Empirical Analysis of Trade Impact on Economic Growth: The Case of Tanzania.

Prepared by

Evarist J Muhaya

Department of Economics

The University of Akron

International Trade

Spring 2010

Introduction:

The positive effects of international trade on economic growth were first pointed out by Adam Smith 1776 (Afonso, 2001). From Adam Smith's discussion of specialization and the extent of the market, to the debates about import substitution versus exported growth, to recent work on increasing returns and endogenous technological progress, economists who are interested in the determination of standards of living have also been interested in trade, Frankel & Romer (1999). They further argued that, despite significant efforts that have been devoted to examine the impact of international trade on growth, there is little convincing evidence concerning the effects of trade on income.

This lead to a very important question in modern trade theory which is "Do open economy countries grow at a faster rate than closed economies"? Yanikkaya study of (2003) indicated that, a wide range of empirical studies claim that outward oriented economies consistently have experienced higher growth rates than inward oriented economies. Smith (1776) indicated that international trade will make it possible to overcome the reduced dimension of the internal market for a given country and thereby, increasing its extension of the market, improve division of labor and increase productivity.

It is also worthwhile to note that the theoretical growth literature has given more attention to the relationship between trade policies and growth, rather than the relationship between trade volumes and growth, Yanikkaya

(2003). As the result, central focus of this research will be to analyze the impact of trade on economic growth. In this paper I adopted a methodology similar to Frankel & Romer (1999), to investigate the impact of international trade on economic growth of Tanzania. The paper will begin with an estimation of bilateral trade between Tanzania and five selected countries using Instrumental Variables estimation (IV). And then by using IV, I will estimate the constructed trade share for Tanzania that will be used to estimate trade's impact on economic growth. Basics result indicates that, an increase in trade lead to marginal increase in gross domestic product for Tanzania.

The structure of this paper is as follows, section two will review the existing literature, followed by section three covering the design of the research and econometric issues. Section four will analyze data followed by section five in which the estimation results will be presented, the final section will present the conclusion of the study.

Literature Review:

There are several studies that investigate the impact of international trade on economic growth such studies are very useful in my research. One of the most important studies is by Frankel & Romer (1999). The objective of the paper was to investigate whether trade cause growth? They examined the direction of the causation between the trade and growth and identified that trade is endogenous, their observation was similar to the studies of Helpman (1988), Bradford and Chakwin (1993) and Rodrik (1995a). In order to address the endogeneity issue they created alternative instrumental variables to

measure the effect of trade on income. Their results suggest that trade has a statistically significant and positive effect on income. The study was based on 150 countries from 1985.

Another study that will be used in my analysis is by Sebastian (1998). The study used comparative data for ninety-three countries to analyze the robustness of the relationship between openness and total factor productivity growth. His results were found to be robust with the use of openness indicator, estimation technique, time period, and functional form and suggest that more open countries experienced faster productivity growth than countries that are less open.

The third study reviewed as I investigating the impact of trade on economic growth is by Yanikkaya (2003). This study analyzed trade openness and economic growth in a cross - country empirical analysis. Consistent with a number of empirical studies, as reviewed in Harrison (1996), Yanikkaya (2003) results support the hypothesis that countries with higher trade shares are likely to grow faster than other countries.

Research Design and Econometric Issues:

Previous trade - growth literature suggested that trade may be endogenous; therefore a simple estimation of income as a function of trade and other variables will lead to a biased estimates of the Ordinary Least Square results. Many studies have also emphasized the likelihood of reverse causation

between growth and trade, because it is easy to think of a case in which fast growth may cause higher trade shares Yanikkaya (2003).

Since trade is endogenous it can not be on the right hand of the regression equation, because it is likely to be correlated with the error term. This will be a violation of the Classical Linear Regression Assumptions.

To address the issue of endogeneity, many researchers such as Frankel & Romer (1999) proposed an alternative method for measuring impact of trade on income using Instrumental Variable (IV) approach. This approach leads to efficient and consistency parameter coefficients that can be used for estimation to make appropriate decision of whether to accept or reject the null hypotheses.

I will adopt a similar approach as in Frankel & Romer (1999), in which they used the gravity model to estimate bilateral trade between countries. They used the literature on the gravity model of trade and adopted countries geographic characteristics to construct IV estimates of trade's impact on income. They estimated a bilateral trade equation and then aggregate the fitted values of the equation in order to estimate a geographic component of countries' overall trade. In contrast to conventional gravity equation, Frankel & Romer (1999) equation included only geographic characteristics such as countries sizes, their distances from one another, border, and land locked variables.

