

MEASURING THE OPPORTUNITY COSTS OF TRADE-RELATED CAPACITY DEVELOPMENT IN SUB-SAHARAN AFRICA.

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Abstract

Trade costs have been identified as an important determinant of a country's ability to participate fully in the world economy (Limao and Venables (2001)). In line with this, recent studies have documented the impact of institutions and infrastructure development on trade flows. This paper studies these issues in the context of trade-related capacity building (TRCB) initiatives and evaluates the opportunity cost of different TRCB policy mixes. Trade-related capacity building which is broadly defined as a coherent set of activities by donors and partner countries designed to improve trade performance through institutional, human capital and infrastructural development, has increasingly gained attention of developing countries and donors alike. In 2001 the WTO Doha Ministerial Declaration recognized trade-related technical assistance and capacity building as core elements of the development dimension of the multilateral trading system and set out commitments in those areas. Since then, substantial resources have been mobilized in support of trade capacity building initiatives. According to a joint report by the WTO and the OECD, the amount of trade-related technical assistance and capacity building to help developing and least-developed countries participate more efficiently in international trade has increased by 50% since the Doha Ministerial Declaration. The purpose of this paper is to address the question of whether the weights assigned to different components of trade-related capacity in existing TRCB programmes is justified. To do this the paper evaluates opportunity cost of different TRCB policy mixes with specific reference to Sub-Saharan Africa (SSA), excluding South Africa. We use a number of variables from both theoretical and empirical literature to come up with composite indicators for trade-related institutions, infrastructure and human capital. Making use of the gravity model we estimate the impact of these TRCB indicators on trade as measured by value of total exports. The model is estimated using trade patterns in 2005 for a data set of 117 world countries of which 37 are in sub-Sahara Africa. We then estimate how much trade flows will be increased under various policy scenarios of improved TRCB indicators in SSA. We examine scenarios that focus on improved institutions, infrastructure and human capital so that they become comparable with the rest of the world. The world's average level is used as the baseline for each of these composite indicators, in the policy simulations.

The results show that the coefficients for three TRCB variables display considerable variation with infrastructure being the most important of them all - exporters' infrastructure being the most significant with an average elasticity of approximately 3.0 (implying an increase of 3% in bilateral trade flows for each 1% improvement in the quality of exporters' infrastructure). Our studies also show that countries with similar institutions will trade more as institutional homogeneity reduces transaction costs between them. Our finding suggests that complementing improvements in the quality of human capital and infrastructure will provide the greatest bilateral trade flow benefit to Sub-Saharan Africa.

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1.1 Introduction

Since the 2001 WTO Doha Ministerial Declaration which recognized trade-related technical assistance and capacity building as core elements of the development dimension of the multilateral trading system. There has since been an increase in attention to these issues by both recipient and donor countries. This growing interest is evidenced by a surge in resources directed towards Trade-Related Capacity Building (TRCB) initiatives, though areas of focus differ across donors. This study is motivated by the need to provide a scientific basis for refining trade-related capacity building policy. Sub-Saharan Africa receives special attention in this paper because of its marginalization from the multilateral trading system. The following research questions will be interrogated in detail: Are the weights assigned to different components of trade-related capacity building activities in existing TRCB programmes justified? To what extent will participation in the MTS be enhanced by trade-related capacity building (TRCB), given the fact that more resources on TRCB imply less on other development priorities? What is the opportunity cost of investing resources in one particular TRCB approach as opposed to another? Investigation of these issues will be organized around four main themes: whether and to what extent TRCB matters in determining trade flows, whether interactions make a difference, whether and to what extent Africa differs from the rest of the world in response of trade to TRCB, and whether the results are robust to changes in estimation methodology or to the change in the constructions of the TRCB composite indices.

This paper focuses on the estimation of the gravity equation to determine the impact of institutions, infrastructure and human capital on bilateral trade flows. The model is estimated using trade patterns in 2005 for a set of 117 world countries of which 24 are in sub-Sahara Africa². This dataset gives 13572 possible bilateral export relationships and approximately 15% of these export flows are zeros. In recent contributions to the theoretical literature on the gravity model the issue of zero bilateral trade flows has received attention. It has been noted that disregarding these zero flows may bias estimates if their occurrence is not random. To avoid such bias a sample selection model based on the methodology of Heckman (1979) is adopted in our estimation. The gravity equation is also estimated using other approaches that have been suggested to deal with zero trade values in order to assess the sensitivity of the results to use of different methods. A comparative evaluation of policies aimed at increasing human, infrastructure and institutional capacities, is also undertaken. This simulation exercise will be the basis for measuring the opportunity costs of the TRCB policy options.

² List of the countries in the sample is given in the Appendix8x, Table 1

1.2 Definition and measurement of TRCB

Trade-Related Capacity Building (TRCB) is broadly defined in the literature as a coherent set of activities by donors and partner countries designed to improve trade performance through institutional, human capacity and infrastructural development. This goes beyond trade facilitation (which has dominated empirical literature in recent years) which focuses on mere movement of goods across borders. Considering supply-side capacity is in the spirit of the Hong Kong Declaration which recognized the need for countries to address supply side capacity and trade-related infrastructure before realizing benefits from WTO agreements. Hence, the focus of this paper goes beyond facilitation issues and attempts to take into account those factors that limit economies' capacities to produce tradable goods. This however, raises challenges with regard to measurement and methodological issues, further compounded by lack of data on a number of indicators that could be used to capture trade capacity building initiatives, especially in Africa. We therefore identify proxies for TRCB initiatives. We use a number of variables from both theoretical and empirical literature to come up with composite indices for trade-related institutions, infrastructure and human capital. These indices are generated using survey information from the World Economic Forum's Global Competitiveness Report (GCR), and the World Bank's Doing Business Report. We rely on survey information because of the limited availability of relevant trade capacity building indicators.

1.2.1 DESCRIPTION OF THE TRCB CATEGORIES:

As mentioned above, three distinct areas for trade-related capacity building are institutions, infrastructure and human capital. In addition to a number of articles in the agreements reached at the conclusion of the Uruguay Round and General Agreement on Tariffs and Trade (GATT) making provision for these areas; our overview of on-going TRCB activities also points towards concentration of investment in these domains. The Singapore WTO Ministerial Meeting and Doha Development Agenda have also highlighted these issues. In this section we will briefly explain each TRCB category and its sub-indicators.

1.2.1.1 INSTITUTIONS

This category captures the quality of the social infrastructure (institutions) of the economy. There has been an increase in interest in the role of institutions for the functioning of markets. This resurgence of interest might be due to a general consensus that "well-developed institutions are likely to decrease the transaction costs for market participants and thus increase the efficiency of markets".³ It is widely observed in the literature that inefficient institutions raise the price of trade goods due to the insecurities associated with doing business in the international market. The choice of sub-indicators is based on both related literature (trade facilitation and institutions, and growth and institutions) and also on the focus of

³ Jansen M and Nordäs H.K (2004), Institutions, trade policy and trade flows. WTO, p. 9

the current TRCB initiatives. The present paper defines and measures quality of institutions using a composite index constructed from selected sub-indicators, drawn from the WEF Executive Opinion Survey and the World Bank's Doing Business Report. Most of the responses in the WEF survey are ranked on a scale of 1 to 7, with the lower figure corresponding to poorer performance. Table 10 in the Appendix defines all the variables used in arriving at TRCB indicators, according to the survey questions which the respondents were asked. We use the following sub-indicators to define and measure institutions:

- a) University/Industry research collaboration: Review of the main features of technical assistance in trade policy shows that research assistance and networking links between think tanks and trade policy makers have received considerable attention. In addition, both growth and trade theory predict that expenditure on research has a direct impact on growth and export growth. Empirical literature reveal that networks of social learning are important in the diffusion of technology e.g. Colonley & Udry (2005) *cited in* Bardham (2004).
- b) Property rights: The agreement on trade-related aspects of intellectual property rights makes provision for the enforcement of intellectual property rights, with the aim of reducing distortions and impediments to international trade.
- c) Presence of demanding regulatory standards: In order to participate in trade a country/exporter has to conform to the requirements of its clients and markets. This sub-indicator is therefore intended to capture the importance in the multilateral trading system of harmonising standards of both products and enterprise systems. This is one of the technical assistance areas emphasized by UNIDO, which provides capacity building in harmonisation, certification of products and systems issues. In addition, there is also the Standards and Trade Development Facility (STDF) a joint initiative through which Food and Agriculture Organisation (FAO), World Organisation for Animal Health (OIE), World Bank, World Health Organisation (WHO) and WTO combine efforts in assisting developing countries to meet international standards in human and animal health, and phytosanitary conditions so that they gain or maintain market access (WTO, 2006). Agreements on the Application of Sanitary and Phytosanitary Measure and on Technical Barriers to Trade⁴ cover standards issues.
- d) Financial market sophistication: The Uruguay Round took specific commitment regarding the financial services under the General Agreement on Trade in Services (WTO, 2002). Beck (2002), cited in Bardham (2004), notes that all other factors being equal institutional factors in credit markets affect the level and structure of exports. Weaknesses in the financial market are serious in the early stages of development and therefore affect levels of specialisation and restrict poor countries to the production of primary goods which do not require large stocks of working capital. According to the

⁴ Article 5 of the agreement gives provision for conformity with technical regulations and standards

2006 Africa Development Indicators, with the exception of Kenya, Mauritius and South Africa, Sub-Saharan Africa's financial systems are very weak.

- e) Number of administrative procedures required to start a business
- f) Number of documents required for exports: "It has been shown empirically that numerous and complex customs procedures and requirements generate substantial costs". (IMF Staff, 2002, p.7). According to the IMF, import costs are increased by around 7-10 percent of total trade value by documentary red tape.
- g) Number of procedures required to enforce a contract: This indicator is meant to capture the efficiency of the legal system, at the same time measuring the economy's approach to regulations. This is important given the uncertainties surrounding international trade, where issues such as contract negotiation and enforcement are crucial, and protection of intellectual property rights which affect innovation capacities.

1.2.1.2 INFRASTRUCTURE

Infrastructure indicators are designed to measure the extent to which an economy has the necessary physical infrastructure required to produce goods for export as well as to move goods (exports and imports) across borders. Inclusion of infrastructure in this study has its basis in both growth and trade theory, and in empirical studies. The latter have shown that quality of infrastructure directly and indirectly affects trade cost as well as productivity of factors of production.⁵ The present study takes note of the difficulty of isolating the trade component of infrastructure activities and therefore follows the approach of the joint OECD/WTO database in regarding all infrastructure aid as trade-related. The quality of infrastructure indicator is an aggregated/composite index constructed from the following variables:

- a) Ports
- b) Air transport infrastructure quality
- c) Railroad infrastructure development
- d) Telephones/fax infrastructure quality
- e) Quality of electricity supply

⁵ See for example Agènor (2006), Fedderke and Bogetic (2005) and Limao and Venables (2001) for recent empirical work that investigate this relationship.

- f) Extent of marketing (The reason for classifying this under infrastructure is that the relevant survey question asks about the tools and techniques used in marketing.)
- g) Quality of competition in the ISP sector
- h) Extent of business use of the Internet

1.2.1.3 HUMAN CAPACITY

Human capital is the sum of the abilities and knowledge of individuals. It measures the quality of labour supply and can be accumulated through education, further education and experience. Education is an investment in human capital, while learning is the process of acquiring knowledge or skills through study, experience or teaching⁶.

According to Bergheim (2005) formal education is not the end of education, but there is need of continuous updating and replacement of depreciated knowledge with new knowledge through on-the-job training, seminars etc. The Global Competitiveness Report (2005-2006) also expressed the same sentiments when it noted that:

"the quality and quantity of higher education provided within an economy are critical for competitiveness, for preparing quality staff for more complex roles in areas, such as production, marketing, management, and R&D. In addition to formal education, on-the-job training has become an increasingly important method of upgrading an economy's human resources" (p.23).

From the overview of on-going trade-related technical assistance we note that these issues have been at the forefront of WTO activities, and to some extent ITC, which trains business entrepreneurs. The human capital indicator developed in this paper is designed to capture any TRCB impacts on human capital development. The index is based on the following variables:

- a) Tertiary enrolment. Some empirical literature has used the average years of schooling of the population aged 25 to 64 years as the best measure of this minimum threshold of stock of human capital of a level of quality that can promote growth⁷. Romer (1999) also notes that the initial level of literacy is important for understanding subsequent growth. Because of data availability problems we will use this less-than ideal indicator. According to Bergheim (2005), though enrolments might not be the best measure of today's human capital, they do provide useful insights about future human capital.
- b) Extent of staff training: This proxy is intended to capture continuous updating and replacement of depreciated knowledge with new knowledge through on-the-job training seminars (e.g. trade courses for government officials)., the activity which seem to have dominated the WTO's training programme.

