The Potential and Constraints of the Exports of Environmental Goods (EGs): the case of Bangladesh

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Abstract

Although the economic importance of environmental goods (EGs) is on a rise with increasing focus on global climate change issues, it is surprising that export growth of environmental goods is witnessing a downward trend in developing countries compared to developed countries. Researchers are divided over explanations for possible reasons: while some argue that lack of technological availability and insufficiency of the technology transfer isolate developing countries from the world market; others contend that country-specific 'behind the border' constraints prevent these countries from fully exploiting their export potential. This paper examines the potentials and constraints for Bangladesh EGs exports by applying a stochastic frontier gravity type model. The estimation results show that Bangladesh remained far from reaching its export potential during 2001 and 2007 despite there being an increased level of realization with the East Asian economies. The results also suggest that reducing 'explicit beyond the border' constraints by partner countries aided Bangladesh in attaining positive export growth between 2001 and 2007.

Keywords: Environmental goods, Bangladesh, 'behind the border' constraints, 'beyond the border' constraints, stochastic frontier gravity model.

JEL Classification: Q56.

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1 Introduction

The nexus between international trade and the environment has raised concern among policymakers across the globe in recent times. While trade promotes economic growth, trade expansion contributes to a higher level of greenhouse gas emissions, harming the environment through inducing climate change. The effects of climate change are more pervasive to developing countries. Evidence shows that temperature increase by 1 degree Celsius in a developing country leads to a 2.0 to 5.7 percentage point reduction in economic growth (Jones & Olken 2010, p. 1). Hence, in order to achieve the green growth,[1] countries are now focusing on imposition of environmental regulations on their trading partners on the one hand and higher production and consumption of environmental goods (henceforth, EGs) on the other. Statistics show that exports trading of global EGs has increased from US$ 323 billion in 2001 to US$ 937 billion in 2012 (WITS 2014). One feature of EGs trading is that it is highly concentrated on developed nations. It is reported that 90 per cent of the EGs industry is located in OECD countries (Tamiotti et al 2009, p. 61). Therefore, enhancing exports of EGs is considered an option for developing countries to reduce environmental degradation while maintaining economic growth.

The discussions on EGs at the international level first came forth at the Fourth WTO Ministerial Conference in 2001 where WTO-members were agreed on 'the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services'[2] (WTO 2014). The literature on EGs mainly focuses on two issues. One is the definition of EGs surrounding the effectiveness of different lists of EGs placed by WTO-members and international forums like the OECD, APEC and the World Bank. The other is liberalizing trade in EGs. With a number of lists WTO members have failed to reach a consensus on preparing a single list till to date. To avoid the definitional complexities, Yoo and Kim (2011) suggest minimizing the product list and including

[1] Green growth refers to economic growth with environmental protection.
[2] Doha Ministerial Declaration, paragraph 31(iii).

some agricultural EPPs to bring all members of the WTO to the negotiation table (p. 601). Balineau and Melo (2013) review the level of tariff reductions in EGs over 1996-2010 and identify that low-income group countries are maintaining the highest protection on EGs trade (p. 22). Khatun (2012) analyses Least Developed Countries (LDCs) to explore whether liberalization on EGs takes place and finds a lower chance of LDCs for opening up their EGs sector (p. 179). Khatun (2012) also reckons that the potential benefit of LDCs may accrue in the long run if FDI and technology transfer take place in the right form through liberalization of trade (p. 179). By conducting an econometric analysis, Schmid (2012) calculates that a 10 per cent increase in the applied MFN tariff rate on EGs follows a 3 percentage point decrease in the likelihood of technology transfer (p. 19).

Research on determining the factors of EGs export is very few. Jha (2008) examines the underlying determinants that explain the trade flow of EGs in the developing countries and finds the economic size of the country (GDP), foreign direct investment (FDI), national environmental performance indicators, tariff and technical assistance project are statistically significant (p. 22). Nguyen and Kalirajan (2013) analyze the data of EGs in India during the period 1996-2010 using the stochastic frontier gravity model and found that 'behind the border' constraints and 'implicit beyond the border' constraints have dominant negative effects on the export of EGs, but 'explicit beyond the border' constraints appear insignificant during that period (p. 15).

It is widely recognized that Bangladesh is one of the worst victims of environmental degradation. Climate shocks such as low rainfall, droughts, floods, cyclones, river bank erosion and salinity ingress bring huge external costs to the economy. Due to the negative impacts of climate change Bangladesh is losing US$ 2.2 billion each year (Thomson Reuters Foundation 2014). It is pertinent to note that the GDP of Bangladesh in 2012 was US$ 116.35 billion (WDI 2014). Considering both economic and environmental vulnerability, Bangladesh is committed to mainstream environmental and climatic change issues into all economic processes and decisions (GED 2011, p. 195). Nevertheless, Bangladesh is not performing well on its EGs' export, which is demonstrated by the decreasing share of EGs in total goods exports from 7 per cent in 1997 to 3 per cent in 2007 (WITS 2014). In this context, there lies an important question: whether Bangladesh has realized its export potentials of EGs fully? If not,

what are the reasons and what are the possible ways out? To date, no study has been conducted for Bangladesh to explore its EGs exports. Hence, this paper aims to identify, analysing the data of 2001 and 2007, the determinants of EGs exports, export potential of EGs and underlying constraints on EGs exports of Bangladesh.

This paper proceeds as follows. Section 2 gives definitional aspects and coverage of EGs. Section 3 provides an overview of EGs exports of Bangladesh. Section 4 draws on theoretical framework and literature review. Section 5 projects empirical model and data. Section 6 describes regression results, an analysis of export potential and growth decomposition of EGs export between 2001 and 2007, and section 7, the final section, presents conclusions with policy implications.

2 Definition and Coverage of EGs

To date, no universal definition of EGs has been established. However, some multilateral agencies and experts have come up with some functional definitions for the empirical analysis of the EGs market. The Organisation of Economic Cooperation and Development (OECD) identifies those products as EGs which are used to 'measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems' (OECD 1999, p. 9). According to Yoo and Kim (2011), EGs are a set of manufactured products, technologies and chemicals used in pollution and waste affecting water, soil and air (p. 582). Of late, the inclusion of Environmentally Preferable Products (EPPs) in the negotiation process of WTO has broadened the discussion on EGs. The United Nations Conference on Trade and Development (UNCTAD) categorizes two broad classes of EGs of which Type A incorporates all chemicals and manufactured products that are directly used to pursue environmental services and Type B covers all other products [EPPs] whose production, end-useand/or disposal have positive impacts on environment, but no direct use for environmental purposes (Hamwey 2005, p. 2).

