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Bangladesh's trade in climate smart goods: An analysis of trends trading patterns and determinants

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Abstract

Trade and environment are complex issues. In one hand, trade contributes to promote economic growth and development, but at the same time it is also responsible to generate greenhouse gases. On the other hand, by exporting and importing CSGs, trade contributes to abate greenhouse gas emissions. To ensure sustainable development, it is essential to expand the market for CSGs. It could also be beneficial for Bangladesh to promote trade in CSGs through policy incentives, but not at the cost of other established export sectors. This study has been conducted with the main objective of analyzing the trend and trading patterns of CSGs of Bangladesh with the rest of the world and also estimating major determining factors that influence trade in CSGs by Bangladesh. Based on the collected data covering the period of 1989 to 2007, the analyses indicate that total trade in CSGs has been found increasing but the percentage share by trade in CSGs was still negligible compared to the total trade by the country services. Bangladesh's export and import of CSGs are dominated by few products and destinations are mostly concentrated on countries like the USA, the UK, Japan, France Monaco, Italy, Hong Kong, Singapore, Indonesia, India, Netherlands and China. In case of determinants of trade in CSGs by Bangladesh, which have been estimated using three different econometric models the findings suggest that for both export as well as import of climate smart goods are significantly influenced by GDP percapita, Exchange rate, GDP deflator, Tariff rate, and Population growth rate in the long run. On the other hand, tariff and exchange rate are found to have no significant impact on export of CSGs.

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Introduction

Climate change is considered as one of the recent burning issues, which has drawn unprecedented global attention. Despite having considerable debates and criticisms about the extent of climate change, anticipated impacts or responsibilities, it is now an established fact that the global climate has been changing and most of the vulnerable countries are those who are poor and not responsible for this change. According to the IPCC's 5th Assessment Report (AR5, 2014), recent climate change is caused by anthropogenic reasons. Total anthropogenic greenhouse gases have been increasing, quite drastically since 1970. Though various mitigation policies have been adopted across the states, things are still far behind a satisfactory level. It is now universally recognized that most of today's developed countries along with a few large fast growing developing economics are mostly responsible for today's climate change, but the worst affected parties are the most economically and technologically weak countries, who are not capable alone to deal with this demon without external help and assistance. Considering the vastness of its impacts and possible casualties, action to mitigate its consequences and adapt with such changes would require gigantic efforts from all possible sources. Facing climate change necessitates actions in both the fronts of mitigation and adaptation. Mitigation is needed as the pace of climatic change needs to be immediately arrested by reducing carbon emissions, while adaptation is required to adjust with the changing situations with minimum consequences. Trade in this context can play a significant role via making available of goods and technologies needed to address climatic concerns and making ethical business that also addresses social concerns. Two types of trade related mitigation plans have been observed in recent years: (i) border carbon adjustment; and (ii) liberalization of climate-friendly environmental goods and services. The UNESCAP, in this regard, has listed 64 climate smart goods (CSGs) and technologies indicated at HS-6 digit codes for future analyze of such goods and technologies and policy consideration.

Although countries like Bangladesh may not share a significant percentage of its trade on climate smart goods, considering its increasing demand for climate adaptation and in certain cases mitigation in one hand and increasing contribution to its GDP by export sector in recent years with an urge to diversify its export sector for a greater sustainability, as assessment of trade in climate smart goods by the country resumes high significance. This may not only help us in assessing its current position in trade in CSGs, but is also expected to help in suggesting timely policy inputs in this regard.

With changes in climatic conditions and Bangladesh being one of the vulnerable most countries globally, trade in climate smart goods and technologies in recent years are expected to be in rapid increase. It is to be mentioned here that climate smart goods and services are products design to measure, prevents, limit minimize or correct the environmental impact from carbon emission (ESCAP, 2011). It is also called environmental goods or environmental friendly goods. The main objective to promote climate smart goods is to reduce environmental damages. To achieve sustainable growth and development, it is necessary to focus on closer attention to the trade and investment of the climate smart goods and services in the present context and the case of Bangladesh may not be different. Bangladesh imports majority of the CSGs from different countries of the world, while exports almost a negligible amount compared to its total export volume. Based on the data it is found that the country has a sharp trade deficit in case of CSGs and technologies. It is also cognizable that with time this trade deficit might further aggravate as the country now focuses more on climate mitigation and adaptation works, which require such goods and technologies. Against this backdrop, this study is designed to understand the trend, pattern and determinants of trade in climate smart goods involving Bangladesh. The rest of the paper has been organized as follows: *section two* has been designed to review important literatures on trade and trading patterns, on CSGs, EGs and other tradable goods. Section three explains the methodology that the study has been used. Section four of this study presents the findings whereas sections five concludes.