In this paper, I will also use countries geographical characteristics to construct IV. As the literature of the gravity model of trade demonstrates,

geography is a powerful determinant of bilateral trade. Frankel & Romer, (1999) indicated that Linneman (1966), Frankel et al., (1995), and Frankel, (1997) had similar observation. Based upon Newton's Law of Gravitation, the gravity model predicts that the flow of people, ideas or commodities between two locations is positively related to their size and negatively related to the distance (Ghosh & Yamarik, 2004). In addition, Ghosh and Yamarik (2004) indicated that, Trade theorists have found that the gravity model equation is consistent with theories of trade based upon models of imperfect competition and the Heckscher – Ohlin model. The following is an extended version of the gravity model which includes X_{ij} representing the vector of other variables used in the international trade literature.

1) $\text{Log}(\text{trade}_{ij}) = \beta_1 + \beta_2(\text{logGDP}_i.\text{GDP}_j) + \beta_3\log(D_{ij}) + X_{ij} + \varepsilon_{ij}$

Where β_1, β_2, β_3, and β_4 are coefficient to be estimates, GDP_i and GDP_j are the gross domestic products of countries i and j, D_{ij} is the distance between country i and j and X_{ij} is the vector of dummy variables. The error term ε_{ij} captures any other shocks and chance events that may affect bilateral trade between countries i and j

For the purpose of this paper I will use gross domestic product (GDP) of each country as a proxy for economic growth and as a dependent variable. The volume of international trade is used as the bilateral trade between two

countries, which is measured by the total amount of country i imports plus exports to country j in a given year. Additional independent variables that will help to explain the variation of bilateral trade will be country i and j geographical components. To begin constructing instrumental variables I will start with a simple model measuring impact of international trade on gross domestic product of Tanzania. Such that

2) $LnGDP_i = \alpha_0 + \alpha_1 T_i + \mu_i$

Where Y_i is Log Income per person, T_i is International trade between Tanzania and all countries in the world, and ε_i is all other influences on income.

Since trade may be endogenous, I will construct instrumental variables to estimate trade's impact on economic growth using a gravity model theory. Previous work on gravity model of bilateral trade shows that trade between two countries is negatively related to distance between them and positively related to their sizes, and that a log linear specification will characterizes the data fairly well, Frankel & Romer (1999).

The specification of equation used to estimate bilateral trade between two countries is grounded on the gravity model with minor difference from the one adopted by Frankel & Romer (1999). The model will include only countries geographic characteristics such distance, and country's size variables to capture the volume of the within the country trade. To measure within the

country trade, I will use country i and j population and areas instead of country size. To identify the impact of area on bilateral trade, I used the interaction term the natural log of the surface area of the two countries as used by Frankel & Rose (2002) to capture the effect of increased area on trade

$$3)\ LnTradeij = a_0 + a_1 lnD_{ij} + a_2 lnN_i + a_3 lnN_j + a_4 lnAiA_j + \varepsilon_{ij}$$

Where LnT_{ij} is a bilateral trade between country i and j, LnNi is population in country i, LnNj is Population in country j, LnAiAj is the product of the surface area of the two countries.

Data:

The data set is derived partly from the World Development Indicators (2009), A World Bank Database and from The Tanzania Ministry of Finance and Economic Affairs under the Economic Survey of 2007. The data set consists of ten years observation for six countries. The data has been organized as a panel data of cross-sectional countries. The period of analysis includes years from 1998 to 2007. This period selection is the result of data availability. The data covers bilateral trade among six countries, which are Tanzania as the focus country (i) and Kenya, Uganda, Zambia, South Africa, and India. Kenya, Uganda, and Zambia are included in order to see the trade patterns between Tanzania and other member within neighboring region. While India and South Africa were are included to observe bilateral trade between Tanzania and its major trading partners.

Distance was measured by using a similar approach used by Frankel & Romer (1999) as the great circle distance between countries' commercial centers. In this paper GDP is used as a measure of a country's economic growth. Other relevant data for each variable was obtained from the above sources. Table I provides a summary statistics of key variables used in this research to explain the impact of trade on economic growth.