In contemporary trade negotiations, there is a debate on the coverage of EGs. The debate is centred on: firstly, the issue of whether goods with dual or multiple end-uses should be categorized as EGs; secondly, the way of capturing EGs by the harmonized

system (HS); and thirdly, the relativity of the definition of 'environmental friendliness' where some goods are considered friendly to some countries and unfriendly to others at the same time (Stilwell 2008, pp. 9-10). In order to address these issues the WTO invited member-countries to suggest approaches in 2008 for finding a universal definition of EGs (WTO 2008). Till 2013, five approaches have been proposed to the WTO. They are the list approach, the request and offer approach, the environmental project approach, the integrated approach and the hybrid approach. The list approach suggests countries identifying lists of EGs for tariff reductions. The request and offer approach allows a country to select its EGs and seek tariff cuts to partner countries. Under the environmental project approach, a project approved by a designated national authority would enjoy trade concessions on the goods and services used in the project. The integrated approach proposes the establishment of public and private entities to carry out environmental activities. All imported goods by these entities would qualify for preferential tariff treatment. Lastly, the Hybrid approach combines all the approaches.

Currently, the discussion on EGs is based on the few proposed lists of which the OECD and the Asia Pacific Economic Cooperation (APEC) lists are considered a beginning stage. The OECD started work on identifying EGs in 1992 and listed a total of 164 goods under three groups at the HS nomenclature. In 1995 the APEC processed to list 109 products in the same nomenclature under 10 categories. Comparing these two lists, the APEC list is narrower, including only established environmental technologies and the OECD list covers both established environmental technologies and cleaner technologies, products and services (Howse & Bork 2006, p. 1). It is important to note that the OECD/APEC lists are not well-recognized by developing countries. Both lists are based on technological solutions to environmental problems and presented a comparative advantage to developed nations in the context of international trade (Lendo 2005, p. 4). In 2007, 'Friends of EGs', a group of countries comprising Canada, the European Union, Japan, South Korea, Norway, New Zealand, Taiwan, Penghu, Kinmen and Matsu, Switzerland and the United States of America submitted a joint proposal on EGs to the Committee on Trade and Environment in Special Session (CTESS) of the WTO. This proposal is well-known as the WTO '153 list'. With a view to minimizing overlaps within different lists, the WTO also prepared a 'combined list' of 411 items at the HS-2002 six-digit level codes in 2011. Out of 411 codes, a group of countries

namely Australia, China, Hong Kong, Singapore, Norway and Colombia made a 'core list' consisting of 26 products and proposed a starting point of new WTO negotiations.

With all these lists, this paper focuses on the WTO '153 list' where the EPPs are well-focused. The '153 list' is considered as a much-discussed list in the WTO and has led to debate on EGs negotiations. This list includes 12 categories of products. They are: (i) air pollution control, (ii) management of solid and hazardous waste and recycling systems, (iii) clean up or remediation of soil and water, (iv) renewable energy plant, (v) heat and energy management, (vi) waste water management and potable water treatment, (vii) environmentally preferable products, based on end use or disposal characteristics, (viii) cleaner or more resource efficient technologies and products, (ix) natural risk management, (x) natural resources protection, (xi) noise and vibration abatement and (xii) environmental monitoring, analysis and assessment equipment (WTO 2008).

3 EGs Exports Performance of Bangladesh

Bangladesh has been pursuing an export-led growth strategy since 1990s. Although Bangladesh experimented import substitution strategy just after independence in 1971, now it opts for an open market economy. Trade liberalisation reforms in the form of reduction in tariff rates, duty-free access to imported inputs, introduction of the Export Performance Benefit Scheme (XPB)[3] and tax rebates on export earnings have helped Bangladesh's export industry to grow (Hossain & Alauddin 2005, p. 130). However, evidence shows a small share of EGs in total goods exports. In 2001, total goods exports was US$ 5,736 million while total EGs exports were only US$ 137 million which is 2.39 per cent of total goods exports (Table 1). On the other hand, total goods exports reached to US$ 12,691 million in 2007 and total EGs exports remained at US$ 351 million capturing only 2.77 per cent of goods exports. It is important to note that the exports of EGs in Bangladesh are dominated by jute and jute-products. The jute market

[3] A scheme of government's financial assistance for export promotion.

is gradually losing its global position due to the emergence of cheap synthetic fibres (Gunter et al 2011, p. 50). This may be the main reason for the lowered share of EGs to total exports.

Table 1 **Export trend in Bangladesh, 1997-2007** (million US$)

Year	Total Goods Export	Total EGs Export	Share of EGs to total Goods Export (%)
2001	5736	137	2.39
2002	5443	216	3.97
2003	6229	133	2.14
2004	7586	173	2.28
2005	8494	242	2.85
2006	11650	272	2.33
2007	12691	351	2.77

Source: UN COMTRADE (2014).

Like other developing countries, the export market of Bangladesh EGs is dominated by the Environmental Preferable Products (EPPs) (Hamwey 2005, p. 26). The EPPs are those industrial and consumer goods which have fewer negative impacts on the environment in the production, end-use or disposal stage (Howse & Bork 2006, p. 2). For example, jute and textile fibres, biodegradable fibres, sisal, natural rubber, and sacks and bags made of natural fibres. In Bangladesh the share of EPPs in the total EGs export was 85 per cent in 2007 and it was even higher in the previous years (Table 1 in Appendix). Among the EPPs jute and jute-based products contribute the lion's share. It is evident that one single commodity namely Jute and other textile based fibres (Code 530310) earned US$ 190 million in 2007 which was amounted to more than 54 per cent of total EGs exports (Table 2). It was even higher during 1970s and 1980s. Based on the annual data of the Bangladesh Bank[4], the contribution of jute to total exports was 73 per cent in 1975-1979 (Gunter et al 2011, p. 50). Other important EGs for Bangladesh are

[4] Bangladesh Bank is the Central Bank of Bangladesh.

machinery for cleaning or dry bottles, parts for vapour turbines, tamping machines and road rollers, and perforated buckets made of iron or steel.

Table 2 **Bangladesh EGs' Exports to world in 2007** (highest 10 commodities)

