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Estimation of an ARDL (m, p, q, r, s) Model to Determine the Long-run Effects of World Income, Relative Price, Real Exchange Rate and Employment on Export Demand for the Garment Sector of Bangladesh

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ABSTRACT: *In this paper, an ARDL (m p, q, r, s, s) log-linear export demand function is estimated to find the long-run impacts of world income, relative price, real exchange rate, and employment on exports of the garment sector of Bangladesh using modern econometric techniques based on time series data from 1979-2020. Long-run significant relationships among exports, relative price, real exchange rate, world income and employment are found. The VEC model's estimated results indicate short-run bidirectional causalities between different pairs of variables. The long-run causalities are found while exports and employment are the endogenous variables. The estimated results indicate that both long-run and short-run exports are influenced positively and significantly by world income. Relative price, real exchange rate and employment carry negative signs for both long-run and short-run in which the effects of relative price and real exchange rate are statistically significant in the long run which implies that a 1% decrease in relative price, exports will increase by 1.256%. It is found that the coefficient of ECM(-1) is -0.9705 which is statistically significant at any significance level, suggesting that when the export value is above its equilibrium level, it will adjust about 97.05% within the first year. The full convergence process to reach the equilibrium level takes more than a year. Thus, this study will help the economists, policymakers and stakeholders of the garment sector of Bangladesh to predict the dynamics of export demand due to changes in world income level, relative price, real exchange rate and employment.*

KEYWORDS: export demand function, garment sector of Bangladesh, long-run relationships, vec model, short-run and long-run elasticities.

JEL Classification Number: C01, C02, C12, C22, C32, C51, C52, C54, C010, O11, O53, Q40

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INTRODUCTION

Background of the Study

The development strategy of Bangladesh played a significant role in changing the socio-economic conditions after the 1980s. After experimenting with a domestic demand-based import substitution strategy for nearly two decades, the country finally chose a more open market-based economy where the private sector would play a significant role as a leader in the country's socio-economic development. Meaningful reforms regarding liberal trade policies were introduced that slashed tariff rates, reduced tariff slabs and largely eliminated quantitative restrictions. Exports were encouraged through various measures. As a result, the trade ratio increased at a faster rate. An essential aspect of export trade is that the demand for a country's exports depends on the import propensities of the people of other countries. Such propensities are known to be influenced by their economic growth. Due to liberal trade policies, the garment sector of Bangladesh became a most dynamic sector to earn foreign currency. The garment sector is the largest industrial sector in Bangladesh which has occupied its foremost presence in the economy of the country in terms of the contribution to GDP, foreign exchange earnings, and employment generation as well. The garment sector plays a significant role in socio-economic development and poverty alleviation in Bangladesh. The garment sector in Bangladesh started its journey in 1978 and formally started its journey in the 1980s after that the RMG sector of Bangladesh started growing at a faster rate, capturing the market globally and providing valuable performance. In 1979 the garment sector of Bangladesh exported only 0.672 million $ operating 12 garment factories with 0.39 million workers but in 2020 within a span of two decays, exports have gone up to 31456.73 million USD with its 4764 export-oriented garment industries including 4.23 million workers in which 59% are female workers. In Bangladesh, the number of garment factories is increasing tremendously with the value of exports. The average growth rate of the garment factories from 1979 to 2020 is 5.41%. The numbers of garment factories from 1979 to 2020 are shown below graphically:

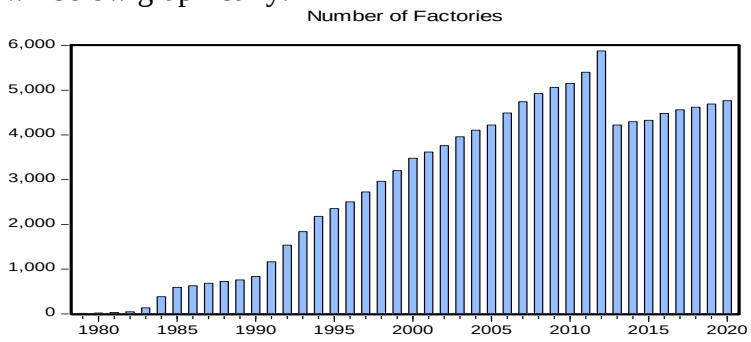

Figure 1: Number of garment factories corresponding to 1979-2020.
Source: BGME Publications.