⁶ Bergheim, S (2005), "Human capital is the key to growth: Success stories and policies for 2020" *Deutsche Bank Research, Current Issues*

⁷ See Bergheim (2005)

- c) Quality of management schools
- d) Local availability of specialised research and training services
- e) Brain drain: Brain drain occurs when skilled labour migrates to rich countries for better paid jobs, thus reducing the supply of skilled workers in poor countries. “The International Organisation for Migration (IOM) estimates that some 300 000 professionals from the African continent live and work in Europe and North America. By some estimates, up to a third of R&D professionals from the developing world are believed to reside in the OECD area”.⁸ Given these magnitudes, brain drain can undermine human capacity development efforts. Therefore there is need to take cognisance of it in assessing actual human resources retained in an economy after capacity building initiatives have been put in place - it is possible that under some circumstances such initiatives build capacity that doesn’t stick.

1.3 CONSTRUCTION OF TRADE-RELATED CAPACITY BUILDING INDICES

We closely follow the approaches of Wilson, Mann and Otsuki (2003) and Nordàs and Piermartini (2004). Each TRCB indicator is measured by a composite index constructed from variables as indicated above. Data on different indicators chosen for TRCB are captured using different units of measurement. Some are actual values (e.g. tertiary enrolment, number of administrative procedures required to start a business, number of documents required to exports, etc.) while some are ranks ranging between 1 and 7. Two main steps are taken to construct the indices:

Step 1: *Normalising the data*

TRCB targets are categorised either under Infrastructure (F), Institutions (I), or Human Capital (H). Given that the various sub-indicators/variables (x_i) used to define these categories are measured in different units as explained above, a necessary first step is to make the raw data comparable. They are converted such that they are all consistent with respect to improvements or worsening of the status quo. Variables that are captured as actual values when a low figure is desirable (e.g. number of administrative procedures required to start a business, number of documents required to export, etc) are converted by taking an inverse of all numbers which then converts the series such that increasing numbers are desirable. For all other TRCB sub-indicators that are measured as indices and actual values (when rising numbers are desirable, e.g. tertiary enrolment rates) are normalised using the sample average of all the countries in the survey, to come up with a sub-index (X_{in}).

⁸ http://www.oecdobserver.org/news/fullstory.php/aid/673/The_brain_drain:_Old_myths,_new_realities.html

$$X_{in} = \frac{x_{in}}{\sum_{n=1}^N X_{in} / N}, \text{ where } X_{in} \text{ denote the sub-index of variable } i \text{ for county } n \text{ (} n = 1, \dots, N \text{)}.$$

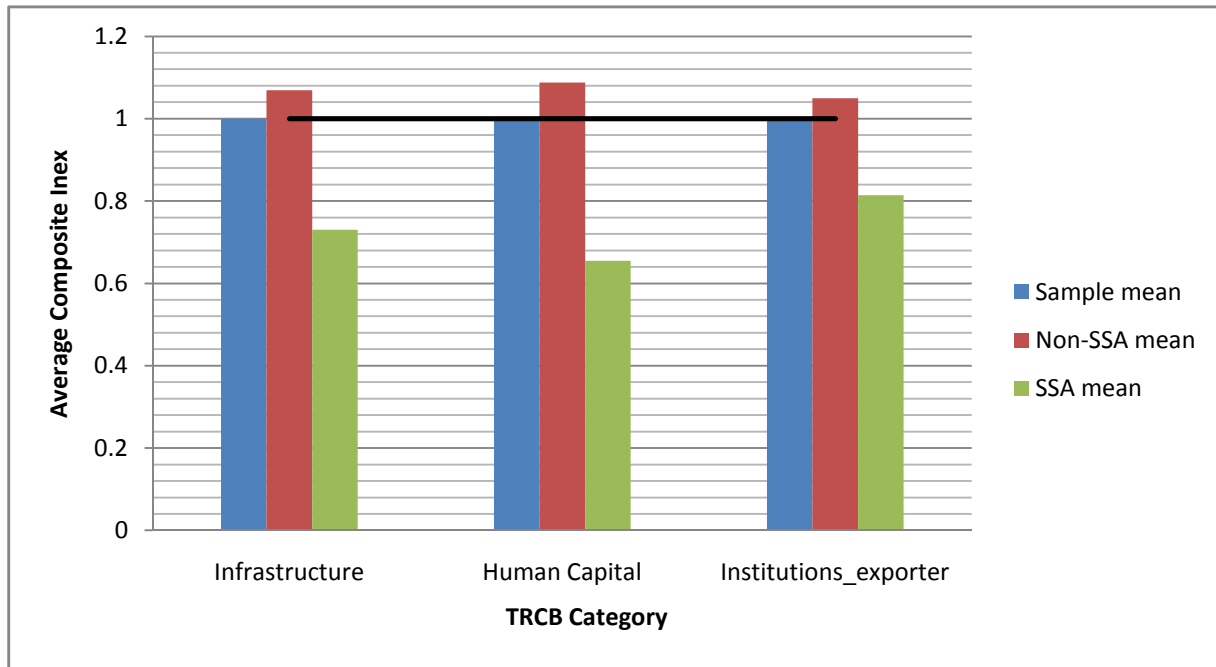
Step 2: Composite TRCB indicator

After normalising all the sub-indicators/variables, the composite indicator (\bar{X}_{kn} where $k = F, I, \text{ or } H$) for each TRCB indicator in country n is calculated as a simple average of the sub-indices.

1.4 Descriptive Statistical Analysis

As a starting point for empirical analysis of the trade effects of TRCB, it is useful to compare average values of these variables in SSA, non- SSA and the rest of the world, with the aim of exploring whether SSA countries' qualities of institutions, human capital and infrastructure depart from the world standards. A comparison of average values among these three categories is highlighted in Figure 2 below. The trend line at 1.0 represents the average for all the countries in the sample which is also taken to be the proxy of the world average. It can be seen that in all the three broad TRCB categories non-SSA countries are superior to the world average, while SSA countries lag behind both the world and non-SSA countries.

Figure 1: Averages of the Three Composite TRCB Variables



Source: Author's calculations; see Table 6 in the Appendix

Figure 2 highlights that on average SSA countries lag behind mainly in the quality of human capital, which shows the greatest difference of approximately 40% to 35% below the non-SSA and sample countries' average standards (see Table 6 in the Appendix). This result seems to lend support to the current focus of TRCB programmes that emphasize human capacity development. However, despite this major capacity gap between SSA and non-SSA countries, recent empirical literature that has looked at trade effects of TRCB has not taken into account human capital (*Wilson et.al, Jansen and Nordas, Iwanow and Kirkpatrick,*). Again, given the fact that the bulk of TRCB activities are geared towards human capacity development we would expect that human capital development would be at the centre of empirical analysis of TRCB; however this has not been the case so far.

Despite rising consensus in recent years that development in African countries is constrained by poor institutions, the data do not reflect this recent importance ascribed to institutions in explanation of Africa's underdevelopment. The average figures show that, compared to other TRCB indicators, average quality of institutions for SSA countries deviates less from non-SSA and sample countries' average standards at 22% and 19% respectively. The next section explores in detail the impact of these differences in the quality of infrastructure, human capital and institutions on trade flows.

1.5 Does TRCB Matter in Determining Trade Flows?

Given the limited availability of donor funds, TRCB resources should be prioritized in such a way as to produce greatest benefit. This section aims to shed light on the relative importance of TRCB in the determination of bilateral trade flows. To examine more rigorously the extent to which trade-related capacity building indicators impact on bilateral trade flows, a gravity equation for bilateral trade was estimated using trade patterns in 2005. The data were obtained from the World Bank's Doing Business Report, World Economic Forum's Competitiveness survey (2005, 2006). The decision to make use of cross-sectional data was based partly on the fact that the main variables of interest do not vary greatly on a year-to-year basis. Therefore cross sectional variations among countries in these variables among countries should account for any differences they generate in bilateral trade flows. We use the following standard gravity model in our estimation, the variables are described in Table 9 in the Appendix:

Equation 1

$$\begin{aligned} \ln(T_{ij}) = & \alpha_0 + b_1 \ln(GDP_i) + b_2 \ln(GDP_j) + b_3 \ln(POP_i) + b_4 \ln(POP_j) + b_5 \ln(1 + TARIFF_i) \\ & + b_6 \ln(1 + TARIFF_j) + b_7 \ln(DIST_{ij}) + b_8 \ln(Human_i) + b_9 \ln(Infra_i) + b_{10} \ln(Inst_i) \\ & + b_{11} \ln(Human_j) + b_{12} \ln(Infra_j) + b_{13} \ln(Inst_j) + b_{14} LOCK_i + b_{15} BORD_{ij} \\ & + b_{16} Comlang_{-off}_{ij} + b_{17} Col_{ij} + b_{18} SSA + b_{19} RTA_{ij} + b_{20} BILATERAL_{ij} + b_{21} ST + \varepsilon_{ij} \end{aligned}$$

We extend the model to include trade related capacity building indicators, and tariffs. Following WMO (2005) we use the TRCB indicators to capture unobserved country specific effects for both exporters and importers. An extended gravity equation that excludes all TRCB variables was first estimated using Heckman's two-step selection model. Table 1 below presents the estimation results⁹. These jointly estimate a selection equation which determines the probability that two countries engage in trade (Probit equation). A regression model determines the bilateral trade flows. The selection equation uses the same explanatory variables as the regression equation, along with at least one identification variable. Following Helpman we use religion as the variable in question. To justify this choice, we estimate both the regression and probit equations separately using standard gravity variables and common religion. Our findings show that the religion variable is not a significant variable in the trade flow regression equation but positively and significantly determines the probability that two countries will engage in trade (*see results in Table 12 in the Appendix*). This forms the basis for omitting the common religion variable from the main regression equation, and for its use as a selection variable in the selection equation. The first column of results in Table 1 below presents the standard gravity equation augmented by a number of

⁹ The table only reports results for the regression equation. Selection results for specifications 1-4 are available on request.

dummies capturing membership in a common regional trade agreement, common official language, and existence of colonial ties, among others.

Table 1: Regressions Results

Dependant Variable: Log Export Value (\$US)