Table 1
Summary Statistics

Variable	N	Mean	Std Dev	Minimum	Maximum
Dependent Variable 1 -LnTradeij	50	4.40	1.47	1.96	6.75
Dependent Variable 2 -LnGDPi	50	9.326	7.926	9.034	9.731
LnTrade Predictions	50	4.40	1.18	2.19	6.65
Sums of Tradeij	10	838.66	564.56	0.84	1863.60
Actual_Trade	10	5191.18	1795.67	3525.85	8619.73
LnGDPiGDPj	50	21.46	22.07	17.11	23.71
LnDij	50	6.94	0.67	6.03	7.97
LnNi	50	3.60	0.08	3.48	3.72
LnNj	50	3.99	1.57	2.30	7.03
LnAiAj	50	-0.36	0.90	-1.74	0.97

Results of Bilateral Trade Estimation:

The results for the bilateral trade between Tanzania and five listed countries are reported on Table 2. The first column show the variables included in the regression model, the second column indicates the parameter coefficients and their respective t-values.

4) $LnTrade_{ij} = -3.9594 - 1.31039lnD_{ij} + 4.5353lnN_i + 0.4067lnN_j + 1.3632lnAiA_j + \varepsilon_{ij}$

Table 2
Bilateral Trade Estimation

Variables	Model 1
Constant	-3.95944
	(0.6)
LnDistance$_{ij}$	-1.31039
	(-3.65)***
LnPopulation$_i$	4.5353
	(2.69)**
LnPopulation$_j$	0.40673
	(3.09)***
LnArea$_i$Area$_j$	1.36323
	(0.13)***
N	50
R^2	0.6435
Adjusted R2	0.6118
F-Value	20.31
Root MSE	0.9145

Notes: In parenthesis are t-values for respective coefficients
*, **, *** Indicates Significance level at 10%, 5%, and 1%

Overall the results are generally as expected; Distance has a large and enormous significant negative impact on bilateral trade. A one unit increase in distance between two countries will result in 1.31 percentage decrease in bilateral trade. Trade between countries i and j is significantly increasing as their population increases, which is as population of country i increase by one percent, bilateral trade will increase by 4.54 percent. In addition, population

increase in country j has a lower effect on bilateral trade; an increase in population in country j by one percent will lead to an increase of 0.41 percent in bilateral trade. On the other hand, the results shows that as the area of country i and j increases, bilateral trade will rise by 1.36 percent. This can only be true if population density is increasing as the area increases. Most importantly the results indicate that, countries geographical variables are major determinants of bilateral trade. By looking at the R^2 of the regression equation which is 0.6435, affirms that geographic variables explains significant portion of countries overall trade.