From this graph, it is clear to us that until 2012 the number of factories increased rapidly but from 2012 to 2013 it dropped due to political crises again from 2013 it is increasing. In 1979 the employment generation in the garment sector to the total national labor force was 1.13% but in 2020

it reached 6.28%. The number of workers in the garment sector to the total national labour force in percentage from 1979 to 2020 is shown below graphically:

Figure 2: Employment (EM) of the garment sector to the total national labour force (NLF) in percentage.
Source: BGME Publications and Word Bank Development Indicators (WDI).

From Figure 2, it can be said that the employment generation in the garment sector is increasing rapidly which is also statistically significant at any significance level. Most of the workers are women and come from rural and remote areas. Thus, it can be said that the garment sector plays a significant role to change positively in different types of livelihood assets such as financial capital, physical capital, human capital, social capital and natural capital of the rural people by employment generation in Bangladesh. Bangladesh is the world's third largest exporter of garment products with an average growth rate of export values of 22.23% (1979-2020) in which the growth rate of total export values is 11.86% (1979-2020) which indicates that the growth rate of exports values of the garment sector is 1.87 times higher than the growth rate of the total export values of Bangladesh. In 1979 the export value of the RMG sector was 0.672 million USD but in 2020 it reached 31456.73 million USD (Export Promotion Bureau, 2020). Also in 1979, the total export value was 749.44 million USD and in 2020 it became about 38758.31 million USD. The export values of the RMG sector including total export values from 1979 to 2020 are shown below graphically.

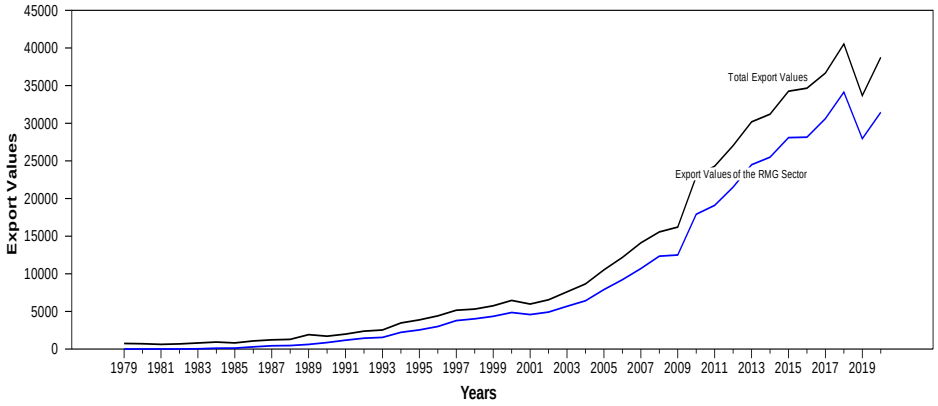

Figure 3: Total export values and export values of the RMG sector of Bangladesh in million $
Source: Word Bank Development Indicators (WDI) and BGME Publications.

Figure 3 indicates that the total export values and the export values of the garment sector of Bangladesh are increasing at a faster rate but in 2019 both of them declined which happened due to COVID-19, however from 2020 they are increasing. It is found that in 1979 the garment sector occupied 0.09% of the total exports but in 2020 it reached 81.16%. The contribution of the garment sector of Bangladesh to the total export values in percentage from 1979-2020 is shown below graphically.