Variables	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Coef.	Std. Err	Coe f.	Std. Err	Coef.	Std. Err	Coef.	Std. Err	Coef.	Std. Err	Coef.	Std. Err
Logtariff_imp			-0.507***	0.054	-0.473***	0.055	-0.489***	0.054	-0.470***	0.053	-0.470***	0.053
Logtariff_exp			-0.583***	0.055	-0.503***	0.055	-0.514***	0.054	-0.502***	0.054	-0.505***	0.054
Loggdp_imp	0.962***	0.020	0.842***	0.023	0.704***	0.027	0.750***	0.034	0.610***	0.029	0.664***	0.034
Loggdp_exp	1.304***	0.020	1.168***	0.023	0.934***	0.027	0.689***	0.033	0.689***	0.029	0.581***	0.033
Logpop_imp	0.039*	0.020	0.180***	0.024	0.292***	0.029	0.252***	0.031	0.337***	0.028	0.299***	0.031
Logpop_exp	0.003	0.019	0.163***	0.024	0.355***	0.029	0.525***	0.031	0.492***	0.028	0.573***	0.032
logdist	-1.094***	0.036	-1.128***	0.036	-1.151***	0.036	-1.155**	0.035	-1.158**	0.035	-1.162**	0.035
Loginst_imp					0.812***	0.141					0.088	0.175
Loginst_exp					1.642***	0.156					-0.524***	0.187
Loghuman_imp							0.661***	0.152			-0.518***	0.201
Loghuman_exp							2.772***	0.156			1.439***	0.196
Loginfra_imp									1.675***	0.158	1.956***	0.204
Loginfra_exp									3.395***	0.167	2.864***	0.213
dcomlang_off			0.870***	0.075	0.741***	0.073	0.882***	0.074	0.814***	0.073	0.845***	0.071
dssa	-0.514***		-0.412***	0.060	-0.540***	0.062	-0.318***	0.059	-0.367***	0.058	-0.323***	0.063
dlocked	-0.065	0.063	-0.054	0.062	-0.0224	0.061	-0.067	0.061	-0.035	0.060	-0.006	0.059
dcolony	0.469***	0.162	0.522***	0.162	0.574***	0.161	0.515***	0.159	0.607***	0.158	0.589***	0.157
dborder	0.825***	0.153	0.816***	0.152	0.859***	0.151	0.820***	0.149	0.850***	0.148	0.841***	0.147
dac	1.043**	0.508	1.270**	0.505	1.675**	0.505	1.392**	0.497	1.724**	0.494	1.661**	0.493
dgafta	0.580	0.504	1.198**	0.503	1.220**	0.502	1.120**	0.495	0.707**	0.492	0.710	0.490
dasean	2.540***	0.358	2.045***	0.358	1.770***	0.357	1.693***	0.353	1.675***	0.350	1.644***	0.349
dcacam	2.467***	0.538	1.924***	0.536	1.919***	0.535	1.967***	0.528	2.236***	0.524	2.223***	0.522
dcaricom	5.428***	0.915	5.610***	0.910	5.486***	0.907	5.486***	0.907	6.060***	0.890	6.222***	0.886
dcefta	0.978***	0.232	0.620***	0.232	0.727***	0.232	0.878***	0.230	-0.849***	0.228	0.891***	0.227
decowas	1.193***	0.415	1.125***	0.412	0.833***	0.410	0.978**	0.405	0.951**	0.401	0.971**	0.401
dcomesa	1.208***	0.229	1.016***	0.228	0.763***	0.226	1.095***	0.225	0.902***	0.222	0.974***	0.222
dmercotur	1.469**	0.655	1.710**	0.652	2.001**	0.651	1.574**	0.642	1.929**	0.637	1.822**	0.635
dcis	2.767***	0.326	2.338***	0.326	2.243***	0.324	2.176***	0.320	2.110***	0.318	2.094***	0.316
dsacu	1.055	0.798	1.103	0.793	1.258	0.789	1.50*	0.780	1.50*	0.749	0.773	0.771
dbilateral	0.222**	0.091	0.375**	0.091	0.316**	0.091	0.283**	0.090	0.224**	0.089	0.219**	0.089
Mills lambda	0.071	0.217	-0.408*	0.218	-0.681***	0.204	-0.405*	0.215	-0.620*	0.209	-0.548***	0.197
Number of obs	12621		12621				12621	12621	12621		12621	
Censored obs	1726		1726		1726	1726	1726	1726	1726		1726	

Notes:

*, ** and *** denote significance at the 10, 5 and 1 percent level, respectively; inside the parenthesis is z value

Insignificant regional trade agreements have not been reported in the table of results as well as the constant for space reasons.

Model 1 estimates the gravity equation without all TRCB variables and tariffs. Then in model 2 importer's and exporter's simple average tariff rates are added in the equation. Models 3, 4 and 5 estimate TRCB variables individually while in model 6 we enter the different categories of TRCB simultaneously. Results show that an increase in tariffs (for either the importing or exporting country) has a negative effect on exports, in conformity to theoretical expectations. The finding on tariffs is robust to changes in model specification. Also, in line with other gravity model studies of bilateral trade we find that increases in GDP of the importer or the exporter positively and significantly affect trade: a 1% increase in exporter GDP raises bilateral trade on average by about 1.3%, while raising the GDP of the importing country by 1 per cent increases trade volume (less than proportionately) by about 0.99 per cent. We note that before tariffs are included importers have approximately unity elasticity, which is reduced by inclusion of tariffs. Inclusion of tariff variables improves the explanatory power of population variables (both importer and exporter's) which is now significant at 1 percent level of significance. The impact of the border dummy is also slightly improved when tariffs are included in the regression equation. This is probably pointing to the border variable capturing the trade opportunities available to bordering countries, which are better accounted for by trade policy (tariffs). While most papers do not include tariffs in their analysis, our results show that omission of tariffs may result in omitted variable biases. The sample of countries used in the data does not represent a free trading block, so its members do not have harmonized tariff policies. Therefore omission of tariffs would result in an upward bias of the coefficients of GDP. Of interest to our hypothesis testing is the coefficient on the SSA dummy which is estimated to be negative and significant at 1% percent level. The implication of the results is that SSA countries' trade with the rest of the world is approximately 34%¹⁰ less than other countries as a function of their 'being African'.

Model 6 shows results in which all the three TRCB variables have been included. The full two-step selection results of the model are presented in Table 16 in the Appendix. The results show that the same variables explain both the trade volumes and the probability that country i exports to country j. In almost all cases the impact goes in the same direction with the exception of the effect of tariffs, population and common border. Both importers' and exporters' tariffs reduce the volume of trade but increase the probability of trading. A common border raises trade volumes but reduces the probability of trading. Helpman (2006) attributes this counterintuitive finding to the effects of territorial border conflicts. Both exporter and importer GDP still yield strong results with very high significance levels. However, inclusion of TRCB variables in the gravity model reduces the impact of exporter GDP by 50%. The elasticity drops from 1.2% to 0.6%. A main insight from these results is that once all the three TRCB indicators are controlled there is considerable variation in the marginal impact of TRCB variables. This is what we expected, and is crucial for policy analysis and simulations. The results also show a higher magnitude for

¹⁰ $=(EXP(-0.412)-1)*100$

the exporters' TRCB indices, indicating the importance of country's own trade related capacity building in improving export performance.

1.5.1 ROLE OF INSTITUTIONS

We estimate a third specification (model 3) in which the standard gravity model controls for institutions only. In this estimation coefficients on institutions are intuitively signed and significant. A 10% improvement in the quality of institutions will see exporters increasing trade by about 16%, while importers will increase by 8%. Quite surprising, though, is the increase in the point estimate of the SSA dummy. Once we control for human capital and infrastructure, the institution coefficient on the exporters' institutions is counterintuitive as it becomes negative and significant, while the coefficient on the importers' institutions is positive and insignificant. This finding on institutions is quite surprising; we expected the institution coefficient to be high with very high significance levels, in light of the recent emphasis in theoretical development literature and in policy studies. According to Easterly (2001), repeated failures of development approaches derived from neoclassical theory recurrently result from ineffective institutions of any country, but different countries exhibit highly variable, particular and sui generis forms of such ineffectiveness. This could be the reason why our institutions variable, which is a composite index of various different sub-indicators, is not behaving as expected.

It must be noted that, compared to literature on institutions and growth there is little research so far on the impact of institutions on trade, hence the scarcity of theoretical arguments linking institutions and trade. However, economic development practitioners have argued that it is institutions in trading partners that matter in determining bilateral trade flows, with similarity of institutions predicting larger flows. The rationale is that institutional similarity both reflects and promotes familiarity of cultural norms and business practices. Linder (1961) was the first to introduce similarity between countries as a booster of trade, though his explanation was based on demand. More recently the argument is that similarity among rich countries goes beyond demand but also entails similarity of institutions. Henri L.F.M de Groot et.al (*unpublished*) using 1998 data of OECD countries attributes the disproportionate trade among OECD members to similarity and high quality of institutions. Our presumption is that countries with similar institutions will trade more as institutional homogeneity will reduce transaction costs between them. We therefore extend the gravity equation with a variable to reflect the effect of institutional homogeneity. To get this variable to reflect institutional similarity we take deviations between exporters and importers indices of institutional quality then take logs of this difference. The smaller the deviation the more homogenous is the quality of institutions between the two trading partners. Once similarity of institutional quality is controlled for, we observe that institutions become intuitively signed and very significant (*Results are reported in Table 14 in the Annex*). The results show a negative and very significant relationship between bilateral flows and differences in institutional quality. According to the results a 10%

increase in the gap in institutional quality between trading partners will depress bilateral trade flows between them by about 1.1%.¹¹ Controlling for institutional homogeneity in model 3 (where only institutions are controlled for) also results in a lower point estimate¹² of the SSA dummy, implying that SSA will trade more with the rest of the world if differences in institutions are reduced.

To explore in detail the institutional impact on bilateral trade flows we estimate our regression model using individual components of the institution index. The results are summarized in Table 13 in the Appendix and they reveal different institutional capacity building needs between importing and exporting countries. However, not all of the individual components are significant and have the expected signs. We therefore focus on those components that are intuitive. According to the results, for exporting countries to boost bilateral trade flows they require the presence of demanding regulatory standards and university/industry research collaboration. Results show that a 10% improvement in standards on products and services by exporters will boost bilateral trade flows by approximately 17%; while similar improvement in the collaboration in research between industry and local universities – or whatever basket of institutional changes this proxies – will result in about a 4% increase bilateral trade flows. Findings on the importance of standards to exporters is in line with current world developments, in which technical regulations and standards issues are increasingly becoming vital following the continued decline in tariff barriers. It is increasingly difficult for companies to sell in foreign markets when national and international standards are very divergent. This has prompted many countries to adopt policies aimed at enhancing international harmonization.

There is a potential problem of endogeneity as trade leads to convergence of institutions. Countries may have high quality institutions because they trade more rather than the other way round. Some authors have argued that competition through foreign trade cleans up institutional deficits (Ades and Di Tella (1999), Anderson (2003), Acemoglu, Johnson and Robinson (2005)). In the absence of an appropriate instrumental variable it might be difficult to measure the trade impact of institutions. This could be one of the factors explaining the poor performance of institution variable.

1.5.2 ROLE OF HUMAN CAPITAL

Model 4 controls for human capital only and results reveal that quality of human capital variable has different impacts on importers and exporters, and is also less significant to importers than to exporters. A 1% improvement in the quality of human capital is estimated to boost exporters' trade flows by approximately 2.8%. When other TRCB indicators are controlled for importers' human capital quality has

¹¹ Henri L.F. de Groot et.al (2004) reports a similar finding.

¹² -0.35 compared to -0.54 when only the quality of institutions is controlled for.

a negative and significant effect on bilateral trade: a 1 percent improvement in the quality of human capital in an importing country will result in approximately 0.5 percent decrease in its imports. We expect this to be the case, assuming that as countries develop their human capital more they can produce more (especially intermediate inputs); the increase in the range of consumption and investment goods produced domestically will translate to less imports. This assumption is based on the empirically documented understanding that in the early stages of development which are also associated with low quality of human capital, economies rely more on imports especially for manufactured intermediate goods. We therefore expect the effect to be greater for imported manufactured intermediate goods than for primary goods. This hypothesis can be tested by estimating the differential impact of human capital on different classes of exports, i.e. primary and manufactured exports. Our estimation using manufactured exports supports this speculation, and shows that a 1% improvement in the quality of human capital will now result in a greater and more significant decrease in the imports of manufactured goods (1.2%, more than double the 0.5% decline in the total exports equation). The differential impact of human capital on imports of primary goods becomes very small (0.01%) and insignificant when we use primary exports in our estimation. On the other hand, quality of exporters' human capital enhances bilateral trade – a 1 percent improvement in human capital quality will boost exports by about 1.4%. We expected this kind of relationship given that as human capacities increase economies are better placed to produce more and hence export more. Empirically it has been shown that economic activity is positively related to exports. Compared to results for model 3 (with institutions only), model 5 (with infrastructure only) and model 6 (with all TRCB indicators), controlling for human capital only results in the lowest point estimate on the coefficient on SSA dummy (-0.318). It may be inferred from this finding that improvement in the quality of human capital seems to be the most important aspect of TRCB for SSA countries.

1.5.3 ROLE OF INFRASTRUCTURE

Models 5 and 6 show estimation results which control for infrastructure separately and with other TRCB indicators respectively. The infrastructure measure retains its significance when other TRCB variables are controlled for. In both specifications results confirm the importance of the quality of infrastructure in determining bilateral trade flows. In terms of coefficient values, infrastructure is the most important of all the TRCB indicators, with exporters' infrastructure being the most significant with an elasticity of approximately 3.0 (implying an increase of 3% in bilateral trade flows for each 1% improvement in the quality of exporters' infrastructure). Estimated coefficient of the SSA dummy is reduced to -0.37 (approximately 31% less trade flows) when only infrastructure is controlled for; from -0.41 (34% less trade flows) when all TRCB indicators are not included in the estimation. This result suggests that some aspect of SSA's marginalization in the global economy is due to its quality of infrastructure, which is below the world's average quality.