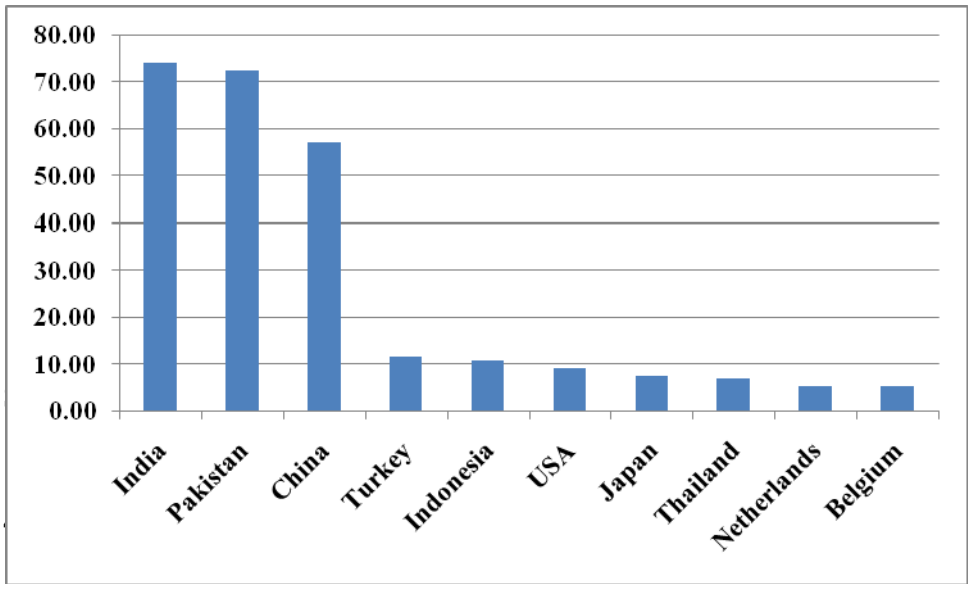
Commodity Code (HS 6-digit)	**HS Code Description**	**Export Value (Million USD)**	**Share to total EGs Export (%)**
530310	Jute and other textile based fibres, raw or processed but not spun; tow and waste of these fibres (Category 7)	190.17	54.18
630510	Sacks and bags, of a kind used for the packing of goods: Of jute or of other textile based fibres of heading 53.03. (Category 7)	82.30	23.45
560710	Twine, cordage, ropes and cables: Of jute or other textile based fibres of heading 53.03. (Category 7)	25.67	7.31
560890	Knotted netting of twine, cordage or rope; made up fishing nets and other made up nets, of textile materials (Category 10)	9.38	2.67
847989	Machines and mechanical appliances having individual functions, not specified or included elsewhere in this Chapter: Other (Category 2)	5.68	1.62
840999	Parts suitable for use solely or principally with the engines of heading No. 84.07 or 84.08: Other (Category 11)	5.53	1.58
842290	Machinery for cleaning or drying bottles or other containers: Parts (Category 2)	5.36	1.53
840690	Parts for steam and other vapour turbines (Category 4)	4.73	1.35
842940	Tamping machines and road rollers (Category 2)	2.39	0.68
732690	Other articles of iron or steel: Other (Category 6)	2.22	0.63

Source: UN COMTRADE (2014)

The export destination of Bangladesh EGs exhibits a different picture compared with overall exports. The USA, Germany and United Kingdom are the top three partner countries for total exports in 2007. But this is not the case of the EGs. The export of

EGs is heavily concentrated on the neighbouring countries. The top three EGs exporting countries are India, Pakistan and China and they collectively received 58 per cent of total EGs export of Bangladesh in 2007 (Figure- 1).

Figure 1 **Export destination of the EGs of Bangladesh in 2007** (million US$)



Source: UN COMTRADE (2014)

4 Theoretical Framework

The gravity model has long been used empirically in describing bilateral trade patterns. It hypothesizes that trade between two countries largely depends on income and population of the partner countries and the distance they apart. Jan Tinbergen (1903-1994) was the pioneer to apply gravity model in determining international trade flows between a pair of countries. Tinbergen (1962) constructs a trade flow equation where he finds that trade has constant elasticity with GNP of country i, GNP of country j and distance between i and j (p. 264). Linnemann (1966), for the first time, extends the gravity model and opines that the better commodity composition fits with two countries, the larger trade flows exists between them (p. 140). Linder (1961) constructs an alternative hypothesis in international trade flows. He suggests that countries will trade more with similar income levels (p. 17). To find the forces of European trade relationships, Aitken (1973) firstly used regional trading arrangements (EFTA and EEC) as dummy variables and found it statistically significant (p. 886). Anderson

(1979) provided a theoretical underpinning on the gravity model by deriving a gravity equation on the basis of constant elasticity of substitution (CES) preferences and differentiation of goods by the country of origin [Armington assumption] (pp. 108-112). It is recognized in trade literature that Anderson first provides a theoretical legitimacy to the gravity model (Armstrong 2007, p. 2).

Bergstrand (1985) presents a microeconomic foundation to the gravity model by showing gravity equation as a 'reduced form from a partial equilibrium subsystem of a general equilibrium model' (p. 174). Bergstrand (1985) also develops a 'generalized gravity equation' where the incomes of exporter and importer countries are exogenous and country parameters of both countries are identical (p. 477). Furthermore, Deardorff (1998) presents the gravity equation a theoretical foundation by the theory of Heckscher-Ohlin (HO) model of international trade. Explaining both homothetic preference and Armington preference, he finds it difficult to justify a simple gravity equation by the existing trade theories (p. 21). Frankel, Stein and Wei (1997) conducted a study using the standard gravity model. They used regional trading blocs as dummy variables along with five basic explanatory variables, namely size of the economy, per capita income, distance, common language and common border, and find regional trading blocs highly statistically significant in the model (p. 77).

According to Anderson (1979), the gravity equation does not include 'economic distance' between the trading countries. The economic distance can be identified as 'historical and cultural ties between traders, the tying of aid, the setting up of multinational subsidiaries, and preferential treatment of one country's exports for other reasons- bias trade' (Roemer 1977, p. 318). The omission of 'economic distance' term leads to incorrect estimates. The reason is that 'economic distance' affects the error term of the model for which $[E(U)_{i,j}] \neq 0$, therefore OLS assumption violates. This leads to heteroskedastic error terms. The estimation methods of the gravity equation with the presence of heteroskedastic error terms will biased and will generate distorted estimates (Silva & Tenreyro 2003, p. 4). Moreover, the standard gravity model does not consider socio-political-institutional factors of the home and partner countries, as argued by Kalirajan (2007).

Many studies have been conducted to improve the application of the basic gravity model. In order to estimate the heterogeneous nature of distance, Egger (2008) suggests

using a panel data model which is linear in parameters but non-linear in trade costs (p. 661). A large number of researchers, like Harrigan (2001), have used relative distance instead of absolute distance as the latter creates mis-specification in the model (p. 35). An important method of estimating the gravity in bilateral trade flows with the presence of biased estimator problem of the conventional gravity model is the stochastic frontier approach (Drysdale et al. 2000, Kalirajan and Findlay 2005). It is worth noting that stochastic frontier analysis is mainly used in production economics for economic modelling, first introduced by Aigner, Lovell and Schmidt (1977), and Meeusen and Van den Broech (1977). The main property of the stochastic frontier approach of the gravity model is the assumption of two error terms where one represents non-negative disturbance term (Drysdale et al. 2000, p. 262). Drawing on Kalirajan (2007), the stochastic gravity equation for exports be,

$\ln X_{ij} = \ln f(Z_i;\beta) \exp(v_i - u_i)$

where,

X_{ij} is actual exports from country i to country j

Z_i is potential exports of country i to country j

β is a vector of unknown parameters

u_i represents single-sided error term which captures economic distance factor following $N(\mu, \sigma^2_u)$ and

v_i represents double-sided error term which captures the influence of other omitted variables following$N(0, \sigma^2_v)$

If u_i is zero, there is no economic distance factor and if $u_i \leq 1$, the economic distance factor exists and it constrains exports from reaching its potential.