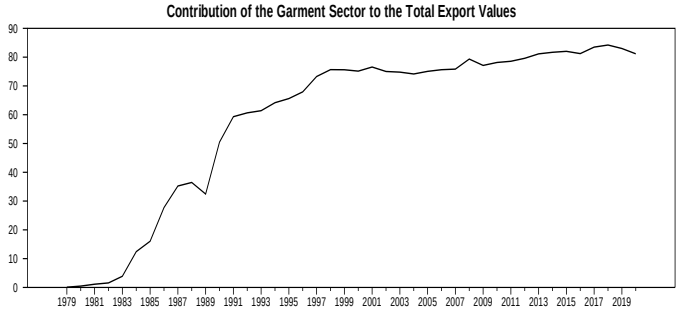

Figure 4: Export values of the garment sector to total export values in percentage
Source: BGME Publications and WDI. Own Calculations

Figure 4 indicates that the contribution of the garment sector to the total export values is increasing at a faster rate with an average contribution is 58.92% which is statistically significant at any significance level. It is also found that in 1979 the contribution of the garment sector to the GDP of Bangladesh was only 0.002% but in 2020 it reached 11.75% which is 5875 times higher than in 1979. The average contribution of the garment sector of Bangladesh to the GDP is 6.13% which is statistically significant at any significance level. The contribution of the garment sector of Bangladesh to the GDP from 1979-2020 is shown below graphically

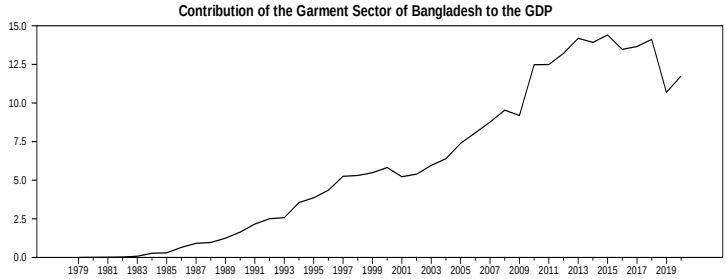

Figure 5: Contribution of the garment sector to the GDP in percentage
Source: BGME Publications, and WDI. Own Calculations.

Figure 5 indicates that the contribution of the garment sector to the total GDP declined in 2019 which happened due to COVID-19 but from 2020 again it starts to increase. Thus, it can be said that nowadays garment sector development has a significant impact on the economic growth in Bangladesh including other emerging and frontier economies. There exists considerable variability in trend exports due to changes in a few important macroeconomic variables namely: world income, real exchange rate, relative prices, and, employment etc. Moreover, due to the developments in foreign trade flows in Bangladesh's economy, a period of exports will be followed by macroeconomic policies designed by policymakers. For economic stability in Bangladesh's economy, a trade deficit needs to be financed by an equivalent amount of positive net capital flows. Therefore, the estimation of the export demand function for the garment sector of Bangladesh is becoming an important issue to researchers and policymakers as a general concern about the economic development of Bangladesh. In addition, the short-run and long-run elasticities of export with respect to world income, real exchange rate, relative price and employment will be very important to the policymakers in choosing commercial policies, exchange rate movement, relative price options and employment to have a better position in foreign trade. The conventional theories highlighted the relationship of exports to foreign income level, prices at home and abroad, exchange rate and employment fluctuation. Therefore, the principal interest of this study is to quantify the important factors that affect the export demand of the garment sector of Bangladesh to the world market. In this regard, it will be important for meaningful export forecasts, planning and appropriate policy formulation.

Objectives of the Study

The main objective of this study is to determine the factors that influence the export demand of the garment sector of Bangladesh using modern econometric techniques based on the time series data from 1979 to 2020 by proposing a log-linear export demand function. In this regard, the specific objectives are given below:

(i) Investigate the dynamic cointegration and causality relationships between exports of the garment sector of Bangladesh and its determinants say world income, relative price real exchange rate and employment