1.5.4 ROLE OF OTHER VARIABLES

Other gravity variables (such as presence of colonial ties, bilateral trade agreement, and common border) in the equation are significant with expected signs. Distance exerts the greatest depressing effect on bilateral trade. The negative impact of distance on bilateral trade is intuitive and has been confirmed by many other studies. It is widely argued that as distance between two trading countries increases transportation and communication costs increase, negatively affecting the magnitude of bilateral trade. The coefficient on distance is quite robust and unaffected by inclusion of other variables in the gravity equation, confirming the importance of trade costs in determining bilateral trade flows¹³.

Our analysis also takes into account regional effects by controlling for various regional trade agreements (*see Table in the Appendix for membership of these RTAs*). The objective here is to measure trade patterns within regional groupings which are not captured by gravity variables. Estimation results show that most of them are positive and statistically significant. Also included in the estimation is a dummy variable capturing the existence of any bilateral trade agreement. Our results suggest trade promoting effects of such agreements, as expected. However, quite puzzling is the negative and insignificant impact of EU and NAFTA membership, which seems to suggest that membership in these regional groupings depress trade. However, exploring this a little bit further, results show that in the first two specifications without both tariffs and TRCB variables joint EU membership raises bilateral trade flows.. After controlling for institutions, infrastructure, human capital and tariffs, EU countries in particular will have lower trade than expected. de Groot et.al (2003) found a similar result on joint OECD membership once institutions were controlled for and he concluded that rich countries trade more due to their effective institutions. However, given the multifarious membership of the EU de Groot et. al's finding does not seem to be main factor behind this relationship, hence the absence of tariffs is a plausible explanation.

Despite issues of occasionally insignificant results and sometimes counterintuitive coefficients, overall, the empirical estimates show that TRCB does matter in the determination of bilateral trade flows; and human capital has the greatest impact on SSA countries.

1.5.5 COMPARISON WITH EXISTING LITERATURE

We compare our results with findings from earlier literature that looked at the similar issues. Table 2 highlights some of the major findings. It is important to note that TRCB variables have been measured differently by different authors, with some restricting infrastructure to just port/roads while other papers used an aggregated index for these variables with varying individual indicators. This makes comparison

¹³ Distance serves as a proxy for the size of transportation costs and also reflects other distances related trade costs.

across different studies difficult. However looking at the main gravity variables (GDP for exporter and importer, distance, adjacency and tariffs) the results of this paper are within the range of previous studies. The conventional gravity model suggests that GDP and adjacency boost trade while tariffs and distance depress exports. Even though different data sets were used in the results indicated in Table 2, qualitative coefficients of the main variables match, though there are slight variations in the magnitudes which might be attributed to biases caused by omitted variables.

Quite noticeable from earlier literature is the absence of empirical analysis of the impact of human capital on bilateral trade flows. Existing literature either focus on institutions or infrastructure or the combination of the two. This represents one of this paper's contributions to the ongoing debate on trade-related capacity building. Regardless of the methodology used to measure institutions/infrastructure indicators and varying sizes of the estimated coefficients in existing empirical literature, the direction of impact and significance level demonstrates the importance of infrastructure and institutions in promoting trade flows.

Table 2: Comparison with Existing Research

Dependant Variable: Log Export Value (\$US)

Explanatory Variable	Thesis ¹	Thesis ²	Wilson et.al (2005) ³	Nordas & Piermartini (2004) ⁴	Jansen & Nordas (2004) ⁵	Henri de Groot et. Al (2004) ⁶
Log Exporter GDP	0.583*** (17.72)	0.639*** (19.07)	1.246***	1.12***	1.12*** (97.5)	1.19***
Log Importer GDP	0.677*** (20.43)	0.646*** (19.11)	0.915***	0.94***	0.96*** (90.9)	0.86***
Log Exporter Pop.	0.582*** (18.46)	0.575*** (17.56)				
Log Importer Pop.	0.298*** (9.64)	0.351*** (10.96)				
Log Exporter Tariff	-0.485*** (-9.03)	-0.516*** (-9.48)	-0.749***		-1.4*** (-3.69)	
Log Importer Tariff	-0.456 (-8.06)	-0.527*** (-9.75)		-0.74***		
Log Distance	-1.177*** (-35.25)	-1.164*** (-34.47)	-1.258***	-1.22***	-1.18*** (42.3)	-1.18***
Log Border	0.839*** (5.73)	0.866*** (5.84)	0.336***	0.66***	0.81*** (5.31)	0.66***
Log Exporter Infrastructure	2.971*** (14.05)	0.275*** (3.75)	0.924***	-0.63***	-0.67*** (-9.52)	
Log Importer Infrastructure	2.015*** (10.04)	0.660*** (9.47)	0.307***	-0.46***	-0.35*** (-3.78)	
Log Exporter Institutions	-0.492** (-2.73)	0.338 (1.96)	0.620***		0.01 (0.15)	0.43***
Log Importer Institutions	0.141 (0.81)	0.415*** (2.46)	0.281*		0.07 (0.88)	0.31***
Log Exporter Human Capital	-0.566*** (-2.87)	2.471*** (13.79)				
Log Importer Human Capital	1.448*** (7.52)	0.144 (0.79)				
Number of observations	13074	13074	7904	11901	10458	8715

*, **and *** denote significance at the 10, 5 and 1 percent level, respectively; inside the parenthesis is z value

1. Results for this thesis using composite index for TRCB variables
2. Results for this thesis using ports as proxy for infrastructure
3. Port efficiency and regulatory environment are used as proxies for infrastructure and institutions respectively.
4. Infrastructure variable is a composite index of roads, ports, air and telecommunication
5. Rule of law is used as a proxy of institutions and infrastructure is an aggregated index including quality of roads, ports, airports, railways and telecommunications
6. The paper looks at the institutional determinants of Bilateral Trade Patterns; and the composite indicator of institutions comprises of; voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption.

1.6 Do interactions and/or complementarities between TRCB variables matter?

We extend the gravity estimation to test for interaction effects of TRCB policy mixes. The objective of such analysis is to test whether the effectiveness of a particular TRCB initiative is affected by interaction with other TRCB initiatives. We investigate the complementarities between TRCB policies on bilateral trade flows by introducing cross-products between TRCB variables (Institutions*Human Capital, Institutions*Infrastructure, Human*Infrastructure and Institutions*Human*Infrastructure), in our

specification. Table 3 below highlights the coefficients of the TRCB variables and associated SSA, inter-SAA and intra-SSA impacts.

Table 3: Marginal Benefits of Complementary TRCB policies

Policy Mix	Coef.	SSA	Inter_SSA	Intra_SSA
Institutions & Human_exporters	0.388***	-0.375***	-0.377***	-0.430***
Institutions & Human_importers	-0.167			
Institutions & Infrastructure_exporters	0.968***	-0.459***	-0.461***	-0.589***
Institutions & Infrastructure_importers	0.919***			
Human & Infrastructure_exporters	2.13***	-0.29***	-0.289***	-0.309***
Human & Infrastructure_importers	0.709***			
Institutions, Human & Infrastructure_exporters	1.192***	-0.440***	-0.441***	-0.571***
Institutions, Human & Infrastructure_importers	0.474***			

Note: *, **, *** Significant at 10%, 5% and 1% level of significance respectively.

All the complementary variables are statistically and significantly associated with increased bilateral trade flows, and the magnitudes of these impacts are substantial, thus lending support to the hypothesis that complementarities between TRCB policies matter. Quite noticeable in the results is the significantly smaller values for importers' variables compared to exporters', thus further confirming the importance of own country's reforms in promoting trade flows. For exporters complementing human capital and infrastructure yields greatest benefit while for importers it is the complementarity between institutions and infrastructure that matters most. Our finding also suggests that complementing improvements in the quality of human capital and infrastructure will provide the greatest bilateral trade flow benefit to Sub-Saharan Africa; this holds for both inter-SAA and intra-SSA bilateral trade flows.

We also examine the bilateral trade impact of complementing trade capacity building initiatives between trading partners. The argument is that improvements in the quality of infrastructure or institutions may have zero effect if a binding constraint is with the trading partners' infrastructure or institutions. Although the impact of institutions and infrastructure on bilateral trade flows has been addressed in a number of papers, the issue of interactions between home and foreign measures of these variables has to our knowledge not been addressed¹⁴. This possibility is captured in the interaction terms (cross-products between trading partners) between home and foreign measures of quality of infrastructure, institutions and human capital (*see results for this estimation in Appendix, Table 14*). The results show that a joint improvement of home and foreign infrastructure and human capital will boost bilateral trade flows between trading partners; whereas if only the quality of institutions is enhanced in both trading countries the impact is not significant. If the quality of infrastructure is improved by 10% in both trading partners bilateral trade flows between them will increase by about 24%, while similar improvement in human capital quality will result in 5% increase. These findings lend support to regional development initiatives

¹⁴ Wilson et. al

as results show that a joint improvement of home and foreign infrastructure and human capital will boost bilateral trade flows between trading partners.

1.7 Is Africa Different from the Rest of the World?

Of particular interest to this study is the Sub-Saharan Africa region which has been portrayed in development literature to be different from other regions. Sub-Saharan Africa has been shown to lag behind other regions in terms of the institutional environment, human capacity development and provision of infrastructural services, with Collier and Gunning (1997) characterizing Africa as high cost and high risk. To incorporate this view, we estimate various specifications as outlined below that focus on SSA.

Results based on model 2, which omits all the three TRCB variables, show the coefficient on SSA dummy¹⁵ to be negative and significant. This finding provides evidence that the gravity model cannot fully account for Africa's bilateral trade flows. Our estimation results show that being in the SSA region leads to approximately 34% lower bilateral trade flows¹⁶. This finding regarding SSA is in line with the view that Africa¹⁷ has not yet been able to integrate successfully into global markets. Africa's marginalization in the global economy is an issue which has recently attracted interest in literature. This proposition is based on the fact that Africa's share of world exports declined from about 4.1 percent in 1980 to about 1.6% in 2000 at the same time that its share of world imports declined from 3.2 percent to 1.3 percent (IMF's *World Economic Outlook*). A range of explanations for Africa's marginalization have been brought forward, with some arguing that Africa's limited institutional, human resource and infrastructure capacities are the reason for this marginalization. To make sure that the SSA dummy is not picking up the effects of poor institutions, human capital and infrastructure services in our estimation we therefore control for these variables. Even after controlling for poor institutions, human capital and infrastructure services, the SSA dummy is still negative and significant but the magnitude of the coefficient drops by about 22% (from -0.412 to -0.323). This implies an improvement in SSA bilateral trade flows with the rest of the world; since by controlling for TRCB variables SSA trades 28% less with the world compared to 34% when these variables are not controlled. Obviously, without controlling for these influences the SSA dummy parameter may erroneously account for a weighted average of influences which are due to poor quality of institutions, infrastructure and human capital.

We further analyze the trade dynamics in SSA by disaggregating it into intra-SSA (Sub-Sahara African nations trading with each other) and inter-SSA (Sub-Sahara African nations trading outside the SSA region). Our results indicate that although both inter-SSA and intra-SSA coefficients are still negative and

¹⁵ This dummy takes the value of 1 if SSA nation is either exporter or importer to/from non SSA countries, and zero otherwise

¹⁶ $(\text{Exp}(-0.41)-1)*100$

¹⁷ In this thesis, Africa refers to Sub-Sahara Africa excluding South Africa

significant both before and after controlling for institutions, human resource and infrastructure services their magnitudes dropped significantly. Inter-SSA bilateral trade flows will improve by about 21% once institutions, human capital and infrastructure services are controlled for all together; while intra-SSA bilateral trade flows will improve by approximately 40%. The inter-SSA coefficient drops from -0.412 to -0.326 while the intra-SSA one drops from -0.567 to -0.341. These findings suggest that once the quality of institutions, infrastructure and human capital are controlled for, bilateral trade within SSA will improve drastically as less transactional costs will be involved.

We also control for TRCB variables separately in our estimation. This is more illuminating as it highlights how much of the improvement in trade flows is due to institutions, human capital or infrastructure alone. Table 4 below shows the marginal benefits of separate TRCB components on inter-SSA and intra-SSA bilateral trade flows.

Table 4: Marginal Benefits of TRCB on Inter & Intra SSA Bilateral Trade Effects¹

	Without all TRCB variables	Human Capital Only	Infrastructure Only	Institutions only	With all TRCB variables
Inter_SSA	-0.412***	-0.320***	-0.368***	-0.541***	-0.326***
Intra_SSA	-0.567***	-0.415*	-0.410**	-0.751***	-0.341**

¹The results are based on the estimation of the gravity model when SSA trade is separated to inter and intra SSA, and TRCB variables are controlled for both separately and simultaneously.