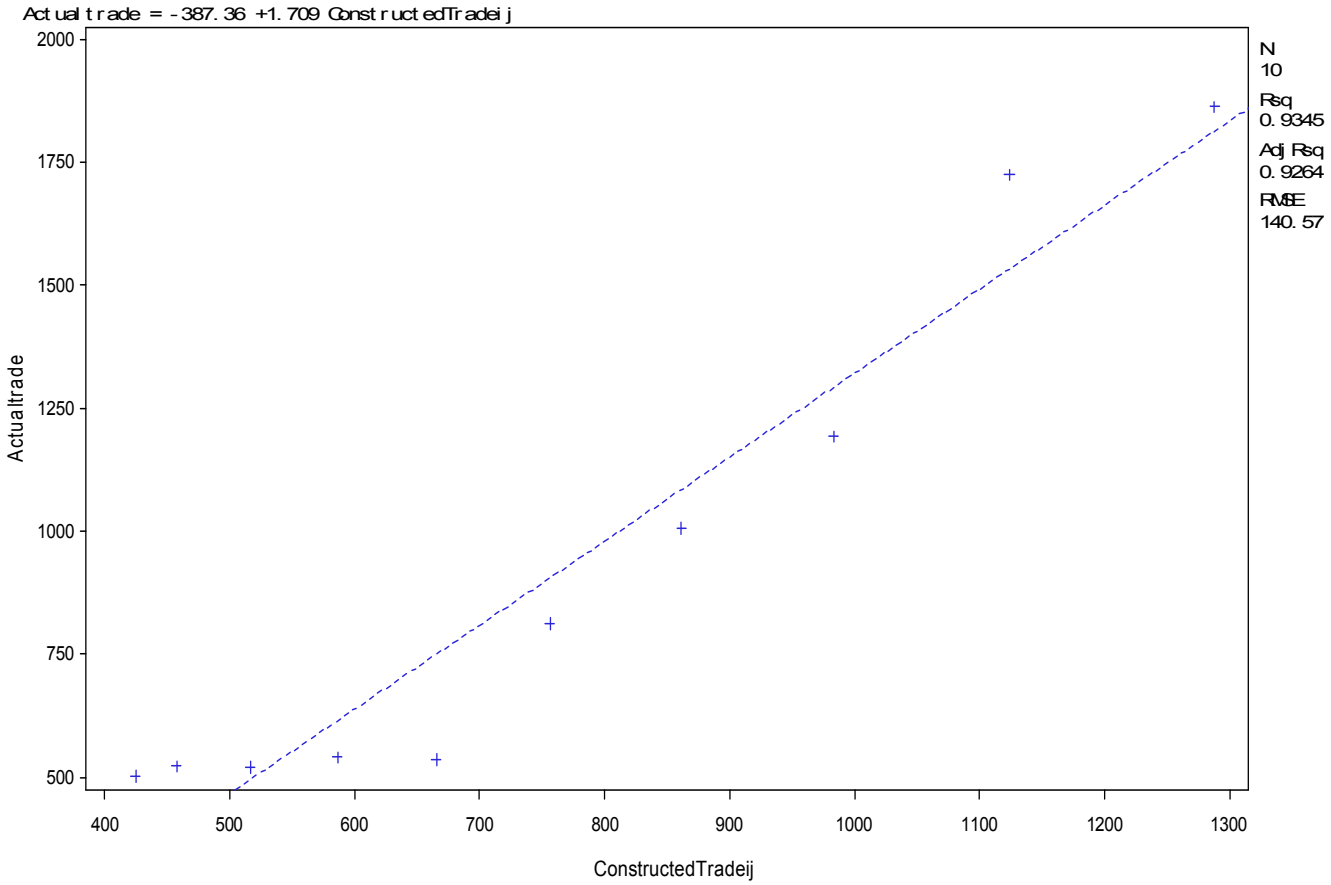
After estimating a bilateral trade equation, I will aggregate the fitted values of the equation to estimate a geographic component of countries' overall trade. This can be done by using the regression equation (4). By plugging respective coefficients for each variable in the model and actual values for each variable for the period of analysis, the trade predictions can be obtained. In this case the estimates of the geographic component of country i's overall trade share is given by

5) $$\check{T} = \sum_{j \neq i} e^{\hat{a}\, x_{ij}}$$

Where â is the vector of coefficients in equation (4) (a_0, a_1, a_2, a_3, and a_4), and X_{ij} is the vector of right hand side variables (1, lnD_{ij}, lnN_i, lnN_j, and lnA_iA_j). I will aggregate the fitted values for only the countries covered by the bilateral trade data set to obtain the constructed trade share between country i and j.

Frankel & Romer (1999) used a similar approach to obtain constructed trade share, however, they limited their calculation of T̃ to the 150 countries in the Penn World Table.

Figure 1



The above figure indicates a scatter plot of the actual trade measured against the constructed trade share T̃ for Tanzania. This shows that, geographic variables accounted for a significant variation in overall trade; it is indicated by a positive relationship between actual trade and constructed trade, the correlation between actual and constructed trade share is 0.96. I

anticipated the constructed trade share to correlate with actual trade share and to be uncorrelated to error term, in this case there isn't a violation of the Classical Linear Assumptions.

Table 3

Relationship Between Actual Trade and Constructed Trade	
	Model 2
Constant	(-387.36)
	(2.97)**
Constructed Trade Share$_i$	1.709
	(10.69)***
N	10
F-Value	114.23
R^2	0.9345
Root MSE	140.568

Notes: In parenthesis are t-values for respective coefficients
*, **, *** Indicates Significance level at 10%, 5%, and 1%

In an attempt to examine whether geographical variables provides significant information regarding international trade, I regressed actual trade against constructed trade share. The results indicate that if you control for size and population, the constructed trade share becomes highly significant with a t-value of 10.6. This affirms that, constructed trade share derived by using instrumental variables estimation contains enough information regarding the actual trade.

After using instrumental variables to estimate the impact of geographical variables on international trade, we can now examine the relationship between trade and growth using instruments constructed earlier. The following equation will be estimated.