Export potential refers to the level of trade that could be achieved in a state of free and frictionless trade between two countries. It is the maximum level of exports that could be realized with the given level of export determinants. To measure export potential, earlier studies estimated the difference between actual export and predicted export by applying OLS estimation to the gravity equation. The feature of OLS estimation is that it provides estimates which represent the centered values of the data set. But the potential export requires estimates that represent the upper limits of the data. To address this issue, stochastic frontier gravity model bears strong theoretical implications (Kalirajan 2007, p. 95). It is worth noting that the gap between potential and actual

export is not only due to core determinants of exports but also various socio-political and institutional factors of both reporter and partner countries. Identifying those factors is useful from the policy perspective in order to minimize or mitigate export constraints. Thus, a country can achieve its full potential in exports through policy reforms and bilateral or multilateral trade negotiations.

Export growth decomposition (Figure 2) helps to identify overall export constraints. Drawing on Khan and Kalirajan (2011), three types of determinants are responsible for changes in exports: natural or core determinants, 'behind the border' determinants and 'beyond the border' determinants (p. 9). Natural determinants refer to the size and income of the importing economy and also distance between exporting and importing countries. It is assumed that higher population and GDP of partner countries lead to more export for the reporter countries. On the other hand, longer distance reduces exports due to higher transport costs. Besides, 'behind the border' determinants imply infrastructural limitations and institutional rigidities of the exporting country. For example, inefficiency of port and customs procedure, restrictions on market access and licensing, foreign equity restrictions and weak protection of intellectual property rights (IPRs). 'Beyond the border' determinants refer to the infrastructural constraints and institutional weaknesses of the partner countries. It can be divided into two parts: 'explicit beyond the border' determinants and 'implicit beyond the border' determinants. Tariff and exchange rate are considered as 'explicit beyond the border' determinants which have inverse relationship with exports of the exporting country. On the flipside, 'implicit beyond the border' determinants indicate the infrastructural and institutional constraints of the importing countries which negatively affects export of the partner country.

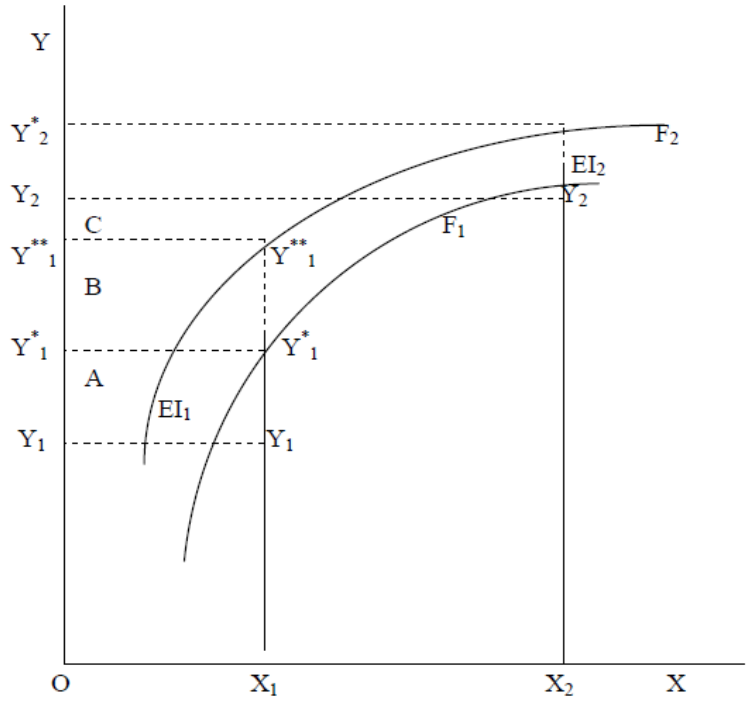
The growth of export can be decomposed in the following way (Khan and Kalirajan 2011),

$$
\begin{aligned}
D = Y_2 - Y_1 &= A + B + C \\
&= [Y_1^{*} - Y_1] + [Y_1^{**} - Y_1^{*}] + [Y_2 - Y_1^{**}] \\
&= [Y_1^{*} - Y_1] + [Y_1^{**} - Y_1^{*}] + [Y_2^{*} - Y_1^{**}] - [Y_2^{*} - Y_2] \\
&= \{[Y_1^{*} - Y_1] - [Y_2^{*} - Y_2]\} + [Y_1^{**} - Y_1^{*}] + [Y_2^{*} - Y_1^{**}] \\
&= [EI_1 - EI_2] + CIBBC + GCD
\end{aligned}
$$

Where, D is export growth, Y_1 and Y_2 is actual export in period 1 and period 2 respectively. F1 is the potential export frontier in period 1 and F2 is the potential export

frontier in period 2 assuming that there is no 'behind the border' constraints. Y_1^* is the potential export in period 1 with given export determinants X_1 and Y_2^* is the potential export in period 2 with given export determinants X_2. Y_1^{**} refers to the potential export in period 2 with the export determinant of period 1.

Figure 2 **Decomposition of Export Growth**



Source: Khan and Kalirajan (2011)

Hence, $EI_1 - EI_2$ represents difference of export inefficiency between period 1 and period 2 due to changes in 'behind the border' constraints of the exporting country.

CIBBC indicates change in export of the exporting country due to changes in 'implicit beyond the border' constraints of the importing country.

GCD implies change in export due to changes in core determinants and 'explicit beyond the border' constraints.

5 Empirical Model

This study uses the stochastic frontier gravity model following Nguyen and Kalirajan (2013). The model is as follows:

$$\ln EX_{i,j} = \beta_0 + \beta_1 \ln(GDP_j) + \beta_2 \ln(POP_j) + \beta_3 \ln(DIST_{i,j}) + \beta_4 TARIFF_{j,i} + \beta_5 \ln(EXR_{i,j}) + \beta_6 RTA_{i,j} - u_{i,j} + v_{i,j} \quad (1)$$

where,

$EX_{i,j}$ represents the total value of EGs export from Bangladesh (i) to partner country (j); GDP_j is the Gross Domestic Product of country j as proxy for income; POP_j is population of country j as proxy for market size; $DIST_{i,j}$ indicates distance between the capital city of Bangladesh (i) and partner country (j) in kilometres; $TARIFF_{j,i}$ indicates the average tariff for EGs of the partner country (j); $EXR_{i,j}$ describes the cross exchange rate of Bangladeshwith its trading partners (j) calculated by dividing Bangladesh's Official Exchange Rate (OER) in US dollar with the partner country's OER in US dollar; $RTA_{i,j}$ is a dummy variable, which is equal to 1if the partner country is under the same regional trade agreement with Bangladesh, otherwise 0; $u_{i,j}$ is a single-sided error term truncated at 0, it refers to the combined effects of economic distance factor or 'behind the border constraints' in Bangladesh for the importing country (j); and $v_{i,j}$ is a double-sided error term following a full normal distribution with mean zero and constant variance, it refers to 'normal' statistical error which captures the effect of inadvertently omitted variables.