Literature review

Current studies on Climate smart goods and services concentrates on issues and concerns of regional and interregional trends and trading patterns of CSGs, and EGs trade only; no effort has been made to highlight the concerns of trends and trading patterns of CSGs trade of Bangladesh. Crowford (2011) showed that from 2002 to 2008 the export of CSGs in Asia and the Pacific was estimated to be as high as a 235 percent growth and the import of CSGs was found to be increased by 222 percent whereas UNESCAP (2011) compared to total world export and import to the percentage share of export and import of CSGTs rose marginally from 2.5 percent in 2002 to 2.7 percent in 2008 and 2.4 percent in 2002 to 2.6 percent in 2008, respectively. UNCTAD (2003) found that international trade flows in EGS seems to be increasing, but it is clear that trade in EGs is not rising as fast as it increased earlier.

Few studies focus on the least developed country's status in CSGs export and import. Kuriyama (2012) and Khatun (2012) mentioned that exports and imports of environmental goods for the least developing economies grew at higher rate than the growth of world trade on environmental goods. Dean (1999), Antweiler *et al.* (2001), Dasgupta *et al.* (2002), Duy (2010) and Zhang (2011) concentrates on the issues on the impact of trade liberalization on environmental goods. Trade liberalization has increased environmental degradations, mainly because of soft environmental regulations across the developing countries. On the contrary, trade liberalization enhances income growth and income growth has a potential effect on environment. Bora *et al.* (2004), Jha (2008), Viljoen (2012), observed that growth in the trade of environmental goods had been significant but their share in world trade was negligible. The trade of environmental goods (EGS) grew rapidly but this rate was accounted for one fifteenth of the global EGs market.

The ratio of export to import rose from 0.36 in 1996 to 0.52 in 2001 in the developing countries, while the ratio for the developed countries were found to be 1.39 to 1.25 in 1996 to 2001, respectively.

To analyze the determinants of trade and trade in climate smart goods several studies uses gravity model. By using a Stochastic Frontier Gravity Model for analyzing determining factors of trade in environmental goods by Bangladesh, Ahsan *et al.* (2014) used five explanatory variables, namely gross domestic product (GDP) as proxy for income, population, distance, tariff rate and exchange rate.
The findings of the study suggest that the dummy variable was statistically significant in the model, implies that regional trade agreement plays an important role in the expansion of trade.

To estimate the trade potential of CSGTs in 2008 UNESCAP (2011) used a Gravity model. Tariff reduction played an important role to increase the trade volume. But in the case of CSGTs trade, regression results showed that tariffs tended to have no significant impact on CSGTs' import. Mathur (2011) used extended gravity model to analyze the ESCAP countries trade in CSGs with the host countries. The study found a weak positive impact of regional trade agreements, mitigation policy and infrastructure on import of CSGs. Deardroff (1997) used a simple gravity equation of trade explains that bilateral trade is a function of income and distance between two countries. To explain Bangladesh's trade with its major trading partners Rahman (2003) applied gravity model while UKessays (2003) used a gravity equation framework to predict the trade volume for the Asian developing and transition economies The generalized gravity model identified that the volume of trade between countries is a function of income (GNPs or GDPs), population, distance, and a set of dummy variables either facilitating or restricting trade between pairs of countries. Linneman (1966) extend the gravity model. He viewed that if a preferable commodity composition fits between two countries, then larger trade flow can exist. Linder (1966) made an alternative hypothesis in international trade and proposed that countries would trade more with similar income levels.

Except Gravity Model, diverse time serious econometric techniques are also uses to explain the determinants of trade and trade in CSGs and EGs trade.

Lai *et al.* (2004) introduced monopolistic competition model to estimate bilateral trade flow whereas Jha (2008) used the robust standard errors to estimate the elasticity of trade in EGs. Rahman *et al.* (2012) applied an ARDL bound F-test model for estimating determinants of bilateral agricultural trade between Bangladesh and India.

