Exploring the Impact of Food Safety Standards on Global Tea Trade: A Gravity Model Based Approach

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Introduction

Tea – the world's second most popular beverage with 22% global beverage market share – contributes nearly 1.9% to the GDP and Rs. Million 136,180 foreign exchange earnings in Sri Lanka with nearly 291 Million Kg. production in 2009. The Russia, United Kingdom and United States are the major importers of tea globally with about 12, 8 and 7 percent of import share, respectively. The Russia, United Arab Emirates and Syria are the major importers of Sri Lankan tea, while Iran, Turkey and Jordan, individually, import more than 5% of tea produced domestically (International Tea Committee Statistical Bulletin, 2010).

The Food and Agriculture Organization has declared tea as an item of food in 1995, and since then, the tea exporting nations are now required to comply with specific food safety and quality standards to meet the demand for safer foods, which include those on usage of approved pesticides with minimum residue limits, microbiological parameters, and the limits on heavy metals. Further, the European Union's Parliamentary Directive on Hygiene of Food Stuff makes it compliance to have a system of Hazard Analysis Critical Control Points (HACCP) in place in 2006 and it is now extended to have ISO 22000 and Maximum Residue Level (MRL).

The economic analysis revealing global impacts of food safety standards on food and agricultural trade are relatively scares. Otsuki *et al.* (2001) and Wilson and Otsuki (2002) use Gravity Model approach and conclude that agricultural exports are negatively affected by importer specific standards. In another study, Yue *et al.* (2010) infer that MRL standards specified by the EU have affected the volume of tea exports significantly. In light of above, this paper employs the Gravity Model approach to examine the impact of food safety standards on global tea marketing.

Methodology

Theoretical Framework

The Gravity Model approach, which is based on the Newton's '*Law of Universal Gravitation*', suggests that the bilateral trade flows between two countries are positively related to size of the economy (represented by GDP) and inversely related to the geographical distance between them (DIS). This basic model was further expanded by incorporating other important variables, including: population (POP), language (LAN), colonial relationships (COL), whether the country is landlocked (LOCK) (Yue *et al.*, 2010), and adoption of food safety standards (ISO 22000, MRL) (Equation 1):

$$\ln Q_{ij} = \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln POP_i + \ln POP_j + \beta_5 \ln DIS_{ij} + \beta_6 DCOL_{ij} + \beta_7 DLAN_{ij} + \beta_8 DLOCK_{ij} + \beta_9 DISO22000_j + \beta_{10} DMRL_j + \varepsilon_{ij} \quad (1)$$

Where, β denotes the coefficients and i and j are exporting and importing countries, respectively (the notation D in the last five variables denotes dummy variable).

Collection and Analysis of Data

The secondary data were obtained from the United Nations Commodity Trade Statistics Database (total tea export values), International Monetary Fund's World Economic Outlook Database (GDP, population), and CEPII Database (distance, colonial ties, common language, landlocked). Those exporting nations with more than 5% global market share (i.e. Kenya, China, Sri Lanka, India, Viet Nam and Indonesia) and importing at least 5% of global production of tea were considered for analysis. The data were initially analyzed without a simulation. Consequently, the model was re-estimated relaxing the variable "safety standards" assuming that the developed importing countries release all tea imports from ISO 22000 and MRL standards. A *Hierarchical Cluster Analysis* was carried out to identify the similarity clusters among the importing countries in 2009. More than 1% importing countries in 2009 was the grouped objects, and more than 5% exporting countries were used as cluster variables. The Statistical Package for Social Sciences (SPSS) (*Version16*) was used to estimate the Gravity Model and carry out the Cluster Analysis.

Results & Discussion

Signs of coefficients of the traditional gravity variables, including population, GDPs of exporter and importer, and distance were as expected (Table 1).