The Maximum Likelihood estimation can be used to estimate the coefficients (β_1....β_6) of the model using the joint density functions of $u_{i,j}$ and $v_{i,j}$. The parameter γ refers to the ratio of the variance due to the 'behind the border constraints' to the total variance of the export of EGs. While γ appears as significant, it depicts that the 'behind the border constraints' are an important factor for the export of EGs. FRONTIER 4.1software (Coelli 1996) is applied to estimate the above model (1) for years 2001 and 2007. Note that initially the model had been estimated with two other explanatory variables. One is FDI stock and the other is technical assistance project. Both variables were found insignificant for both years, thereby, omitted from the model.

6 Data

This study uses cross sectional data of 41 trading partners of Bangladesh on the export of EGs for the period 2001 and 2007. A list of countries is shown in Table 3. Data on EGs exports has been collected from the UN COMTRADE (United Nations Commodity Trade Statistics Database). UN COMTRADE upholds the export data of EGs up to the

year of 2007 for Bangladesh. Due to data availability constraint of EGs exports, average of two years (the year mentioned and the previous year) has been considered for the export of 2001 and 2007. It is observed that there was no big change on demand side and supply side during that period. Data on Gross Domestic Product (GDP) as a proxy to income, population as a proxy for market size and Official Exchange Rate (OER) of both Bangladesh and partner countries for calculating cross-exchange rate have been extracted from the database of the World Development Indicators (WDI) of the World Bank. The distance, bilateral distance between Bangladesh and its trading partners in kilometres, data has been derived from the French Research Center in International Economics (the CEPII) which is developed by Mayer and Zignago (2005). Tariff data was collected from the WITS (World Integrated Trade Solution) by HS (Harmonized System) 6-digits. First weighted average tariff for every exporting commodity was extracted and then average of those tariffs has been derived. Data on regional trade agreements (RTAs) was collected from the website of the WTO (World Trade Organisation)

Table 3 **Trading partner of Bangladesh EGs exports**

Africa (4)	*Jordan*	*Turkey*	*Portugal*	*Brazil*
Egypt	*Malaysia*	**Europe (13)**	*Spain*	*Chile*
Morocco	*Pakistan*	*Denmark*	*Sweden*	*Peru*
Nigeria	*Philippines*	*France*	*Switzerland*	*Uruguay*
Tunisia	*Republic of Korea*	*Germany*	*United Kingdom*	**Oceania (2)**
Asia (15)	*Russian Federation*	*Greece*	**North America (3)**	*Australia*
China	*Saudi Arabia*	*Ireland*	*Canada*	*New Zealand*
India	*Singapore*	*Italy*	*United States*	
Indonesia	*Sri Lanka*	*Netherlands*	*Mexico*	
Japan	*Thailand*	*Poland*	**South America (4)**	

Source: UN COMTRADE (2014)

7 Results and Discussion

7.1 Stochastic Frontier Gravity Model

The Stochastic Frontier Gravity Model in equation (1) has been estimated using the Frontier 4.1 software. The estimated results of the drivers of Bangladesh's EGs export are presented in Table 4.

Table 4 **Maximum Likelihood Estimates of the Stochastic Frontier Gravity Model** (Dependent variable: Bangladesh's total exports of EGs in logarithm)

Category	**2001**	**2007**
Constant	8.7259 (1.3234)	11.7829 (3.2264)
Ln GDP_j	0.3837** (0.1770)	0.2181** (0.1036)
Ln $Population_j$	0.3677** (0.1679)	0.4386*** (0.0336)
Ln $Distance_{i,j}$	-1.1713*** (0.3262)	-1.2308*** (0.3095)
$Tariff_j$	-0.00086 (0.01310)	-0.0901** (0.0412)
Ln Exchange $rate_{i,j}$	0.1301*** (0.0512)	0.2563** (0.1488)
$RTA_{i,j}$ dummy	0.5824*** (0.1459)	1.9062*** (0.4190)
σ^2	3.2899*** (0.64244)	4.1451** (2.2515)
γ	0.9999*** (0.3716)	0.9999*** (0.1995)
Log likelihood	-56.93	-56.25
Number of observations	41	41

Note:
*****, **** show the significance level at 1% and 5% respectively.
Figures in parentheses are standard errors of estimates.

The estimated results in the Table 4 conform to the gravity model, and show that the income and size of the partner countries has a statistically positive influence on the exports of Bangladesh's EGs. Distance is also an important determinant by showing statistical significance and negative value, as expected from the gravity model. Tariff

was not a significant variable determining the EGs export in Bangladesh for 2001. But it shows a statistically significant and negative impact in 2007. Both exchange rate and regional trade agreement are significant variables in the model and exhibits positive influences on EGs exports in Bangladesh.

The result also indicates that both sigma-squared (σ^2) which is a measure of mean total variation and gamma (γ) that is the ratio of variation due to 'behind the border' constraints to total variation are statistically significant in period 2001 and 2007. Thus, sigma-squared (σ^2) implies that the potential EGs exports of Bangladesh have been changing (not constant) over time. Besides, larger gamma (γ) coefficient which is close to 1 indicates that the influence of 'behind the border' constraints are present and these are responsible for a big proportion of mean total variation in the model. This further suggests that 'behind the border' constraints prevent Bangladesh from reaching its EGs export potential.

7.2 Export Potential

The potential export estimation of EGs based on the stochastic frontier gravity model for all partner countries is presented in Table 2 of Appendix. Export potential has been calculated by multiplying the coefficients with the respective determinants of EGs export. The results show that Bangladesh's EGs export potential was higher than its actual export with all its trading partners during the estimated period. The highest gap between potential and actual export was obvious for China in 2001 and Singapore in 2007. India, Pakistan, Indonesia, Jordan, Russia and Tunisia were the key partners that offered substantial potential for Bangladesh's export in EGs. In the South Asian region, the unexplored market for EGs was Sri Lanka. Considering East Asian countries, Bangladesh was far away from reaching its potential. Only 16 per cent of China's market had been realized in 2007. The situation worsened in 2001 with about 2 per cent realization. The results reveal poor performance, except Indonesia, of Bangladesh's EGs exports with ASEAN countries during the period. The Singapore market was unrealized with the highest extent amongst all the ASEAN countries. There is significant scope for the EGs of Bangladesh to explore EU markets. To be specific, Denmark, Switzerland, Sweden, the United Kingdom and Italy project higher potential.

Comparing the realisation of EGs export potential of 2007 with 2001, a significant increase is observed for East Asian countries. This matches with establishing the 'look east' diplomacy of Bangladesh with the East Asian countries in early 2000s (Firdaus, 2011). However, realising potential export decreases for ASEAN countries. On the other hand, most of the EU countries show higher realisation of EGs export potential in 2007 than that of 2001. A group of countries like Australia, Canada, Brazil, Turkey, United Kingdom, Malaysia and Sri Lanka show lower trend in realizing EGs export potential between period 2001 and 2007.