Materials and methods

Theoretical framework

Bivariate analysis suggests how two variables relate to each other. In a bivariate analysis we examine what type of associationship or causality exists between a dependent and an independent variables. To check whether the variables have associationship and moving together over the time span we use a cointegration analysis. The Johansson cointegration test denotes that there is a cointegrating relationship among the variables at rank zero. This indicates that all of the variables have correlation in the long run.

Similarly, variance decomposition in a fitted VAR indicates that the percentage of the forecasted error variance of a particular variable is explained by exogenous shocks to the variables in the system. Granger causality, on the other hand, explains how dependent variable causes an independent variable and an independent variable causes a dependent variable.

Empirical Model Specification

The study has employed as many as three different methods, namely a bivariate analysis by using Johansen cointegration test, a bivariate Ganger causality test by using vector error correction model (VECM) and a variance decomposition analysis using vector autoregressive model (VAR) model for estimating the determinants of climate smart goods' export supply and import demand between Bangladesh with the rest of the world. After a careful consideration of interrelationship among various climate smart goods' export supply and import demand variables, this study finally considered GDP, GDP per capita, population, exchange rate and tariff rate as the determining factors for the long run export supply and import demand for climate smart goods trade between Bangladesh with the rest of the world.

As the dataset in the current case is small- covering just a period of 19 years which seems to be smaller in case of a time serious analysis and thus a multivariate modelling approach is unlikely to produce reliable results. Hence, we adopt a bivariate modelling approach to estimate the variables exerting significant impacts on exports and imports of climate smart goods by Bangladesh.

On the other hand, the bivariate cointegration analysis using the Johansen's procedure (1991) along with variance decomposition and the Granger causality techniques have been applied to find out the determinants of exports and imports of CSGs by Bangladesh.

Data Sources

Data were collected covering the period of 1989 to 2007 (19 years). All observations were annual and at HS 6-digit level. Data on trade has been extracted from UN Comtrade and UNCTAD sites. Data on GDP, GDP per capita, population and GDP deflator were obtained from WDI of the World Bank. Data on tariff and exchange rate were obtained from the World Bank. GDP and GDP per capita are measured in current US dollar. Population are considered in million. Total exports and imports of climate smart goods are measured in thousand US dollar. Data on exchange rates are used in BDT per US dollar; and certain missing information has been taken from Export Promotion Bureau (EPB), Foreign Trade Section, BBS and annual Export Receipts (AER) and Import Payments (AIP) reports of Bangladesh Bank.

Results and discussion

Trends of Trade in Climate Smart Goods by Bangladesh with the Rest of the World

Global and regional trade in CSGTs is rising, but still represents merely a 3 percent of both global and regional trade, respectively. In 2008 the share of CSGTs in world export was estimated to be 2.7 percent whereas the import was estimated to 2.6 percent (UNESCAP, 2011). Bangladesh's exports and imports of climate smart goods was largely characterized by the mix of developed and developing countries.

From the Table 1, it can be seen that except for 2002, Bangladesh's total trade had been increasing from 1989 to 2007. In 2002 total trade was found to be slightly decreasing; but after that it once again started to increase. In case of climate smart products, trade volume had also been increasing. Though both the overall trade and trade in climate smart goods had been increasing during that period, the percentage share by climate smart goods was estimated to be very low compared to its total trade.

Table 1. Total trade and trade in climate smart goods by Bangladesh.

Year	Total Trade of Bangladesh (all goods; Merchandise trade Million USD)	Total CSG Trade of Bangladesh (000 USD)	Percentage Share of CSGs in Bangladesh's Total Trade
1989	4955	56257.576	0.0011354
1990	5289	105788.947	0.0020002
1991	5101	92149.521	0.0018065
1992	5830	111069.255	0.0019051
1993	6272	94028.499	0.0014992
1994	7263	78529.291	0.0010812
1995	10195	65640.243	0.0006438
1996	11281	106563.044	0.0009446
1997	12095	88355.971	0.0007305
1998	12616	97568.119	0.0007734
1999	13828	106269.307	0.0007685
2000	15272	114970.471	0.0007528
2001	15098	160027.417	0.0010599
2002	14741	115369.77	0.0007826
2003	17424	131463.78	0.0007545
2004	20341	204467.144	0.0010052
2005	23186	287221.669	0.0012388
2006	27836	328703.671	0.0011809
2007	31049	319831.691	0.0010301

Source: Author calculation based on data collected from UNCTAD & UN Comrade (2010) extracted by World Integrated trade solution (WITS), accessed in the month of August 2014.