*, ** and *** denote significance at the 10, 5 and 1 percent level, respectively; inside the parenthesis is z value

Of the three variables human capital enhances inter-SSA trade the most, while the greatest benefit of intra-SSA trade is attained when all three variables are controlled for. This finding supports the argument that lack of trade within SSA countries is attributed to poor quality of human capital, institutions and infrastructure services, as often proposed in the literature, whereas trade outside SSA will be greatly improved if human capital alone is accounted for. The result is consistent with our earlier discussion, which suggested that on average SSA countries lag behind mainly in the quality of human capital. This variable shows the greatest negative difference, of approximately 40% and 35%, from the non-SSA and sample countries' average standards. Our results support the idea that gaining access to foreign markets requires technical know-how necessary to understand the intricacies of developed countries and to negotiate favourable trading terms.

Finally, to test whether TRCB variables have different trade effects in SSA we extend our analysis by estimating our model using a sub-set of our data –estimation restricted to only SSA countries as exporters. This final stage allows us to examine whether different TRCB measures affect trade flows

differently in SSA. The results are presented in Table ? in the Appendix. The comparison with the fuller sample results shows an increase in parameter estimates of TRCB variables, with infrastructure indicators almost doubled. This further supports the already indicated importance of infrastructural development. The standard gravity equation, by estimating an average elasticity for all countries, underestimates the importance of TRCB in SSA. Our dataset reveals that SSA lags behind world average in all TRCB categories, implying that an improvement in these areas is likely to result in greater impact compared to other countries that have already attained higher levels of development in institutions, infrastructure and human capital. However, the direction of impact remains the same, with the sign on exporters' institutions remaining counterintuitive; prompting us to conclude that in SSA trade effects of institutions, human capital and infrastructure are qualitatively the same as in other regions of the world. However, quite noticeable is the insignificance of exporters' tariffs and reduced effect of exporter's GDP, implying that tariffs are not a major impediment to trade flows from SSA and also that trade in SSA is aided more by TRCB than by improvements in GDP.

1.8 Testing the Consistency of the Results

For a consistency check of the results we compare our sample selection results to other approaches often used in literature to deal with zero trade flows, country fixed effects and remoteness issues. According to Anderson and van Wincoop (2003) the standard gravity model may suffer from inconsistency due to the correlation between included variables and omitted fixed effects. We therefore first consider this theoretical argument and explore our analysis in a fixed effect model. We follow two approaches: first a method introduced by Nordas and Piermartini (2004) which requires us to develop bilateral variables for institutions, human capital and infrastructure; and second an approach due to WMO (2005) which makes use of partner fixed effects (with importers' / exporters' trade facilitation variables replaced with importers' / exporters' fixed effects respectively). Following Nordas and Piermartini (2004) we develop two bilateral variables. The first takes the average of quality of institutions, human capital or infrastructure between two trading partners, and the second looks at the minimum value of institutions, human capital or infrastructure between the country pairs. The conceptual idea behind using the minimum instead of the maximum value is that for trade to flow there is a certain level of institutions, human capital or infrastructure that is required.

Table 5: Consistency Analysis

Variables						Fixed Effects Models				
	Standard equation	Using Residuals	OLS-Non-zero sample	Tobit-censored \$1	Remoteness at term	Importer Effects	Fixed Effects	Exporter Effects	Fixed Effects	TRCB Averages
logtrade										
Logtariff_imp	-0.470***	-0.470 (-8.79)	-0.455*** (-8.75)	-0.158 (-1.56)	-0.42*** (-7.89)	-0.744*** (-5.99)		-0.525*** (-10.69)		-0.73*** (5.63)
Logtariff_exp	-0.505***	-0.504 (-9.34)	-0.457*** (-8.74)	-0.02 (-0.20)	-0.45*** (-8.35)	-0.526*** (-9.90)		-2.712*** (-13.95)		-2.70*** (-9.15)
Loggdp_imp	0.664***	0.877 (41.34)	0.698*** (21.85)	0.996*** (16.66)	0.69*** (20.48)	0.787*** (8.55)		0.678** (21.51)		1.39*** (6.87)
Loggdp_exp	0.581***	1.212 (55.50)	0.60 (18.47)	0.775*** (12.81)	0.60*** (17.99)	0.539*** (16.33)		1.075*** (15.97)		1.47*** (12.13)
Logpop_imp	0.299***	0.154 (6.52)	0.287 (9.38)	0.299*** (5.18)	0.27*** (8.59)	0.236** (2.48)		0.310*** (10.73)		-0.36* (-1.91)
Logpop_exp	0.573***	0.129 (5.47)	0.581 (18.32)	0.674*** (11.62)	0.55*** (17.30)	0.589*** (18.95)		1.135*** (10.56)		0.69*** (5.35)
logdist	-1.162**	-1.162 (-33.37)	-1.187 (-36.75)	-1.652*** (-25.90)	-1.23*** (-39.20)	-1.146*** (-30.40)		-1.362*** (-38.65)		-1.43*** (-35.59)
Loginst_imp	0.088	0.090 (0.52)	0.194 (1.17)	2.110*** (6.54)	0.16 (0.93)			-0.032 (-0.21)		-10.49*** (-6.15)
Loginst_exp	-0.524***	-0.521 (-2.79)	-0.404 (-2.29)	2.180*** (6.43)	-0.43*** (-2.28)	-0.385** (-2.06)				
Loghuman_imp	-0.518***	-0.521** (-2.59)	-0.509 (-2.61)	-2.066*** (-5.57)	-0.56*** (-2.78)			-0.342* (-1.84)		1.10*** (0.77)
Loghuman_exp	1.439***	1.437*** (7.35)	1.513 (7.97)	0.20 (0.55)	1.41*** (7.27)	1.362*** (7.06)				
Loginfra_imp	1.956***	1.96*** (9.63)	1.916 (9.67)	2.718*** (7.12)	2.08*** (10.26)			2.012*** (10.77)		4.96*** (2.46)
Loginfra_exp	2.864***	2.868*** (13.48)	2.907 (14.10)	3.782*** (9.58)	2.99*** (14.05)	2.701*** (12.90)				
dcomlang_off	0.845***	0.848*** (11.90)	0.920 (13.70)	1.929*** (14.60)	0.77*** (10.72)	0.721*** (9.57)		0.853*** (12.03)		0.66*** (8.69)
dssa	-0.323***	-0.325*** (-5.19)	-0.33 (-5.83)	-1.428*** (13.22)	-0.44*** (-6.80)	-0.497*** (-6.37)		0.083 (-1.15)		-0.12 (-0.68)
dcolony	0.589***	0.588*** (3.75)	0.536 (3.47)	0.057 (0.18)	0.64*** (4.11)	0.474*** (2.97)		0.786*** (5.17)		0.68*** (4.48)
dborder	0.841***	0.840*** (5.70)	0.777 (5.34)	0.615*** (2.15)	0.79*** (5.37)	0.939*** (6.39)		0.574*** (4.20)		0.58*** (4.25)
dbilateral	0.219***	0.219*** (2.47)	0.235 (2.69)	0.224 (1.26)	0.22** (2.54)	0.191** (2.09)		0.178** (2.09)		0.11 (1.25)
Lnlat_exp					-0.16*** (-6.39)					
Lnlat_imp					-0.16*** (-6.42)					
Mills lambda	-0.548***	-0.187 (-1.13)			-0.38 (-1.93)					-1.20*** (-5.47)
Number of obs.	12621	12621	11405	13570		12621		12621		12621

Censored obs	1726	-	-	2166	1726	1726
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*, **, and *** significant at 10%, 5% and 1% respectively.

Constant, regional trade agreements and exporter and importer fixed effects are not reported in order to save space but full results are available on request.

We estimate 7 different specifications to incorporate these issues and the results are reported in Table 5. Results for the fixed effects model are presented in the last three columns of Table 5. On comparison, the standard gravity model underestimates the importance of tariffs, GDP and distance, which are estimated to have a larger effect in the fixed effects model that uses bilateral TRCB variables. The impact of bilateral trade agreement is also exaggerated; which it estimates to result in 24% more trade compared to 12% in the fixed effects model¹⁸.

Replacing importers' trade facilitation variables with importers' fixed effects as in WMO (2005) yields estimated coefficients of TRCB variables which are quite similar to our standard gravity equation estimates. The distance estimate and elasticities are also virtually the same.

Next we follow literature that has used latitude to capture remoteness and estimate our gravity equation including a remoteness term. The results appear in column 6 of Table 5. The estimated coefficients for tariffs, GDP, TRCB and distance do not differ much from those presented earlier. Despite the quantitative changes in some estimates the qualitative effects do not change in comparison to the standard gravity equation (without both country-fixed effects and remoteness term) as represented in equation 1 with results in column 2. Institutions continue to be a problem with the coefficient for importers' institutions being insignificant while the exporters' institutions coefficient takes a wrong sign (and is significant). In terms of coefficient values, quality of infrastructure continues to exert the greatest impact on bilateral trade. The estimated coefficients of latitude show that a 1 percent increase in the latitude will on average depress export performance by 0.16%

Now turning to the issue of zero trade flows, we first use the ordinary least squares estimation which we apply on the set of explanatory variables employed in the original selection model on a sample excluding the zero bilateral trade values. The results are not significantly different than those obtained from the previous specification. Just like in the selection model, all the other TRCB variables with the exception of institutions are in line with theoretical predictions. The institutions variables are still not behaving as expected, with both importers' and exporters' institutions coefficients being negative. As before, the variable measuring the quality of exporters' infrastructure is statistically the most significant among the TRCB variables. Like in the selection model, tariffs, country's income (as measured by GDP), country's size (population), presence of colonial ties and common official language, and existence of bilateral trade between two trading partners are significantly important in explaining bilateral trade flows. However, looking at the magnitudes of the coefficients shows that most of the OLS estimates are underestimated compared to sample selection estimates. This is in line with concern noted in the literature that if reduced trade is due to other factors, omission of zero flows from the analysis will result in an underestimation of the effects of these variables on trade. (Rauch, 1999, pp. 18-19 *cited in de Groot et al*).

¹⁸ The fomular is $100 * (e^{\beta} - 1)$

To further address the zero bilateral trade flows issue we use a Tobit estimation that imposes censoring on our trade data. All zero trade flows were substituted by 1, thus putting censoring limit to $\ln(1)=0$. It should be noted that there is no relationship between the imposed censoring limit and the zero trade flows other than that \$1 is the lowest trade flow recorded in our sample. The results are presented in column 5 of Table 5. The results show that, the magnitudes of the impact of the TRCB variables is significantly different from the magnitudes in the previously estimated specifications: most TRCB parameter estimates are generally overestimated compared to the Heckman selection model and OLS on non-zero sample. However, as in the previous two specifications, quality of exporters' infrastructure gives a strongest boost to bilateral trade flows.

A final test of consistency involved a fourth specification, tested using the Heckman selection model. The gravity equation is estimated using a different construction of the composite indices. In this specification we take into account differences in income levels and country sizes and regress the indices of TRCB on gross domestic product and population. The residuals from these estimations are then used as representative of deviations from income conditional expected values for each of the three TRCB indices. Adopting this methodology ensures that we are no longer comparing countries at different levels of development and secondly helps us correct for the likely multicollinearity problem because the proxies of TRCB are dependent on level of income. The impact of the explanatory variables was robust to the change in the constructions of the composite indices. Although the magnitudes of the coefficients are slightly less, the specification yields similar results to the original model. Again, quality of exporters' infrastructure gives a strongest boost to bilateral trade flows. The results are reported in column 4 of Table 8 in the Annex.

1.9 Benefits from Trade-Related Capacity Building: Policy Simulations

Making use of estimated results from the standard gravity equation, in this section we analyze different TRCB policy mixes and their likely benefits. We examine the impact through simulation of three main policy approaches: (1) committing resources to the improvement of all the TRCB variables simultaneously; (2) targeting one particular variable at a time while leaving the others at current levels; and (3) complementary policy initiatives.

