, Malaysia, Singapore, Australia, and Hong Kong respectively.

The results also indicate that whereas it is difficult for Tanzania's exports to penetrate foreign markets, foreign goods easily penetrate Tanzania's market. A possible explanation of this outcome is that the structure and weakness of the Tanzanian economy has kept the competitiveness of exports rather low. The policy implication of this finding is that measures and institutional changes that will increase the efficiency of the export sector would significantly increase the ability of Tanzanian exports to penetrate foreign market. These should include measures to eliminate the core supply side constraints, promote local entrepreneurship, and improve basic infrastructure.

Finally, the results clearly identified the openness relationship between Tanzania and her trading partners who are not members of the EU and EAC. Japan appeared to be the most open economy to Tanzania. This is an indication that, as the Japanese economy continues to pick up momentum, Tanzania could take advantage of it to gain increased market access especially since the trade deficit with Japan is the greatest and seems to drive Tanzania's overall trade deficit. The United States is also relatively open to Tanzania exports. It is expected that the enhanced trade and investment opportunities offered by AGOA IV will lead to increase in access to the United States market. Tanzania also has the opportunity to increase its market access to Asia, given that the economies of India, Singapore, and Hong Kong are relatively open to Tanzania's exports. The policy implication is that the government should continue with its efforts to gain more market access to the emerging significant trading partners if the export growth development strategy is to become a reality in Tanzania.

ENDNOTES

[1] For the theoretical derivation of equation 3 refer to Deardorff (1995, 1998).
[2] The general form of the specification in equation 5 assumes the use of pooled time series data of all the countries involved in a study. Since this study uses time series data from only Tanzania's perspective, I impose the restrictions that $\alpha_i = 0$ and N=1.

[3] See Matyas (1997, 1998) for more theoretical details.
[4] As Woodridge (2002) argued heteroscedastic robust procedures result in valid t and F statistics even with the presence of heteroscedasticity.
[5] They differ by country specific import and export intensity indices.
[6] The EAC dummy also captures the border effect since Kenya and Uganda are the only countries in the sample that share common border with Tanzania.
[7] We excluded one country dummy (Canada) in all regressions instead of restricting them to sum to unity as Matyas (1997) did.

APPENDIX

List of Countries Included in Regression Analysis

1. Australia
2. Canada
3. China
4. Denmark
5. Finland
6. France
7. Germany
8. Greece
9. Hong Kong
10. India
11. Italy
12. Japan
13. Kenya
14. Malaysia
15. Netherlands
16. Portugal
17. Singapore
18. Spain
19. Sweden
20. Switzerland
21. United Kingdom
22. United States of America
23. Uganda

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