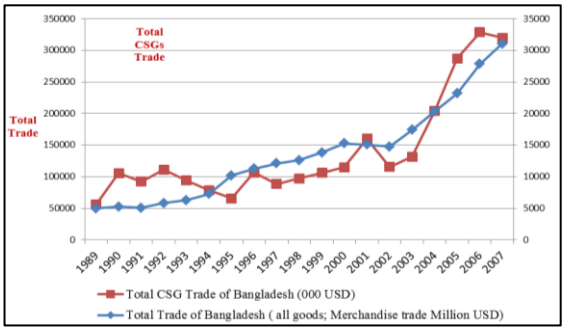

Fig. 1. Total trade and total CSGs trade by Bangladesh for the study period.
Source: Author's calculation based on UNCTAD & UN Comrade (2010) extracted by World Integrated Trade Solution (WITS), accessed in August 2014.

Fig. 1 shows an upward trend in the total trade of Bangladesh, which reflects an increasing trade driven growth for the Bangladesh economy. In case of CSGs trade it can be seen that trade in climate smart products remained quite fluctuating from 1989 to 2001, although such changes were not so significant in nature. The main reason behind this fluctuation was that the concept of climate smart goods was indeed a new one and introduced only in 2002. After 2001, trade in climate smart products started to increase and continued. The main driving force behind this upward trend in the trade in CSGs was increasing global awareness or concern about environmental issues.

The Fig. 2 below illustrates that an upward trend had been observed in the case of total export earnings from all goods by Bangladesh; which has been rising continuously. Bangladesh's exports are mainly dominated by readymade garment products (RMGs). Three quarters of Bangladesh's exports were readymade garments (World Bank, 2006). In FY2008-09 total export earning was Tk. 1074992 million, of which garments sector alone contributed Tk. 849672 million.

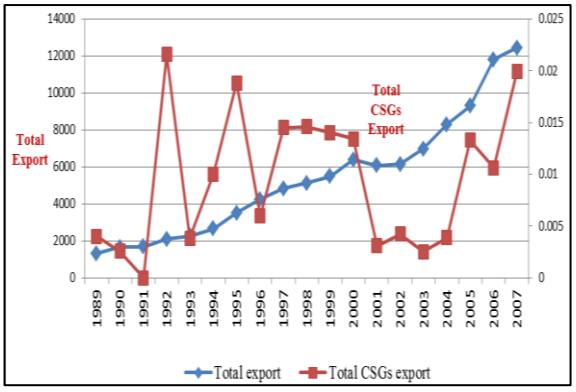

Fig. 2. Bangladesh's export values with the rest of the world (in million USD).

Source: Author calculation based on UNCTAD, UN Comrade (2010) extracted by World Integrated trade solution (WITS) and Foreign Trade Section, BBS accessed in August 2014.

Base for overall exports was considered from the left to right (along the X-axis), while for climate smart goods, it's been right to left in the Fig.

Trade in climate smart goods by Bangladesh had experienced considerable volatility in between 1989 to 1997. The pattern of export of CSGs to the rest of the world market has been changing quite significantly after 1997, particularly since 2000.

A comparative analysis of Bangladesh's export values (of CSGs and other goods) since 1989 showed that the export of CSGs fluctuated until 1996. After 1996, the export of climate smart products started rising and then remained at a consistent level until 2000.

In 2001 exports of CSGs fell quite drastically once again. However, since then exports have started to increase quite remarkably mainly because of higher opportunities in the global market.

Fig. 3 below showed that an increasing trend has also been observed in case of total import payments by Bangladesh. In the same way, imports of climate smart goods by Bangladesh were also in an increasing trend. The fluctuations of imports were quite less compared to export by Bangladesh. Bangladesh's CSGs import basket was dominated by a few products. Among them machine and mechanical appliances and articles of plastics and arts of others materials were the two most important items.