1.9.1 BELOW AVERAGE TRADE-RELATED INSTITUTIONS, INFRASTRUCTURE AND HUMAN CAPACITY ARE UPGRADED HALFWAY TO THE WORLD AVERAGE

The first policy option that we consider is when trade-related infrastructure, institutions and human capital indicators in all SSA countries are simultaneously upgraded so that they come halfway to the world's average level (represented by sample average). While the best and ultimate scenario is to have all SSA countries' trade-related institutions, infrastructure and human capacity at the same level with the world's best, attainment of this high level in the immediate future is limited by resource constraints. Using estimated coefficients on cross-products of TRCB variables, our simulations show that bilateral trade flows from the SSA region are increased by US\$52.2 from the current level, while non-SSA countries' trade is boosted by US\$212.8 (. As noted before, the impact of TRCB initiatives on bilateral trade is not only due to reforms by the exporting country and its trading partners. Results, however show that own country's reforms are more important, resulting in greater benefits, than partner country's reforms,

1.9.2 TARGETED TRCB POLICY

Summary results of simulations targeting one particular variable at a time are presented in Table 6 below.

Table 6: Bringing Below Average Countries Halfway up to the World Average (In US \$ Billions)

		Exporters	Importers	Total [exporters+importers]
Human Capital	SSA	28.5	-6.8	21.7
	Other	109	-36	73
Infrastructure	SSA	38.0	17.3	55.3
	Other	84.1	58.3	142.4
Institutions	SSA	-4.36	1.0	-3.39
	Other	-58.8	25.9	-32.9
Improvement in all variables	SSA	62.11	11.5	73.61
	Other	134.3	48.2	182.5

To better tailor the simulation exercise to inform policy decisions on what kind of TRCB initiative might yield the greatest improvements in trade, in addition to improving all TRCB halfway to the world's average we examine the impact of improving one TRCB indicator at a time halfway to the world average (while holding other indicators constant, at their current levels) and compare the trade gains (as proxies for opportunity costs). Thus under this simulation we are assuming that all available TRCB resources are targeted at one

particular initiative at a time. The parameter estimates of our TRCB variables in the standard gravity model allows us to do this directly as they measure the percentage change of trade due to a particular TRCB variable change given that others are held constant. Estimating the impact of both domestic and trading partners' (exporters' and importers' respectively) capacity development efforts highlights that TRCB trade benefits are a combined effect of own and partners' export and import reforms. Our findings reveal that in the SSA region, improvement in human capital while leaving infrastructure and institutions at their current levels will cause a US\$21.7 billion (total of exporters' and importers benefits) increase in bilateral trade flows which is equivalent to approximately 13.4 per cent increase in total bilateral trade flows with the region. Improvement in human capital will enable importing SSA countries to reduce their imports by US\$6.8 billion, as the countries will be better placed to produce manufactured exports on their own¹⁹. A TRCB policy that targets only infrastructural development in SSA region will result in the highest bilateral trade boost, of approximately US\$55.3 billion, with exporters and importers contributing US\$38 billion and US\$17.3 billion respectively. This is slightly double the benefit from human capital.

According to our findings, focusing all attention on the improvement of institutions alone will not result in increased trade flows, either in the region or in other non-SSA countries. Moving resources from either improving human capital or infrastructure towards institutional development will be the worst TRCB policy to adopt. However, results on complimentary effects of TRCB initiatives on trade reveal positive gains in bilateral trade flows when institutions are improved in conjunction with the other factors. The next section discusses these issues in detail.

1.9.3 COMPLIMENTARY TRCB POLICY OPTION

Lastly we look at the policy options that emphasize the complementarities of TRCB initiatives. Under this simulation we are assuming that all the available TRCB resources are targeted to improving two or all of the TRCB indicators at a time, upgrading them halfway to the world's average level. The following combinations are considered: human capital and Institutions, human capital and infrastructure, and institutions and infrastructure. To compute the potential benefits we make use of the estimated results of the standard gravity equation extended by interaction variables of TRCB (cross-products of the variables), summary results found in Table 7 below.

¹⁹ Our estimation using manufactured exports supports this speculation; and shows that a 1% improvement in the quality of human capital result in a greater and more significant decrease in the imports of manufactured goods, than when we estimate using total exports or primary exports.

Table 7: Bilateral Trade Benefits from Complementary TRCB Policies in US\$ Billions

		Exporters	Importers	Total
Human Capital & Institutions	SSA	39.5	11.3	50.8
	Other	214	112	326
Infrastructure & Institutions	SSA	32.8	14.8	47.6
	Other	178	156	334
Human Capital & Infrastructure	SSA	63	15.6	78.6
	Other	180	61.9	241.9
Institutions, Human & Infrastructure	SSA	48.4	3.8	52.2
	Other	194	18.8	212.8

Complementing human capital and infrastructural development will result in the highest increase in SSA's exports and imports (US\$ 78.6 billion). While for non-SSA countries it is upgrading of human capital and institutions, and institutions and infrastructure that matters most for exporters and importers respectively.

1.10 CONCLUSIONS, IMPLICATIONS FOR POLICY OPTIONS AND FUTURE RESEARCH

The motivation for this research was the notion that development resources flowing to Africa are scarce, and therefore their allocation should be prioritized. This paper sheds light on the optimal balance of emphasis in TRCB policies as amongst infrastructural, institutional and human capital development. Using the opportunity costs estimated in the preceding section the analysis help interrogate the current focus of TRCB activities.

This study finds that tariffs are not a major impediment to trade flows from SSA and also that trade in SSA is aided more by TRCB than by improvements in GDP. Committing all TRCB resources towards one particular area at a time, SSA would benefit the most by improving its infrastructure followed by human capital development; contrary to emphasis given to institutions in theoretical development literature. Results show that if SSA improves its human capital halfway up to the world average its imports will decrease by approximately US\$ 6.8 billion. However, to get the greatest boost of SSA's bilateral trade flows complementary policy mix that targets improvement of human capital and infrastructure should be adopted. Our findings also reveal different TRCB needs between regions, with non-SSA countries gaining the most from complementing infrastructure and institutions. Infrastructure was noted to be persistently important to both SSA and non-SSA countries, implying the importance of having a minimum level of infrastructure for trade flow to occur. Emphasizing human capital development at the expense of improvement in infrastructure in SSA will not bring about the greatest benefit.

Our finding on institutions was not robust to changes in specifications leading us to conclude that, even though institutions matter they are usually country specific or even region specific in their effect on how the economy works. In particular, an institutional policy reform may have one consequence in one country and another effect (or no effect) in another. This implies that besides knowledge in economics policy makers should also have very good sense of a country's specific social infrastructure (institutions). Country specific studies would be more informative on which kind of institutions matter most. The process of coming up with a composite index on institutions (adopted in this paper), which has common policy applicability to all countries, might result in loss of some relevant information. According to Jansen and Nordas (2004), lack

of robustness of the institutions variable might indicate that institutions matter less to foreign trade than they do to direct foreign investment where more commitment and sunk costs are involved. Foreign markets can be serviced through exports and foreign direct investment (FDI); therefore to access economies with poor institutions investors rely more on exports than on FDI. This proposition supports the negative and significant relationship between exporters' institutions and bilateral trade flows revealed in our results. However, institutional homogeneity was shown to boost trade flows, in line with other findings.

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APPENDIX

Table 8 List of Countries in the Sample

Albania	Ghana	Norway
Algeria	Greece	Pakistan
Angola	Guatemala	Panama
Argentina	Guyana	Paraguay
Armenia	Honduras	Peru
Australia	Hong Kong SAR	Philippines
Austria	Hungary	Poland
Azerbaijan	Iceland	Portugal
Bangladesh	India	Romania
Belgium	Indonesia	Russian Federation
Benin	Ireland	Serbia and Montenegro
Bolivia	Israel	Singapore
Bosnia and Herzegovina	Italy	Slovak Republic
Botswana	Jamaica	Slovenia
Brazil	Japan	South Africa
Bulgaria	Jordan	Spain
Burkina Faso	Kazakhstan	Sri Lanka
Burundi	Kenya	Sweden
Cambodia	Korea, Rep.	Switzerland
Cameroon	Kuwait	Taiwan
Canada	Kyrgyz Republic	Tajikistan
Chad	Latvia	Tanzania
Chile	Lesotho	Thailand
China	Lithuania	Trinidad and Tobago
Colombia	Macedonia, FYR	Tunisia
Costa Rica	Madagascar	Turkey
Croatia	Malawi	Uganda
Czech Republic	Malaysia	Ukraine
Denmark	Mali	United Arab Emirates
Dominican Republic	Mauritania	United Kingdom
East Timor	Mauritius	United States
Ecuador	Mexico	Uruguay
Egypt	Moldova	Venezuela
El Salvador	Mongolia	Vietnam
Estonia	Morocco	Zambia
Ethiopia	Mozambique	Zimbabwe
Finland	Namibia	
France	Netherlands	
Gambia	New Zealand	
Georgia	Nicaragua	
Germany	Nigeria	

Table 9: Data Description

This paper makes use of the following variables in the gravity model. The data is organized such that unit of observation is a pair of importing and exporting countries.

Variable	Description	Data Source
Exports	The value of total exports from country J to I	Commodity and Trade Database(COMTRADE) of the United Nations Statistics Division for trade data
Gross Domestic Product (GDP)_Exp	Exporting country's GDP in current U.S. dollars	International Monetary Fund, World Economic Outlook Database, April 2007
Gross Domestic Product (GDP)_Imp	Importing country's GDP in current U.S. dollars	International Monetary Fund, World Economic Outlook Database, April 2007
Distance	Geographical distance between capital cities of country I and J	CEPII Distances Databases (dist_cepil)
Population	Total population of a country in millions	International Monetary Fund, World Economic Outlook Database, April 2007
Tariff	Is the weighted average tariff faced by exporter (where weights are given by the share of each trading partner in country j 's total exports) specific to the trading partners i and j and year t	Trade Analysis and Information System (TRAINS) database of the United Nations Conference on Trade and Development(UNCTAD)
Trade-related human capital ²⁰	Is a composite index based on the aggregation of a number of sub-indicators	World Development Indicators & World Economic Forum, Global Competitiveness Report,(GCR) ²¹
Trade-related infrastructure	Is a composite index based on the aggregation of a number of sub-indicators	World Economic Forum, Global Competitiveness Report,(GCR)
Trade-related institutions	Is a composite index based on the aggregation of a number of sub-indicators	World Economic Forum, Global Competitiveness Report,(GCR) & Doing Business Reports
Religion	This is the probability that two randomly drawn persons one from each country share the same religion	Central Intelligence Agency (CIA) The World Factbook
Regional Trade Agreement dummy	The dummy variable take the value of 1 if i and j belong to the same regional trade agreement and 0 otherwise	The World Trade Organisation (WTO)
Bilateral Trade Dummy	Takes a value of 1 if i and j have a bilateral trade agreement and 0 otherwise	The World Trade Organisation (WTO)
SSA Dummy	Takes a value of 1 if the exporting country belongs to the SSA region (excluding South Africa) and zero otherwise	http://www.countriesandcities.com/regions/sub-sahara-africa.htm
Land Locked dummy	The dummy takes the value of 1 if the exporting country is land locked and 0 otherwise;	CEPII Distances Databases (geo_cepil)
Border dummy	The dummy takes a value of 1 if country i and j share a land border and zero otherwise.	CEPII Distances Databases (dist_cepil)
Common Language dummy	1 if country i and j share a common official language and zero otherwise;	CEPII Distances Databases (dist_cepil)
Colonial dummy	Takes value of 1 if I and j have ever had a colonial link and 0 otherwise	CEPII Distances Databases (dist_cepil)

²⁰ The definitions of the trade-related variables (i.e. human capital, infrastructure and institutions) and the method adopted to construct them is described in detail on pages 20-22 of this thesis.