6) $\ln GDP_i = \delta_0 + \delta_1 T_i + \delta_2 \ln N_i + \nu_i$

Where GDP_i is gross domestic product for country i, Ti is country's i trade share, and N_i is the population, and ν_i is the error term. This specification is different from the one used by Frankel & Romer (1999). It does not include variable capturing the effect of size (area) for country i. This makes my analysis easier because if area was included in the model, the model could potentially face a multi-collinearity issue since part of size variable is correlated to constructed trade share. The goal of the above model specification is to capture trade effects on GDP growth.

Table 4

The Effect of Trade on GDP Growth	
	Model 3
Constant	3.499
	(1.93)*
Trade Share$_i$	0.00023
	(2.75)**
LnPopulation$_i$	1.55
	(2.97)**
N	10
F-Value	100.32
R^2	0.795
Root MSE	0.0503

Notes: In parenthesis are t-values for respective coefficients
*, **, *** Indicates Significance level at 10%, 5%, and 1%

Table 4 presents the regression results of the model which estimates the impact of trade on growth. The results indicates that trade has a statistically significant relationship with gross domestic product for country i (t-statistic =

2.75). The results suggest that, a percentage increase in trade share will be associated with an increase of 0.02 percent on gross domestic product. In addition, the point estimates indicates that a percentage increase in population will increase gross domestic product by 1.55 percent (t-value = 2.97).

Conclusion:

The objective of this research paper was to examine the impact of international trade on economic growth of Tanzania. The amounts that countries trade are not determined exogenously, as the result correlations between trade and income will not identify the effect of trade Frankel & Romer (1999). In this paper, countries geographical characteristics are used to estimate bilateral trade as in Frankel & Romer (1999) study. The results indicated that, country geographical components are significant determinants of overall trade variations.

Countries geographical variables were used as instruments of measuring trade, and also to estimate constructed trade share of Tanzania. The results found that, there is a positive correlation between constructed trade share and the amount of actual trade between Tanzania and other countries. I was able to use the estimated trade share of Tanzania and the natural log of population in Tanzania to estimate trade effects on gross domestic product growth of Tanzania. The results indicated that, trade is statistically and economically significant determinant of growth; the results show that a one unit increase in trade will lead to a marginal increase of 0.023 percentage of the gross domestic product. This effect is expected to increase as more trade data are used to

reflect bilateral trade with all countries that trade with Tanzania. Based on the scope of this study that information was not available, this could save as a motivation for future researches.

References:

Edwards, Sebastian (1993), "Openness, Trade Liberalization, and Growth in Developing Countries," *Journal of Economic Literature*, XXXI, 1358-1393.

Edwards, Sebastian (1998), "Openness, Productivity and Growth: What Do We Really Know?" *Economic Journal*, 108, 383-398.

Frankel, Jeffrey A. *Regional trading blocs in the world trading system*. Washington, DC: Institute of International Economics, 1997.

Frankel, Jeffrey A. and David Romer (1999), "Does Trade Cause Growth?," *American Economic Review*, 89, 379-399.

Frankel, Jeffrey A. Stein, Ernesto and Wei, Shang-jin. "Trading Blocs and the Americas: The Natural, the Unnatural, and the Supernatural." *Journal of Development Economics*, June 1995, *47*(1), pp. 61–95.

Frankel, J., Rose, A.K., 2002. An estimate of the effect of common currencies on trade and income. *The Quarterly Journal of Economics* 117, 437–466.

Ghosh, Sucharita & Steven Yamarik (2004), "Are Regional Trading Arrangements Trade Creating? An Application of Extreme Bounds Analysis" *Journal of International Economics*, 63, 369-395

Halit, Yanikkaya (2003), Trade Openness and Economic Growth: A Cross Country Empirical Investigation. *Journal of Development Economics 72, 57– 89*

Harrison, A. (1996). Openness and growth: a time series, cross-country analysis for developing countries. Journal of Development Economics 48, 419–447.

Helpman, Elhanan (1988)**.** "Growth, Technological Progress, and Trade." National Bureau of Economic Research (Cambridge, MA) Reprint No. 1145, 1988.

Linneman, Hans. *An econometric study of international trade flows*. Amsterdam: North- Holland, 1966.

Rodrik, Dani. "Getting Interventions Right: How South Korea and Taiwan Grew Rich." *Economic Policy*, April 1995a, (20), pp. 53–97.

Smith, Adam (1776), *An inquiry into the nature and causes of the wealth of nations*, tradução portuguesa: *Inquérito sobre a natureza e as causas da riqueza das nações*, Fundação Calouste Gulbenkian, Lisbon, 1981.