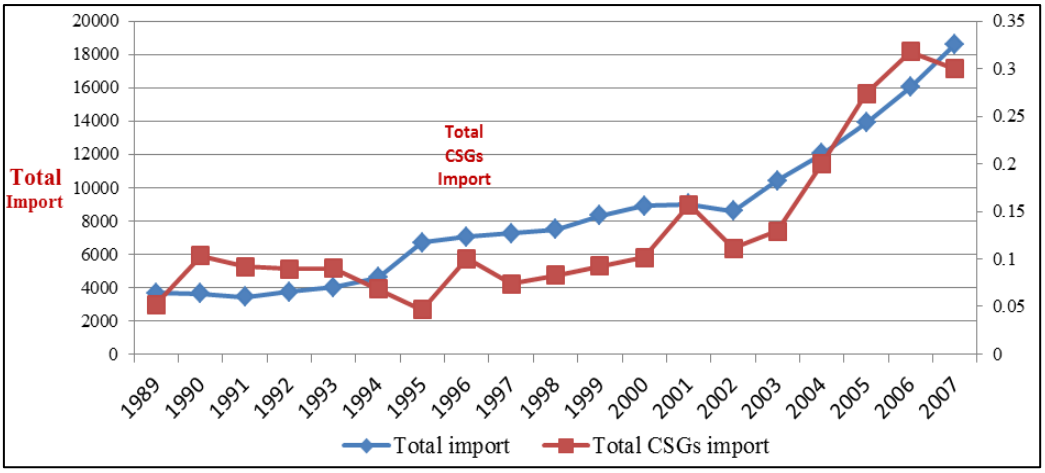

Fig. 3. Bangladesh's import values with rest of the world (in million USD).

Source: Author calculation based on UNCTAD, UN Comrade (2010) extracted by World Integrated trade solution (WITS) and Foreign Trade Section, BBS accessed in August 2014.

Patterns of CSGs trade between Bangladesh and the rest of the world

Bangladesh's export scuttle of CSGs to the global market is undoubtedly confined, centralizing on a determinate number of items. Its exports of climate smart goods to the world market also have stayed exceedingly undiversified. Among the top five export items, the most commonly traded products were machine and mechanical applications, articles of plastic and arts of other materials, containers of any material for liquid or solid waste, including municipal or dangerous waste, instruments and apparatus for measuring or checking power without a recording device, and static converters, gas turbines of a power exceeding 5,000kW, etc.

Fig. 1 below shows that from 1989 to 2007 those CSGs that were frequently exported from Bangladesh and held the larger shares and earned higher trade values were machine and mechanical application having individual functions, articles of plastics and arts of other materials, parts of electric motors, generators, generating sets and rotary converters, electric discharge lamps fluorescent and mirrors of glass. Of these five items, machine and mechanical appliances having individual functions took the top position and held the major share and contributions by the remaining products were quite insignificant and almost negligible. This implies that despite Bangladesh has the opportunity of diversifying its climate smart goods' list as export items to the increasing global demand, the country has failed to reap the full benefits.

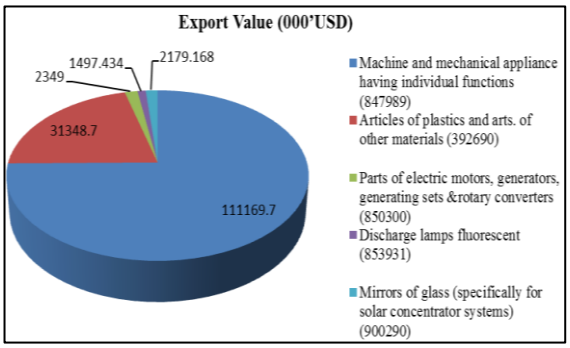

Fig. 4. Year-wise export values of the top five CSGs by Bangladesh (1989 to 2007).

Source: Author calculation based on UN Comtrade (2010.) extracted by World integrated trade solution (WITS), accessed in 2013.

It can also be said that Bangladesh's export of CSGs to the rest of the world as exhibited from the product lists indicates that exports of such products to the world market is mostly driven by individual interest and not policy driven. The government can explore the possibility of further expansion of export of CSGs after a careful assessment without harming the overall export.

The table 1 given above exhibits that Bangladesh's exports of climate smart products were highly concentrated in some countries such as Singapore, Japan, China, Indonesia, India, United Arab Emirate, Hong Kong, Areas nes, Sri Lanka, Pakistan, UK, USA and Korea. In 1989, total export value of climate smart products was $3992.726, of which $2583.217 from Singapore and $891.494 from Japan. Since 1989, export destinations are found to be by and large the group of countries, except for some changes. For example, besides Singapore and Japan, Indonesia and Hong Kong are the two other countries from Asia, France and UK from Europe, UAS from the North America maintained to be our major export destinations for climate smart goods. Besides, in recent years exports to South Asian neighbours like India and Sri Lanka are found to have added, although such exports volumes are not very significantly high. Fig. 2 below shows that from 1989 to 2007, climate smart products that were frequently imported by Bangladesh and held the larger share and earned higher trade values were mostly machine and mechanical application having individual function, articles of plastics and arts of other materials, electricity meters including calibrating meters, static converters and machinery, plant or laboratory equipment treat of mat by change of heat exchanger.