²¹ All survey data in GCR comes from the World Economic Forum's Executive Opinion Survey

Table 10: Variables used to develop TRCB indicators

Indicators	Source of Data	Definition
1. Human Capital		
Tertiary enrolment	World Development Indicators	School enrolment, tertiary as a percentage of the relevant age group.
Brain drain	World Economic Forum	Your country's talented people (1 = normally leave to pursue opportunities in other countries, 7 = almost always remain in the country)
Quality of management schools	World Economic Forum	Management or business schools in your country are (1 = limited or of poor quality, 7 = the best in the world)
Extent of staff Training	World Economic Forum	The general approach of companies in your country to human resources is (1 = to invest little in training and employee development, 7 = to invest heavily to attract, train, and retain employees)
Local Availability of specialised research and training services	World Economic Forum	In your country, specialized research and training services are (1 = not available, 7 = available from world-class local institutions)
2. Institutions		
University/Industry research collaboration	World Economic Forum	In its R&D activity, business collaboration with local universities is (1 = minimal or nonexistent, 7 = intensive and ongoing)
Property rights	World Economic Forum	Property rights, including over financial assets, are (1=poorly defined and not protected by law, 7=clearly defined an well protected by law)
Presence of demanding regulatory standards	World Economic Forum	Standards on product/service quality, energy, and other regulations (outside environmental regulations) in your country are (1 = lax or nonexistent, 7 = among the world's most stringent)
Financial market sophistication	World Economic Forum	The level of sophistication of financial markets in your country is (1 = lower than international norms, 7 = higher than international norms)
Number of administrative procedures required to start a business	World Bank, Doing Business	All generic procedures that are officially required for an entrepreneur to start up and operate an industrial or commercial business. These include obtaining all necessary licenses and permits and completing any required notifications, verifications or inscriptions with relevant authorities.
Number of documents required for exports	World Bank, Doing Business	All the documents required to export and import goods are recorded. It is assumed that contract and letters of credit counted have been agreed upon and signed by both parties. Documents include port filling documents, customs declaration and clearance documents and official documents exchanged between the concerned parties. Documents filed simultaneously or in packages are considered different documents but with the same time frame for completion
Number of procedures required to enforce a contract	World Bank, Doing Business	All procedures mandated by law or court regulation that demand interaction between the parties, or between them and the judge (or administrator) or court officer are recorded.
3. Infrastructure		
Ports	World Economic Forum	Port facilities and waterways in your country are (1=underdeveloped, 7=as developed as the world's best)
Air transport quality	World Economic Forum	Passenger air travel in your country is (1=infrequent and inefficient, 7=as extensive and efficient as the world's best)
Railroad infrastructure development	World Economic Forum	Railroads in your country are (1=underdeveloped, 7=as extensive and efficient as the world's best)"
Telephone/fax infrastructure quality	World Economic Forum	New telephone lines for your business are (1=scarce and difficult to obtain, 7=widely available and highly reliable)
Quality of electricity supply	World Economic Forum	"The quality of electricity supply in your country in terms of lack of interruptions and lack of voltage fluctuations is (1=worse than in most other countries, 7=meets the highest standards in the world)"
Quality of competition in the ISP	World Economic Forum	Is there sufficient competition among the Internet service providers (ISPs) in your country to ensure high quality, infrequent interruptions and low prices? (1=no, 7=yes, equal to the best in the world)
Extent of business use of internet	World Economic Forum	Internet use by business in your country to buy and /or sell products and services is (1=very low, 7= very widespread)
Extent of marketing	World Economic Forum	The extent of marketing in your country is (1=limited and primitive, 7=extensive and employs the world's most sophisticated tools and techniques)

Table 11: Averages of the Three Composite TRCB Indices per Income Group

		Non-SSA	SSA
High income: OECD	Infrastructure	1.384	
	Institutions	1.430	
	Human Capital	1.490	
High income: non-OECD	Infrastructure	1.226	
	Institutions	1.165	
	Human Capital	1.260	
Low income	Infrastructure	0.778	0.703
	Institutions	0.756	0.813
	Human Capital	0.720	0.645
Lower middle income	Infrastructure	0.881	0.739
	Institutions	0.855	0.752
	Human Capital	0.835	0.623
Upper middle income	Infrastructure	1.03	0.973
	Institutions	0.973	1.019
	Human Capital	1.069	0.842

Table 12: Justifying the use of religion as a selection variable.

<i>Variable</i>	Standard Gravity equation <i>Dependant variable: logtrade</i>	Probit equation <i>Dependant variable: ptrade</i>
<i>Logtariff_imp</i>	-0.538*** (-10.03)	0.053 (1.30)
<i>Logtariff_exp</i>	-0.609** (-11.33)	0.073 (1.77)
<i>Loggdp_imp</i>	0.894*** (53.51)	0.333*** (26.45)
<i>Loggdp_exp</i>	1.221*** (70.06)	0.332*** (24.49)
<i>Logpop_imp</i>	0.153*** (6.60)	-0.096*** (-5.42)
<i>Logpop_exp</i>	0.136*** (5.83)	-0.069*** (-3.89)
<i>logdist</i>	-1.312*** (-47.30)	-0.237*** (-9.63)
<i>Logrel</i>	0.008 (-0.60)	0.067*** (7.33)
<i>dcomlang_off</i>	0.936*** (13.91)	0.410*** (7.48)
<i>dlocked</i>	-0.148 (-2.48)	-0.342*** (-9.25)
<i>dcolony</i>	0.491*** (3.07)	-0.126 (-0.57)
<i>dborder</i>	1.123*** (7.69)	-0.192 (-1.44)
<i>_cons</i>	19.722 (61.97)	1.194 (4.56)

Note: *, **, and *** denote significance at the 10, 5 and 1 percent level, respectively; inside the parenthesis is z value

Table 13: Regression using individual institutions components

<i>Variables</i>	<i>Rights</i> 1	<i>Contract</i> 2	<i>Standards</i> 3	<i>Financial</i> 4	<i>Documents</i> 5	<i>Research</i> 6	<i>Permits</i> 7
Logtariff_imp	-0.5*** (-8.6)	-0.5*** (-9.0)	-0.5*** (-8.9)	-0.5*** (-8.0)	-0.5*** (-8.0)	-0.5*** (-8.8)	-0.5*** (-8.6)
Logtariff_exp	-0.5*** (-9.0)	-0.5*** (-9.4)	-0.5*** (-8.8)	-0.5*** (-9.2)	-0.5*** (-9.2)	-0.4*** (-8.4)	-0.5*** (-8.8)
Loggdp_imp	0.7*** (20.4)	0.7*** (20.2)	0.7*** (20.5)	0.7*** (19.9)	0.7*** (19.9)	0.7*** (20.2)	0.7*** (20.0)
Loggdp_exp	0.6*** (17.3)	0.6*** (17.5)	0.6*** (16.9)	0.6*** (17.4)	0.6*** (17.6)	0.6*** (17.8)	0.6*** (17.5)
Logpop_imp	0.3*** (10.1)	0.3*** (9.6)	0.3*** (9.5)	0.3*** (9.9)	0.3*** (10.1)	0.3*** (9.8)	0.3*** (9.95)
Logpop_exp	0.6*** (19.1)	0.6*** (18.9)	0.6*** (19.7)	0.6*** (19.12)	0.6*** (18.8)	0.6*** (18.3)	0.6*** (18.9)
logdist	-1.2*** (-35)	-1.2*** (-35.7)	-1.2*** (-35.5)	-1.2*** (-34.7)	-1.2*** (-35.3)	-1.2*** (-35.4)	-1.2*** (-35)
Loginst_imp	0.9*** (5.6)	-0.2** (-2.3)	-0.95*** (-3.8)	0.3** (2.2)	0.3*** (3.6)	-0.2 (-1.1)	0.1 (1.95)
Loginst_exp	-0.4*** (2.6)	-0.5** (-6.2)	1.4*** (6.9)	-0.02** (-0.2)	-0.2*** (-2.1)	0.4*** (2.53)	0.001 (0.03)
Loghuman_imp	-0.7*** (-3.6)	-0.4** (2.4)	-0.3 (-1.5)	-0.6*** (-3.2)	-0.5*** (-2.6)	-0.4** (-2.1)	-0.6** (-3.1)
Loghuman_exp	1.3*** (7.1)	1.5*** (7.9)	0.9*** (4.4)	1.3*** (6.8)	1.3*** (6.7)	1.1*** (5.1)	1.3*** (6.77)
Loginfra_imp	1.5*** (7.0)	2.1*** (11.2)	2.6*** (10.97)	1.8*** (8.5)	1.9*** (9.6)	2.2*** (10.7)	2.0*** (10.4)
Loginfra_exp	3.0*** (13.6)	2.9*** (14.8)	1.7*** (6.7)	2.8*** (12.3)	2.8*** (13.8)	2.6*** (12.5)	2.7*** (13.5)
dcomlang_off	0.9*** (12.3)	0.9*** (12.8)	0.9*** (12.4)	0.9*** (12.2)	0.9*** (12.5)	0.9*** (12.7)	0.8*** (12.2)
dssa	-0.4*** (-7.3)	-0.3*** (-5.6)	-0.4*** (-7.2)	-0.4*** (-7.1)	-0.4*** (-7.0)	-0.4*** (-6.9)	-0.4*** (-7.0)
dlocked	-0.01 (-0.1)	0.02 (0.3)	-0.09 (-1.5)	-0.02 (-0.3)	-0.03 (-0.6)	-0.1 (-0.9)	-0.001 (-0.0)
dcolony	0.6*** (3.6)	0.6*** (3.8)	0.6*** (3.6)	0.6*** (3.6)	0.6*** (3.6)	0.6*** (3.5)	0.6*** (3.7)
dborder	0.9*** (5.8)	0.8*** (5.7)	0.8*** (5.8)	0.8*** (5.7)	0.9*** (5.8)	0.8*** (5.7)	0.9*** (5.8)
dac	1.8*** (3.6)	1.6** (3.6)	1.7*** (3.6)	1.7*** (3.5)	1.7*** (3.5)	1.7*** (3.6)	1.7*** (3.5)
dgafta	0.7 (1.4)	0.5 (1.1)	0.7 (1.4)	0.7 (1.4)	0.7*** (1.4)	0.7 (1.5)	0.7 (1.4)
dasean	1.6*** (4.7)	1.7*** (4.8)	1.6*** (4.7)	1.6** (4.7)	1.6*** (4.5)	1.6*** (4.7)	1.6*** (4.8)
dcacam	2.2*** (4.3)	2.3*** (4.4)	2.2*** (4.3)	2.2*** (4.2)	2.21*** (4.2)	2.3*** (4.3)	2.2*** (4.3)
dcaricom	6.2*** (7.0)	6.4*** (7.3)	6.1*** (6.99)	6.2*** (7.0)	6.2*** (7.0)	6.2*** (7.1)	6.2*** (6.99)
dcefta	0.9*** (4.3)	0.9*** (4.4)	0.9*** (4.2)	0.97*** (4.3)	0.9*** (4.2)	1.0*** (4.3)	0.9*** (4.1)
decowas	0.9** (2.2)	1.0** (2.4)	0.9** (2.2)	0.9** (2.2)	0.9** (2.2)	0.9** (2.3)	0.9** (2.3)
dcomesa	1.0*** (4.4)	1.1*** (5.0)	1.0*** (4.5)	1.0*** (4.5)	1.0*** (4.6)	1.0*** (4.5)	1.0*** (4.4)
deu	-0.1 (-0.8)	-0.1 (-0.8)	-0.1 (0.8)	-0.1 (-0.8)	-0.1 (-0.7)	-0.1 (-0.7)	-0.08 (-0.7)
dmercosur	1.9*** (3.08)	1.8*** (2.8)	1.9*** (3.0)	1.9*** (2.97)	1.9*** (3.0)	1.9*** (3.1)	0.7*** (1.8)
dnafta	-0.9 (-1.1)	-0.8 (-0.9)	-0.9 (-1.0)	-1.0 (-1.1)	-0.9 (-1.1)	-1.0 (-1.1)	-1.0 (-1.1)
defta	0.9 (1.1)	1.2 (1.3)	0.96 (1.1)	0.9 (1.1)	0.9 (1.1)	0.9 (1.1)	1.0 (1.1)
dcis	2.3*** (7.4)	2.3*** (7.3)	2.3*** (7.4)	2.3*** (7.4)	2.3*** (7.4)	2.3*** (7.3)	2.2*** (7.3)
dsapta	-0.1 (0.1)	-0.1 (-0.1)	-0.1 (-0.2)	-0.1 (0.1)	-0.03 (-0.05)	-0.03 (-0.04)	-0.1 (-0.1)
dsadcnsacu	0.8 (1.8)	0.8 (1.9)	0.7 (1.8)	0.8 (1.8)	0.7 (1.8)	0.8 (1.9)	0.7 (1.8)
dsacu	0.9 (1.2)	0.8 (1.04)	0.9 (1.2)	0.9 (1.2)	0.9 (1.2)	0.9 (1.2)	1.0 (1.3)
dbilateral	0.2*** (2.3)	0.2*** (2.6)	0.2*** (2.5)	0.2*** (2.4)	0.2** (2.5)	0.2** (2.5)	0.2** (2.5)