7.3 Growth Decomposition

A key objective of estimating the stochastic frontier gravity model is to measure the influence of 'behind the border' constraints on export potential. All other associated constraints can also be found. Hence, Bangladesh's EGs export growth between 2001 and 2007 has been decomposed for all the major exporting countries (Table 3 in Appendix). The decomposition shows that 'behind the border' constraints have negative impacts on the EGs export growth of Bangladesh for a large number of countries. In general, due to 'behind the border constraints' Bangladesh fails to reach its potential exports in Sri Lanka, Singapore, Thailand, Malaysia, Switzerland, the United Kingdom and Australia. More importantly, 'behind the border' constraints are more evident for the ASEAN and EU market. On the other hand, Bangladesh's EGs export growth during the period 2001-2007 has been positively influenced in China, Malaysia, Indonesia, the Philippines, Turkey and Tunisia for reducing their 'implicit beyond the border' constraints. Interestingly, 'explicit beyond the border' constraints have been reduced by most of the countries during the estimated period for which positive export growth took place in Bangladesh.

8 Conclusions

The export of EGs in Bangladesh is dominated by a few products and the export destination is concentrated in neighbouring countries. This analysis, applying the stochastic frontier gravity model, finds that the exports of Bangladesh EGs is positively affected by GDP and population of partner countries, cross exchange rate of Bangladesh

currency with respect to the partner country and regional trade agreements. In contrast, geographic distance and tariff project negative influences on Bangladesh EGs exports. An important finding of this paper is that it did not find enough evidence to identify tariff significant in case of EGs exports of Bangladesh. The potential export calculation of this study reveals that East Asian and ASEAN countries are far from realizing the export potential of Bangladesh. However, the 'look east' diplomacy of Bangladesh helped increase a higher realization in 2007 compared with 2001. Furthermore, export growth decomposition between 2007 and 2001 identifies that 'behind the border' constraints for the case of ASEAN and EU countries were higher than other regions in Bangladesh and caused negative bearing on EGs exports. Reducing 'implicit beyond the border' constraints and 'explicit beyond the border' constraints by the partner countries has resulted in positive EGs export growth in Bangladesh.

To facilitate the export of EGs, Bangladesh needs to diversify its product basket. Exploring the market of industrialized countries may increase exports. It is evident that 'behind the border constraints' deters Bangladesh from reaching its export potential. To reduce 'behind the border constraints' Bangladesh needs to update its exporting firms with the latest regulations and requirements in line with other importing countries, create separate zones for the production of EGs, and enhance port and custom facilities. For addressing 'implicit beyond the border constraints' and 'explicit beyond the border constraints' Bangladesh Mission abroad needs to play a more proactive role.

There are some limitations to this study. First, a lack of extensive data availability for which this study has used the average of two years (estimated year and the previous year) export data while other variables are for single year. Second, this paper could not identify specific 'behind the border constraints' due to lack of uniform data. Third, the effect of price change (terms of trade effect) has not been taken into account in finding the change of 'implicit beyond the border constraints', also because of unavailability of adequate data. Therefore, future research can be done by incorporating terms of trade (TOT) effect into the model and separate this effect from 'implicit beyond the border' constraints.

Appendix

Table 1 **Category-wise Bangladesh EGs' Export to World in USD (2007-1997)**

Category	2007	2006	2005	2004	2003	2002	2001
1	1658917	932013	995415	487399	509987	505118	576707
2	14190629	9507639	4201528	1429390	1821688	6209473	3494579
3	544729	668934	209135	536250	16962	-	9873
4	11856871	3978369	1543480	1294311	1607447	1289466	907211
5	117460	4637	19630	25405	72488	10761	568
6	4918196	1945979	6402715	1091996	407593	615354	797970
7	299698813	253266425	227033489	166106245	127088226	204446008	130089801
8	34635	1716	199	416	-	7200	-
9	138432	6496	1208578	645548	508932	553778	50906
10	9501274	110028	33556	354672	67844	38669	1409
11	5767346	629528	674746	808964	558759	2428146	1329970
12	2348733	701161	49591	138696	54061	125660	33532
Total	350776035	271752925	242372062	172919292	132713987	216229633	137292526

Source: Author's Calculation

1. Air pollution control
2. Management of solid and hazardous waste and recycling systems
3. Clean up or remediation of soil and water
4. Renewable energy plant
5. Heat and energy management
6. Waste water management and portable water treatment
7. Environmentally preferable products, based on end use or disposal characteristics
8. Cleaner or more resource efficient technologies and products
9. Natural risk management
10. Natural resources protection
11. Noise and vibration abatement
12. Environmental monitoring, analysis and assessment equipmen

Table 2 **Export Potential of EGs in 2001 and 2007 (Thousand USD)**

No	Country	Actual Export		Potential Export		Export Gap		Ratio of Actual to Potential (%)	
		2001	2007	2001	2007	2001	2007	2001	2007
1	India	41240.44	52158.62	72987.74	58002.74	31747.30	5844.12	56.50	89.92
2	Pakistan	21308.15	54935.48	21396.00	54972.49	87.85	37.00	99.59	99.93
3	Sri Lanka	541.72	411.04	4892.26	4917.75	4350.54	4506.70	11.07	8.36
4	China	2250.16	44482.21	116823.76	273254.10	114573.60	228771.89	1.93	16.28
5	Japan	5143.27	8119.34	16946.80	13457.31	11803.52	5337.96	30.35	60.33
6	South Korea	820.54	2238.78	9631.39	10192.64	8810.85	7953.86	8.52	21.96
7	Singapore	7632.53	1846.59	101419.32	265448.89	93786.79	263602.31	7.53	0.70
8	Thailand	9875.03	5842.80	27162.59	55110.62	17287.56	49267.83	36.36	10.60
9	Indonesia	8311.00	11940.54	8317.55	12835.34	6.55	894.80	99.92	93.03
10	Malaysia	1043.12	1217.16	13074.26	38842.68	12031.14	37625.52	7.98	3.13
11	Philippines	126.32	363.40	9934.80	28541.96	9808.48	28178.56	1.27	1.27
12	France	467.53	689.82	1648.18	1637.82	1180.65	948.00	28.37	42.12
13	Germany	1645.72	2217.68	6156.39	5686.63	4510.67	3468.96	26.73	39.00
14	Greece	613.28	1400.14	2523.91	2653.70	1910.64	1253.57	24.30	52.76
15	Ireland	78.60	220.00	1167.27	1334.31	1088.68	1114.31	6.73	16.49
16	Italy	792.37	1414.35	10288.81	7799.32	9496.43	6384.97	7.70	18.13
17	Netherlands	3655.96	5395.52	8648.44	6838.60	4992.48	1443.08	42.27	78.90
18	Poland	82.71	283.62	3769.47	2180.77	3686.76	1897.15	2.19	13.01
19	Portugal	225.66	117.51	1587.03	1455.02	1361.37	1337.50	14.22	8.08
20	Spain	1947.49	1422.82	3158.37	2681.80	1210.88	1258.98	61.66	53.05
21	Sweden	39.21	169.26	1086.97	889.68	1047.76	720.42	3.61	19.02