From the above pie chart it is seen that machine and mechanical appliances having individual function took the top position and holds the major share and the contributions by the remaining products were small compared to these two items. The Table 2 presented above shows the list of top five CSGs import items. It can be seen here that sources of Bangladesh's imports of CSGs continued to remain by and large almost similar in type. This includes machine and mechanical appliance, article of plastics, parts of electric motors, generators, generating sets & rotary converters (850300), etc. In case of sources of imports or Bangladesh's import partners for CSGs countries such as Japan, China, Korea, Hong Kong, India, Italy, German, UK, USA, France Monaco, etc. continued to dominate the list.

Table 2. Major climate smart export items by Bangladesh and their major destinations.

Year	Country Name	Items
1989	Singapore, Japan, Indonesia, UK, India	Machine and Mechanical appliance having individual functions (847989), Gas turbine of a power exceeding 5000kW (841182)
1990	Japan, UAE, Singapore, India, USA	Gas turbine of a power exceeding 5000kW (841182), Machine and Mechanical appliance having individual functions (847989)
1991	Malaysia	Electricity meters including calibrating meters (902830)
1992	Singapore, Japan, France Monaco, Italy, Sri Lanka,	Machine and Mechanical appliance having individual functions (847989), Gas turbine of a power exceeding 5000kW (841182),
1993	China, Singapore, USA, Japan, Hong Kong,	Machine and Mechanical appliance having individual functions (847989), Mirror of glass(specially for solar concentrator system)
1994	Rwanda, China, Japan, Hong Kong, Korea Republic	Machine and Mechanical appliance having individual functions (847989), Instruments and apparatus for measuring or checking power without a recording device (903039)
1995	Singapore, Japan, China, Myanmar, Sri Lanka	Machine and Mechanical appliance having individual functions (847989), Producer gas or water gas generator with or without purifiers (840510)
1996	Singapore, USA, Japan, Hong Kong, France Monaco	Machine and Mechanical appliance having individual functions (847989), Articles of plastics and arts of others materials (392690)
1997	Singapore, Japan, USA, Korea, China,	Machine and Mechanical appliance having individual functions (847989), Articles of plastics and arts of others materials (392690)
1998	Singapore, France Monaco, China, USA, Netherlands	Machine and Mechanical appliance having individual functions (847989), Gas turbine of a power exceeding 5000kW (841182)
1999	NA	NA
2000	Indonesia, Singapore, USA, UK, UAE	Machine and Mechanical appliance having individual functions (847989)
2001	Singapore, Japan, Malaysia, Belgium, China,	Machine and Mechanical appliance having individual functions (847989)
2002	Japan, China, UK, France Monaco, Indonesia	Machine and Mechanical appliance having individual functions (847989), Articles of plastics and arts of others materials (392690)
2003	UK, Kenya, Japan, Area nes, Sri Lanka	Parts of electric motors, generators, generating sets &rotary converters (850300), Articles of plastics and arts of others materials (392690)
2004	Areas nes, UAE, China, Korea, Pakistan	Articles of plastics and arts of others materials (392690), Photosensitive semiconductor device (854140)
2005	Areas nes, UAE, Pakistan, Sri Lanka, China	Articles of plastics and arts of others materials (392690), Machine and Mechanical appliance having individual functions (847989)
2006	Areas nes, India, China, Sri Lanka, Hong Kong	Articles of plastics and arts of others materials (392690), Other lead acid accumulators
2007	China, Areas nes, India, Singapore, Sri Lanka	Machine and Mechanical appliance having individual functions (847989), Articles of plastics and arts of others materials (392690)

Source: UN Comrade & WITS.

Determinants of CSGs trade between Bangladesh and the rest of the world

To identify the determinants that influence Bangladesh's trade in CSGs (export supply and import demand), the study has used three different methods, a bivariate analysis by using Johansen cointegration test, a Granger causality test using vector error correction model (VECM) and a variance decomposition analysis within vector autoregressive model (VAR), considering the complicacy that came in the way to estimate the determinants using a dataset of only 19 years.