Mills lambda	-0.3 (-1.5)	-0.2 (-0.96)	-0.2*** (-1.2)	-0.2** (-1.2)	-0.3** (-1.8)	-0.2 (-0.9)	-0.3 (-2.0)
_cons	20.2*** (54.6)	20.4*** (54.75)	20.2*** (54.8)	20.3*** (53.7)	20.2*** (54.3)	20.2*** (54.6)	20.2*** (54.5)
Number of obs	13074	13074	13074	13074	13074	13074	13074
Censored obs	2071	2071	2071	2071	2071	2071	2071

Table 14: Complementarities between Home and Foreign TRCB Quality

Heckman selection model -- two-step estimates
(regression model with sample selection)

Number of obs = 12621
Censored obs = 1726
Uncensored obs = 10895

Wald chi2(53) = 12571.01
Prob > chi2 = 0.0000

	Coef.	Std. Err.	z	P>|z|	[99% Conf. Interval]	

logtrade						
logtariff~mp	-.4521056	.0536038	-8.43	0.000	-.5901798	-.3140313
logtariff~xp	-.5217034	.0538419	-9.69	0.000	-.660391	-.3830157
loggdp_imp	.4622092	.0269221	17.17	0.000	.3928626	.5315559
loggdp_exp	.7880013	.027268	28.90	0.000	.7177638	.8582389
logdist	-1.163702	.0350112	-33.24	0.000	-1.253885	-1.07352
logpop_imp	.4400026	.0279722	15.73	0.000	.3679511	.5120542
logpop_exp	.426413	.0277551	15.36	0.000	.3549205	.4979054
loginst_si~r	-.2284955	.1367072	-1.67	0.095	-.5806299	.1236388
loginfra_s~r	2.394624	.1510276	15.86	0.000	2.005603	2.783646
loghuman_s~r	.4796987	.1454642	3.30	0.001	.1050077	.8543897
dcomlang_off	.8505442	.0718266	11.84	0.000	.6655311	1.035557
dlocked	-.0084032	.0597615	-0.14	0.888	-.1623386	.1455322
dcolony	.5902332	.1577072	3.74	0.000	.1840063	.99646
dborder	.8362985	.1481953	5.64	0.000	.4545726	1.218024
dssa	-.3224346	.0631259	-5.11	0.000	-.4850362	-.1598329
dac	1.65591	.495534	3.34	0.001	.3794984	2.932321
dgafta	.6968548	.4924668	1.42	0.157	-.5716557	1.965365
dasean	1.644437	.350511	4.69	0.000	.7415807	2.547294
dcacam	2.218744	.5244248	4.23	0.000	.867915	3.569572
dcaricom	6.218264	.8904014	6.98	0.000	3.924742	8.511786
dcefta	.892934	.2277966	3.92	0.000	.3061689	1.479699
decowas	.9703734	.4028217	2.41	0.016	-.0672266	2.007973
dcomesa	.9754337	.2228065	4.38	0.000	.4015223	1.549345
deu	-.0568091	.122755	-0.46	0.644	-.373005	.2593869
dmercosur	1.828102	.6384736	2.86	0.004	.1835035	3.472701
dnafta	-.7882468	.8931229	-0.88	0.377	-3.088779	1.512285
defcta	1.032205	.8882928	1.16	0.245	-1.255886	3.320295
dcis	2.104102	.317514	6.63	0.000	1.28624	2.921963
dsapta	.0364414	.632995	0.06	0.954	-1.594046	1.666928
dsadcnsacu	.743135	.4093207	1.82	0.069	-.3112053	1.797475
dsacu	.8170212	.7752005	1.05	0.292	-1.179763	2.813805
dbilateral	.2190768	.0894486	2.45	0.014	-.0113276	.4494813
_cons	20.19059	.3722163	54.24	0.000	19.23183	21.14936

mills						
lambda	-.5157234	.1983908	-2.60	0.009	-1.026744	-.0047026
rho	-0.23852					
sigma	2.1621836					
lambda	-.51572341	.1983908				

Table 15: Regression Results – For SSA Exporter

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
logtrade						
logtariff~mp	-.527522	.1941231	-2.72	0.007	-.9079962	-.1470478
logtariff~xp	.1212414	.3582879	0.34	0.735	-.5809899	.8234727
loggdg_imp	.9008382	.1293921	6.96	0.000	.6472344	1.154442
loggdg_exp	.3917771	.1151372	3.40	0.001	.1661123	.6174419
loginst_imp	.7861587	.6587331	1.19	0.233	-.5049344	2.077252
loginst_exp	-.2082739	.9590658	-0.22	0.828	-2.088008	1.671461
loghuman_imp	-1.810997	.7117267	-2.54	0.011	-3.205956	-.4160382
loghuman_exp	1.703614	.7751641	2.20	0.028	.1843201	3.222908
loginfra_imp	4.655341	.7112209	6.55	0.000	3.261373	6.049308
loginfra_exp	4.982981	1.043442	4.78	0.000	2.937871	7.02809
logdist	-1.973218	.1984567	-9.94	0.000	-2.362186	-1.58425
logpop_imp	.4739375	.1106814	4.28	0.000	.257006	.690869
logpop_exp	.674223	.1268259	5.32	0.000	.4256488	.9227972
dcomlang_off	1.378047	.2105906	6.54	0.000	.9652967	1.790796
dlocked	.1009154	.1843848	0.55	0.584	-.2604723	.462303
dcolony	1.341064	.7054866	1.90	0.057	-.041664	2.723792
dborder	1.753941	.5685686	3.08	0.002	.6395674	2.868315
decowas	-.5808172	.6818361	-0.85	0.394	-1.917191	.755557
dcomesa	1.49592	.4093765	3.65	0.000	.6935573	2.298284
dsadcnsacu	.8737558	.6419483	1.36	0.173	-.3844398	2.131951
dsacu	-.5849578	1.324376	-0.44	0.659	-3.180687	2.010772
dbilateral	1.616784	1.230329	1.31	0.189	-.7946171	4.028186
_cons	23.3756	1.98707	11.76	0.000	19.48102	27.27019
mills						
lambda	3.219021	.5248752	6.13	0.000	2.190284	4.247757

Table 16 Base Model with all TRCB Variables

Heckman selection model -- two-step estimates
(regression model with sample selection)

Number of obs = 13074
Censored obs = 2071
Uncensored obs = 11003

Wald chi2(61) = 14044.88
Prob > chi2 = 0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]
logtrade					
logtariff~mp	-.4564516	.0530937	-8.60	0.000	-.5605134 -.3523898
logtariff~xp	-.4847147	.0536721	-9.03	0.000	-.5899101 -.3795194
loggdgdp_imp	.6771783	.0331444	20.43	0.000	.6122165 .7421401
loggdgdp_exp	.583431	.0329214	17.72	0.000	.5189062 .6479558
loginst_imp	.14056	.1729133	0.81	0.416	-.1983438 .4794637
loginst_exp	-.4915291	.1801419	-2.73	0.006	-.8446009 -.1384574
loghuman_imp	-.5662755	.1972608	-2.87	0.004	-.9528996 -.1796514
loghuman_exp	1.448122	.1926136	7.52	0.000	1.070607 1.825638
loginfra_imp	2.015343	.2008072	10.04	0.000	1.621768 2.408917
loginfra_exp	2.971382	.211424	14.05	0.000	2.556999 3.385765
logdist	-1.176889	.0333913	-35.25	0.000	-1.242335 -1.111443
logpop_imp	.2981838	.0309205	9.64	0.000	.2375807 .3587868
logpop_exp	.5815994	.0315123	18.46	0.000	.5198365 .6433623
dcomlang_off	.8937563	.0689996	12.95	0.000	.7585195 1.028993
dlocked	-.0182019	.0596772	-0.31	0.760	-.135167 .0987631
dcolony	.5486409	.1550156	3.54	0.000	.2448158 .8524659
dborder	.8388485	.1464333	5.73	0.000	.5518445 1.125853
dssa	-.3668062	.0594336	-6.17	0.000	-.483294 -.2503184
dac	1.676935	.4897668	3.42	0.001	.7170095 2.63686
dgafta	.677039	.4860477	1.39	0.164	-.275597 1.629675
dasean	1.669499	.3457729	4.83	0.000	.9917968 2.347202
dcacam	2.263267	.5188218	4.36	0.000	1.246394 3.280139
dcaricom	6.283899	.8797205	7.14	0.000	4.559679 8.00812
dcefta	.9657176	.2257484	4.28	0.000	.5232588 1.408176
decowas	.9525796	.3987508	2.39	0.017	.1710424 1.734117
dcomesa	1.043898	.2200816	4.74	0.000	.6125457 1.47525
deu	-.0889945	.120932	-0.74	0.462	-.3260168 .1480278
dmercosur	1.840771	.6305752	2.92	0.004	.6048668 3.076676
dnafta	-.9061584	.881025	-1.03	0.304	-2.632936 .8206189
defta	.9987898	.8769333	1.14	0.255	-.719968 2.717547
dcis	2.237656	.3093899	7.23	0.000	1.631263 2.844049
dsapta	.0122022	.6248321	0.02	0.984	-1.212446 1.236851
dsadnsacu	.7817077	.4046351	1.93	0.053	-.0113625 1.574778
dsacu	.8940577	.7671212	1.17	0.244	-.6094723 2.397588
dbilateral	.2187829	.0881157	2.48	0.013	.0460793 .3914866
_cons	20.16221	.3689818	54.64	0.000	19.43902 20.8854
ptrade					
logtariff~mp	.1933312	.0445139	4.34	0.000	.1060855 .2805769
logtariff~xp	.2591238	.044199	5.86	0.000	.1724954 .3457522
loggdgdp_imp	.1933352	.0231277	8.36	0.000	.1480057 .2386647
loggdgdp_exp	.0411133	.0231063	1.78	0.075	-.0041742 .0864008
loginst_imp	1.401304	.1477164	9.49	0.000	1.111785 1.690823
loginst_exp	1.093724	.1456738	7.51	0.000	.8082085 1.379239
loghuman_imp	-.4349286	.1448682	-3.00	0.003	-.7188651 -.1509922
loghuman_exp	.4874783	.1425971	3.42	0.001	.2079931 .7669636
loginfra_imp	.219768	.1555585	1.41	0.158	-.085121 .5246571
loginfra_exp	.4934465	.1571782	3.14	0.002	.1853829 .8015101
logdist	-.152576	.0292012	-5.22	0.000	-.2098093 -.0953427
logpop_imp	.0196729	.0226343	0.87	0.385	-.0246894 .0640352
logpop_exp	.1435721	.0226272	6.35	0.000	.0992237 .1879206
logrel	.0971866	.0100099	9.71	0.000	.0775676 .1168057
dcomlang_off	.3302893	.0585291	5.64	0.000	.2155744 .4450043
dssa	-.4302258	.0424064	-10.15	0.000	-.5133408 -.3471107
dlocked	-.2845842	.0395125	-7.20	0.000	-.3620274 -.2071411
dcolony	.0095028	.2318337	0.04	0.967	-.4448829 .4638886
dborder	-.3410827	.1483603	-2.30	0.022	-.6318635 -.0503019
dac	5.102267	.	.	.	.
dgafta	4.019773	.	.	.	.
dasean	-.0777254	.3948204	-0.20	0.844	-.8515593 .6961084

dcacam	|	5.048952	.	.	.	.	.
dcaricom	|	5.184885	.	.	.	.	.
dcefta	|	1.097898	.3337203	3.29	0.001	.4438184	1.751978
decowas	|	.1366206	.220271	0.62	0.535	-.2951027	.5683439
dcomesa	|	.4805596	.1334484	3.60	0.000	.2190055	.7421137
deu	|	4.711216	.	.	.	.	.
dmercotur	|	5.186653	.	.	.	.	.
dnafta	|	2.482953	.	.	.	.	.
deftra	|	3.350165	.	.	.	.	.
dcis	|	.0906758	.1956013	0.46	0.643	-.2926957	.4740473
dsapta	|	4.465767	.	.	.	.	.
dsadcnsacu	|	.7068568	.3355751	2.11	0.035	.0491418	1.364572
dsacu	|	-.5530236	.3984211	-1.39	0.165	-1.333915	.2278675
dbilateral	|	.3338469	.137309	2.43	0.015	.0647263	.6029675
_cons	|	1.144168	.3109563	3.68	0.000	.5347047	1.753631

mills	|						
lambda	|	-.1823425	.1668334	-1.09	0.274	-.50933	.1446451

rho	|	-0.08543					
sigma	|	2.1343054					
lambda	|	-.18234245	.1668334				