Table 1- Outcome of Gravity Model:

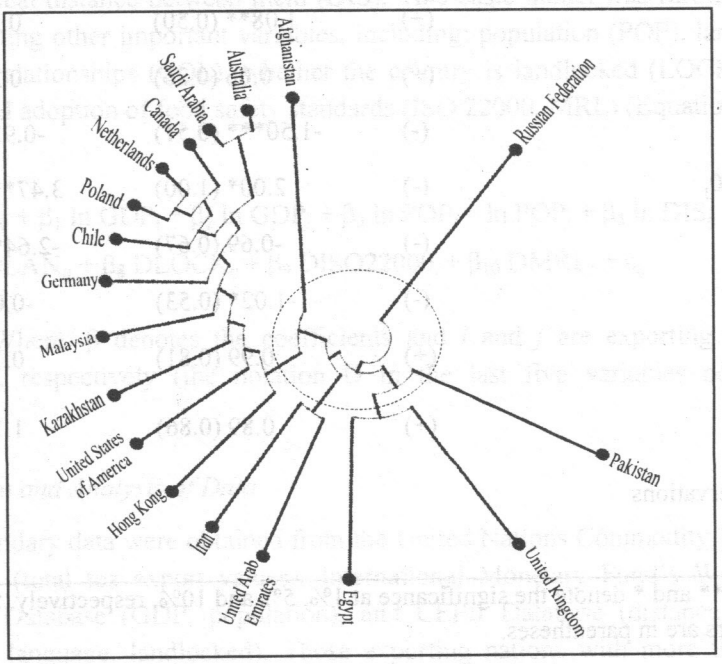
Variable	Expected Sign	Scenario 1	Scenario 2
ln POP_i	(-)	-1.34** (0.57)	-0.74 (0.56)
ln POP_j	(+)	1.08*** (0.39)	0.96*** (0.28)
ln GDP_i	(+)	1.08** (0.50)	0.54 (0.51)
ln GDP_j	(+)	0.06 (0.26)	0.20 (0.18)
ln DIS_{ij}	(-)	-1.50*** (0.51)	-0.93* (0.49)
$DISO22000_j$	(-)	2.00* (1.00)	3.47*** (0.86)
$DMRL_j$	(-)	-0.69 (0.67)	-2.64** (1.04)
$DLOCK_{ij}$	(-)	-1.02* (0.53)	-0.06 (0.50)
$DCOL_{ij}$	(+)	0.99 (0.81)	0.12 (0.74)
$DLAN_{ij}$	(+)	0.89 (0.86)	1.16 (0.79)
No of Observations			66
R^2 adjusted			0.509

Note: ***, ** and * denote the significance at 1%, 5% and 10%, respectively. Standard Errors are in parentheses.

The negative sign of exporting country's population highlights that higher population decreases the quantity exported due to considerable amount of domestic consumption. The results further emphasized that exporting country's GDP has a significant impact, though that of importing country was insignificant in tea trade. The positive and significant coefficient of ISO 22000 revealed that complying with the meta-system was seen as an added advantage augmenting the quantity traded. On the contrary, compliance to MRL had significant negative effects, implying hampering impacts. Being a landlocked importing country was seen to impose negative effects on tea trade, mainly due to higher cost of transportation. Surprisingly, sharing a common language and having colonial ties and business linkages did not significantly contribute to tea trade between the major tea trading partners. The outcome of analysis under the scenario of "relaxation of standards" highlighted that the sign of GDP, population and distance variables were as expected (Table 1). In this instance, only the importing country's population and distance variables were seen to have a significant impact on trade. Differing from the first scenario, both ISO 22000 and MRL were significant at $\rho = 0.01$ and 0.05, respectively. Contrastingly, the coefficient of ISO 22000 was

positive, while that of MRL was negative. Thus, the results revealed that, *ceteris paribus*, mandatory ISO 22000 imposed by developed countries result in a four-fold increase in tea exported, while enforcement of MRL will decrease quantity by three times.

Figure 1 - Cluster analysis of major tea importers



The Dendrogram from Cluster Analysis shows six clusters at 71% similarity level (Figure 1 above). Russian Federation – the largest global tea importer – has been clustered separately at 55% similarity level due to exceptional amount of tea quantities imported. The other cluster consists of mostly the developed countries and transition economies due to the similarity in population and GDP implying that most of these nations trade in similar patterns.

Conclusions

The outcome of analysis, in contrary to the common belief that food safety standards hinder global agricultural trade, suggests that complying with a metasystem like ISO 22000 can have trade facilitating effects. Where Sri Lanka is of concern, it implies that adoption of such metasystems would have positive effects on tea exports to the European Union and Japan in the long run.

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