Table 3. Major Climate smart import items and their major destinations.

Year	Country Name	Major Items
1989	Hong Kong, Korea, Japan, Fm German, Romania	Machine and mechanical appliance having individual functions (847989), articles of plastics and arts of others materials (392690)
1990	FM German, Hong Kong, Japan, Korea, Netherlands	Machine and mechanical appliance having individual functions (847989), articles of plastics and arts of others materials (392690)
1991	Japan, India, Hong Kong, Korea, Germany	Machine and Mechanical appliance having individual functions (847989), articles of plastics and arts of others materials (392690)
1992	Japan, Hong Kong, China, Korea, Asia others	Machine and Mechanical appliance having individual functions (847989), articles of plastics and arts of others materials (392690)
1993	Japan, Hong Kong, France Monaco, China, Italy	Machine and Mechanical appliance having individual functions (847989), Articles of plastics and arts of others materials (392690)
1994	NA	NA
1995	Hong Kong, China, USA, Korea, India	Articles of plastics and arts of others materials (392690), machine and mechanical appliance having individual function (847989), electricity meters including calibrating meters (902830)
1996	Chile, USA, Hong Kong, Japan, India	Producer gas or water gas generators with or without purifiers (840510), machine and mechanical appliance having individual functions (847989), articles of plastics and arts of others materials (392690)
1997	Japan, USA, India, Italy, China	Machine and Mechanical appliance having individual function (847989), electricity meters including calibrating meters (902830), parts of electric motors, generators, generating sets & rotary converters (850300)
1998	Hong Kong, Korea, Japan, Malaysia, Denmark	Machine and mechanical appliance having individual functions (847989), articles of plastics and arts of others materials (392690)
1999	NA	NA
2000	Hong Kong, India, Korea, Singapore, USA	Articles of plastics & others materials (392690), machine and mechanical appliance having individual function (847989)
2001	India, Italy, China, Hong Kong, Korea	Gas turbine of a power exceeding 5000kW (841182), machine and mechanical appliance having individual function (847989)
2002	United Kingdom, Korea, China, Hong Kong, Italy	Machine and mechanical appliance having individual function (847989), electricity meters including calibrating meters (902830)
2003	China, German, India, Asia others, Swaziland	Machine and mechanical appliance having individual function (847989), articles of plastics & others materials (392690)
2004	China, Ecuador, India, German, Netherlands	The major traded items were machine & mechanical appliances having individual function and parts of the boilers
2005	China, India, Italy, Others Asian Nations, Thailand	Machine & mechanical appliances having individual function (847989), machinery, plant or laboratory equip f treat of mat by change of temperature (841989)
2006	China, German, Asia others, India, Italy	Machine and mechanical appliance having individual function (847989), Primary cells & primary batteries (850680)
2007	China, Malaysia, India, Japan, Italy	Machine and mechanical appliance having individual function (847989), static converters (850440)

Source: UN Comrade & WITS.

Table 4.3.1 illustrates that there is a long run causality running from the explanatory variables to export. Frist considering the cointegration column, our estimate shows that there is a long run causality running from the explanatory variables to export. This indicates that export of climate smart goods is significantly influenced by *Lgdppercap, Lexrate, Linfgdp, Ltariff*, and *Lpopgr* in the long run.

Table 4. Summary of the pair-wise analysis for export supply.

Variables	Cointegration	Granger Causality	Variance Decomposition (in Year 10)
Lgdppercap	Yes	Yes	34.26197
Lexrate	Yes	No	5.825640
Linfgdp	Yes	Yes	60.02382
Ltariff	Yes	No	11.56255
Lpopgr	Yes	Yes	5.630396