No	Country	Actual Export		Potential Export		Export Gap		Ratio of Actual to Potential (%)	
		2001	2007	2001	2007	2001	2007	2001	2007
22	Switzerland	365.51	188.95	2220.22	2242.74	1854.72	2053.79	16.46	8.43
23	United Kingdom	3631.22	1614.52	4657.97	5760.04	1026.74	4145.51	77.96	28.03
24	Denmark	267.93	52.82	10122.32	4643.44	9854.38	4590.62	2.65	1.14
25	Turkey	5593.86	14041.81	5606.63	16629.29	12.77	2587.48	99.77	84.44
26	Saudi Arabia	646.46	907.76	4807.75	3518.29	4161.29	2610.52	13.45	25.80
27	United States	9691.50	7695.68	20815.16	12656.14	11123.66	4960.46	46.56	60.81
28	Australia	2914.33	1845.92	2920.81	3234.75	6.48	1388.83	99.78	57.07
29	Canada	1196.26	528.65	3146.37	1831.50	1950.11	1302.86	38.02	28.86
30	New Zealand	250.94	303.30	566.37	626.60	315.44	323.30	44.31	48.40
31	Brazil	2207.61	1364.95	6972.99	13938.46	4765.39	12573.50	31.66	9.79
32	Chile	59.43	97.11	541.49	741.00	482.05	643.89	10.98	13.11
33	Egypt	2035.05	2124.53	7350.75	7533.11	5315.70	5408.58	27.68	28.20
34	Jordan	867.48	499.72	868.88	501.67	1.40	4422.80	99.84	99.61
35	Mexico	1130.48	1347.70	5553.28	5209.75	4422.80	3862.05	20.36	25.87
36	Morocco	253.74	642.75	1926.37	4832.71	1672.63	4189.96	13.17	13.30
37	Nigeria	1138.84	885.20	2509.99	1716.12	1371.15	830.92	45.37	51.58
38	Peru	325.58	105.59	1120.54	868.26	794.96	762.66	29.06	12.16
39	Russian Federation	4311.56	3318.82	7063.35	3499.00	2751.80	180.18	61.04	94.85
40	Tunisia	315.68	650.39	1738.35	723.68	1422.67	73.29	18.16	89.87
41	Uruguay	143.47	108.74	342.69	315.51	199.22	206.76	41.87	34.47

Source: Author's Calculation

Table 3 Export Growth Decomposition of Bangladesh EGs Export, 2001-2007

No	Country	2001-2007: Export growth due to changes in		
		BTBC (%)	IBTBC (%)	CD & EBTBC (%)
1	India	198	-1068	970
2	Pakistan	0.36	-72	171
3	Sri Lanka	-102	44	-42
4	China	71	4	25
5	Japan	151	-121	70
6	South Korea	94	-15	21
7	Singapore	-168	60	8
8	Thailand	-235	111	24
9	Indonesia	-20	6	114
10	Malaysia	-605	609	96
11	Philippines	0.13	91	9
12	France	102	-144	142
13	Germany	126	-151	125
14	Greece	94	-49	55
15	Ireland	87	-63	76
16	Italy	148	-101	53
17	Netherlands	160	-137	77
18	Poland	145	-147	102
19	Portugal	-87	-52	39
20	Spain	-48	-161	109
21	Sweden	114	-42	29
22	Switzerland	-101	-41	42
23	United Kingdom	-126	-22	48
24	Denmark	-52	-63	15
25	Turkey	-18	92	26
26	Saudi Arabia	192	-427	335
27	United States	116	-284	68
28	Australia	-122	-127	150
29	Canada	-34	-83	17
30	New Zealand	47	-267	320
31	Brazil	-244	29	115
32	Chile	36	-57	121
33	Egypt	43	-1853	1910
34	Jordan	-0.41	-252	152
35	Mexico	136	-448	412
36	Morocco	1	-97	196
37	Nigeria	51	-838	687
38	Peru	-77	-46	23
39	Russian Federation	168	-331	63
40	Tunisia	221	209	-330
41	Uruguay	-70	-33	3

Source: Author's Calculation

References

Aigner, D, Lovell, AK & Schimdt, P 1977, 'Formulation and estimation of stochastic frontier production models', *Journal of Econometrics*, vol. 6, no. 1, pp. 21-37.

Aitken, ND 1973, 'The effect of the EEC and EFTA on European trade: a temporal cross-section analysis', *The American Economic Review*, vol. 63, no. 5, pp. 881-892.

Anderson, JE 1979, 'A theoretical foundation for the gravity equation', *The American Economic Review,* vol. 69, no. 1, pp. 106-116.

Armstrong, S 2007, 'Measuring trade and trade potential: a survey', Asia Pacific Economic Paper, no. 368, Australia-Japan Research Centre, Crawford School of Economics and Government , ANU College of Asia and the Pacific, viewed 21 May 2014,
<http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1760426>.

Balineau, G & Melo, JD 2013, 'Removing barriers to trade on environmental goods: an appraisal', World Trade Review, vol. 12, no. 4, pp. 693-718.

Bergstrand, JH 1985, 'The gravity equation in international trade: some microeconomic foundations and empirical evidence', *The Review of Economics and Statistics*, vol. 67, no. 3, pp. 474-481.

Coelli, TJ 1996, 'A guide to FRONTIER version 4.1: a computer program for stochastic frontier production and cost function estimation', CEPA Working Papers, no. 7, Department of Econometrics, University of New England, Australia, viewed 21 February 2014,
<http://www.une.edu.au/econometrics/cepawp.htp>.

Deardroff, AV 1998, 'Determinants of bilateral trade: does gravity work in a neoclassical world?', in JA Frankel (ed.), *The regionalization of the world economy*, University of Chicago Press, Chicago, pp. 7-32.

Drysdale, P, Huang, Y & Kalirajan, K 2000, 'China's trade efficiency: measurement and determinants', in P Drysdale, Y Zhang & L song (eds), *APEC and liberalization of the Chinese economy*, Asia Pacific press, Canberra, pp. 259-271.

Eagger, P 2008, 'On the role of distance for bilateral trade', *The World Economy*, vol. 31, no. 5, pp. 653-662.

Firdaus, N 2011, 'Foreign policy options for Bangladesh', The Daily Star (online edition), 28 March, viewed 27 May 2014,
<http://archive.thedailystar.net/suppliments/2011/anniversary/part5/pg5.htm>.

Frankel, JA, Stein, E & Wei, SJ 1997, *Regional trading block: in the world economic system*, Institute for International Economics, Washington, DC.

GED, see General Economics Division
General Economics Division 2011, *Sixth five year plan FY 2011- FY 2015: accelerating growth and reducing poverty*, General Economics Division, Planning Commission, Ministry of Planning, Government of People's Republic of Bangladesh, Viewed 15 May 2014,
<http://www.plancomm.gov.bd/wp-content/uploads/2013/09/SFYP-Final-Part-1.pdf>.