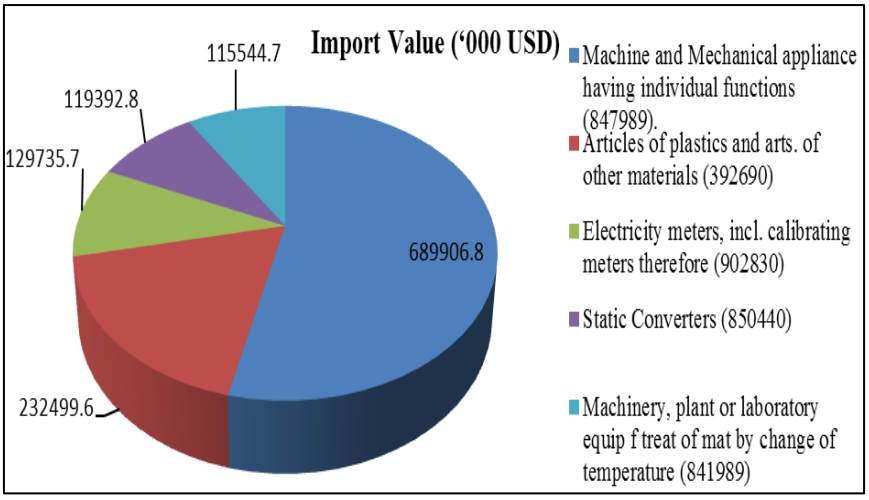

Fig. 5. Year-wise import values of the top five CSGs by Bangladesh (1989 to 2007).
Source: Author calculation based on UN Comtrade (2010.) extracted by (WITS), accessed in 2014.

But, if we look at the findings from the Ganger causality test and variance decomposition analysis, we can understand that *tariff* and *exchange rate* have no significant impact on climate smart goods' export and their variance decomposition is also very small. But *Lgdppercap, Linfldgp* and *Lpopgr* have significant impact on CSGs' export. In case of both *Linfgdp* and *Lgdppercap* the variance decomposition is very high; the two variables have strong impact on export of CSGs.

Table 5. Summary of pair-wise analysis for import demand.

Variables	Cointegration	Granger Causality	Variance Decomposition (in Year 10)
Lgdppercap	Yes	Yes	95.36515
Lexrate	Yes	No	4.033986
Linfgdp	Yes	Yes	5.318773
Ltariff	Yes	No	51.50071
Lpopgr	Yes	Yes	40.88105

Table 5 above illustrates that there is a long run causality running from the explanatory variables to import. First, considering the cointegration column, our estimate shows that there is a long run causality running from the explanatory variables to import.

This indicates that Bangladesh's import of climate smart goods is significantly influenced by *Lgdppercap, Lexrate, Linfgdp, Ltariff* and *Lpopgr* in the long run. But if we look at the findings of the Ganger causality test, it is found that *tariff* and *exchange rate* have no significant impact on imports of climate smart goods, but the variance decomposition is very high for *tariff*. *Lgdppercap, Linfldgp* and *Lpopgr* have significant impact on imports of CSGs in case of Bangladesh. In case of *Lgdppercap* the variance decomposition is found to be very high; which implies that the variable has a strong impact on imports of CSGs.

Conclusion

The main objective of this study has been to find out the trends, trading patterns and determinants of trade in climate smart goods between Bangladesh and the rest of the world. Based on the collected data the descriptive statistics indicate that the total trade in CSGs has been increasing with time, although the percentage share still remains quite negligible if compare with the total global trade volume. Bangladesh's exports and imports in climate smart goods are largely characterized by the presence of both developed and developing countries as its trading partners. It is understood that although Bangladesh exports and imports the same two broad categories of products, but the diversity within a broad category of product (at 6 digit level) is clearly visible in its trade in CSGs. It is also clear that the country imports far higher than its exports of CSGs, mainly because of its failure to use the export possibility of producing more such commodities locally and also its increasing demand for CSGs for numerous adaptation and mitigation measures that the country has been adopting in recent years quite in an aggressive manner (e.g. use of solar energy).

Three econometric methods are used to identify the major determining factors that influence trade (both export and import) in CSGs by Bangladesh. The major findings of these models are quite interesting. The Jhohansen cointegration test identified that export and import in climate smart goods by the country is significantly influenced by variables like its GPD per capita, Exchange rate, GDP deflator, tariff rate, and population growth rate in the long run. The Ganger causality test and the variance decomposition analysis showed that tariff and exchange rate have no significant impact on Bangladesh's exports of climate smart goods. But the Ganger causality test showed that tariff and exchange rate have no significant impact on Bangladesh's import of CSGs. In case of CSGs import, the variance decomposition was found to be very high for exchange rate, tariffs, and population growth, so it can be said that these variables have significant impacts on the import of CSGs by Bangladesh. In case of GDP percapita the variance decomposition was estimated to be very high, indicating the variable has a strong impact on import of CSGs by the country.

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