Gunter, BG, Jahan, MS & Rahman, AFMAG 2011, 'Papermaking from jute: a win-win solution for Bangladesh', *Bangladesh Economy in 21st Century*, pp. 85-103.

Hamwey, RM 2005, 'Environmental goods: where do the dynamic trade opportunities for developing countries lie?', ICTSD Working Paper, International Centre for Trade and Sustainable Development, Geneva, viewed 12 May 2014,
<http://www.ictsd.org/downloads/2008/08/hamway.pdf>.

Harrigan, J 2001, 'Specialization and the volume of trade: do the data obey the laws?', NBER Working Paper, no. 8675, Cambridge, viewed 11 May 2014,
<http://www.nber.org/papers/w8675.pdf>.

Hossain, MA & Alauddin, M 2005, 'Trade liberalization in Bangladesh: the process and its impact on macro variables particularly export expansion', *The Journal of Development Areas*, vol. 3, no. 1, pp. 127-150.

Howse, R & Bork, PBV 2006, 'Options for liberalising trade in environmental goods in Doha Round', ICTDS Issue Paper, no. 2, International Centre for Trade and Sustainable Development, Geneva, viewed 12 May 2014,
<http://www.ictsd.org/downloads/2008/04/egshowse_bork.pdf>.

Jha, V 2008, 'Environmental priorities and trade policy for environmental goods: a reality check', ICTSD Issue Paper, no. 7, International Centre for Trade and Sustainable Development, Geneva, viewed 15 May 2014,
<http://www.ictsd.org/downloads/2012/03/environmental-priorities-and-trade-policy-for-environmental-goods.pdf>.

Jones, BF & Olken, BA 2010, 'Climate shocks and exports', NBER Working Paper, no. 15711, National Bureau of Economic Research, Cambridge, viewed 10 May 2014,
<http://www.nber.org/papers/w15711>.

Kaliranjan, K 2007, 'Regional cooperation and bilateral trade flows: an empirical measurement of resistance', *The International Trade Journal,* vol. 21, no. 2, pp. 85-107.

Kalirajan, K & Findlay, C 2005, '*Estimating Potential Trade Using Gravity Models: A Suggested Methodology'*, Foundation for Advanced Studies on International Development, Tokyo.

Khan, IU & Kalirajan, K 2011, 'The impact of trade costs on exports: an empirical modelling', ASARC Working Paper, no. 7, GRIPS-FASID Joint Graduate Program, National Graduate Institute for Policy Studies, Tokyo, viewed 21 May 2014,

<https://crawford.anu.edu.au/acde/asarc/pdf/papers/2011/WP2011_07.pdf>.

Khatun, F 2012, 'Trade in environmental goods by least developed countries: issues for negotiations', *South Asia Economic Journal*, vol. 13, no. 2, pp. 157-182.

Lendo, E 2005, 'Defining environmental goods and services: a case study of Mexico', ICTSD Issue Paper, no. 1, International Centre for Trade and Sustainable Development, Geneva, viewed 20 May 2014,
<http://www.cbd.int/financial/pes/mexico-pesdefining.pdf>.

Linder, SA 1961, *An essay on trade and trans formation*, John Wiley & Sons, New York.

Linnemann, H 1966, *An econometric study of international trade flows*, North-Holland Publishing Company, Amsterdam.

Mayer, T & Zignago, S 2011, 'Notes on CEPII's distances measures: the GeoDist database', CEPII Working Paper, no. 25, French Research Center in International Economics, France, viewed 25 April 2014,
<http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6>.

Meeusen, W & Van den Broek, J 1977, 'Efficiency estimation from cobb-douglas production functions with composed error', *International Economic Review*, vol. 18, no. 2, pp. 435-444.

Nguyen, VS & Kalirajan, K 2013, 'Export of environmental goods: India's potential and constrains', ASARC Working Paper, no. 15, Crawford School of Public Policy, The Australian National University, viewed 25 May 2014,
<https://crawford.anu.edu.au/acde/asarc/pdf/papers/2013/WP2013_15.pdf>.

OECD, see Organization for Economic Co-operation and Development
Organisation for Economic Co-operation and Development 1999, *The environmental goods and services industry; manual for data collection and analysis*, Organisation for Economic Co-operation and development, viewed 28 May 2014,
<http://unstats.un.org/unsd/envaccounting/ceea/archive/EPEA/EnvIndustry_Manual_for_data_collection.PDF>.

Roemer, JE 1977, 'The effect of sphere of influence and economic distance on the commodity composition of trade in manufactures, *The Review of Economics and Statistics*, vol. 59, no. 3, pp. 318-327.

Schmid, G 2012, 'Technology transfer in the clean development mechanism: the role of host country characteristics', Working Paper, Department of Economics, university of Geneva, viewed 24 May 2014,
<http://www.unige.ch/ses/dsec/research/wps/12021.pdf>.

Silva, JMCS & Tenreyro, S 2003, 'Gravity-defying trade', *Federal Reserve Bank of Boston*, Boston, viewed 30 April 2014,
<http://www.bostonfed.org/economic/wp/wp2003/wp031.pdf>.

Stilwell, M 2008, 'Advancing the WTO environmental goods negotiations: options and opportunities', EcoLoMICS Occasional Paper, no. 8, Geneva, viewed 15 May 2014, <http://www.ecolomicsinternational.org/eops_08_1_matthew_stilwell_wto_ctess_environmental_goods_negotiations.pdf>.

Tamiotti, L & Olhoff, A 2009, *Trade and climate change*, World Trade Organization and United Nations Environmental Programme, Viewed 21 May 2014, <http://www.wto.org/english/res_e/booksp_e/trade_climate_change_e.pdf>.
Thomson Reuters Foundation 2014, 'Bangladesh seeks export privileges to US on climate vulnerability grounds', *Thomson Reuters Foundation* (online edition), 21 May, viewed 8 June 2014, <http://mygoldenbengal.wordpress.com/2014/05/21/bangladesh-seeks-export-privileges-to-us-on-climate-vulnerability-grounds>.

Tinbergen, J 1962, *Shaping the world economy*, Twentieth Century Fund, New York, United States of America.

UN COMTRADE Database, viewed 21 February 2014, <http://comtrade.un.org/>.

WDI, see World Development Indicators
World Development Indicators, viewed 25 February 2014, <http://data.worldbank.org/data-catalog/world-development-indicators>.

WTO, see World Trade Organization
World Trade Organization 2014, *Doha WTO ministerial 2001: ministerial declaration*, World Trade Organization, viewed 8 June 2014, <http://www.wto.org/english/thewto_e/minist_e/min01_e/mindecl_e.htm>.

_____ 2008, *Committee on trade and environment in special session*, World Trade Organization, viewed 23 May 2014, <https://docs.wto.org/dol2fe/Pages/FE_Search/.../77194/.../TN/TE/18.pd>.

Yoo, SH & Kim, J 2011, 'Trade liberalization in environmental goods: major issues and impacts', *Korea and the World Economy*, vol. 12, no. 3, pp. 579-610.