(ii) Examine empirically the short-run and long-run effects of world income, relative price real exchange rate and employment on exports using the time series from 1979 to 2020. The investigation of the dynamic short-run and long-run causal relationships between the variables involves the following steps. In the first step, the existence of a unit root in each variable is examined using the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) unit root tests. If a unit root problem is found in each time series variable, then in the second step long-run co-integration relationships among the variables are examined using the Johansen and Juselius's, (JJ, 1990) test. If long-run relationships among the variables are found, then at the third step a VEC model is estimated to determine the direction of the causal relationships between the variables using the Granger causality test. In the final step, the GMM method is applied to examine the short-run and the long-run impacts of world income, relative price, real exchange rate, and employment on exports of the garment sector of Bangladesh.
(iii) For the robustness of our results, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests proposed by Borensztein et al. (1998), are applied and diagnostic tests for serial correlation, heteroscedasticity and autoregressive conditional heteroscedasticity are applied in the short-run model.
(v) Response functions are estimated to find responses of the variables world income, relative price, real exchange rate and employment in the variable exports of the garment sector for the next 10 years for appropriate policy formulation.

The Organizational Structure of the Study

The organizational structure of the paper is as follows:
Section II presents a literature review. Section III discusses the model specification of the export demand function for the garment sector of Bangladesh. Section IV discusses data sources and some descriptive statistics. Section V presents an econometric methodology, empirical analyses and results discussion and finally, section VI concludes with a summary of the main findings and policy implications.

LITERATURE REVIEW

In frontier, developed and developing economies several empirical studies have been conducted on the determinants of the export demand function by considering the importance of international trade to economic growth and development. In this regard, two notable studies conducted by Orcutt (1950) and Kreinin (1967) were noteworthy. They attempted to explain that the level of real income and price competitiveness are the main factors impacting exports. Later on, by econometric analysis Houthakker and Magee (1969) found that in countries which were imported and in the countries which were exported, the level of real income and price competitiveness impacted exports significantly. Hatton (1990) carried out a study on the demand for British exports based on the time series data from 1870 to 1913 and explained that the price plays an important role in the determination of exports for British. Wong et al. (2011) conducted a study on exchange rate variability and the export demand for Malaysia and found that there is a unique long-run relationship between quantities of export, relative

price, real foreign income and real exchange rate variability in Malaysia. James and Paul (2013) carried out a study on the export demand function of the USA and found a significant relationship between aggregate exports, world trade and the real exchange rate in the US economy. Also considering the importance of international trade to economic growth and development several studies in international trade research have been conducted during the last two decades to know that the elasticities of foreign demand play a significant role. See, for example, Goldstein and Khan (1985); Cocar (2002); Hossain (2009); Islam (2016) and Raissi and Tulin (2018) their studies revealed that exports respond significantly to change in relative price. Cocar (2002) conducted a study on the Turkish export demand function based on panel data and found that the real exchange rate elasticity of total export demand is inelastic, whereas income elasticity is relatively elastic. Hossain (2009) carried out a study on structural change in the export demand function for Indonesia and found that the country's exports had highly elastic demand with respect to price in the long run. Narayan and Narayan (2010) re-estimated the import and export demand functions for Mauritius and South Africa using time series data and found that there is a long-run relationship between import demand, income and prices for both countries.

Haider et al. (2011) carried out a study on the estimation of the export and import demand functions using bilateral trade data of Pakistan. This study is based on time series data from 1973 to 2008. This study found that income is the principal determinant of exports and imports. Pakistan exports are cointegrated with Japan and USA while the imports are cointegrated with UAE and USA. Pakistan's imports and exports are cointegrated with Bangladesh and Sri Lanka but not with India and China. Income and exchange rate are both important determinants of foreign trade. Continuing its trade with traditional partners and making efforts for greater market access to the USA and EU. This study recommended that Pakistan should make efforts to increase its trade with Asian countries notably China and India because both are fast-growing economies and have huge markets. Abbas (2012) conducted a study on the merchandise export demand function for Egypt. This study is based on panel data analysis and applied the fixed effect model. This study found a significant relationship between the real value of merchandise exports for Egypt and the trade panther's income, relative export price, and trade panther's real exchange rates. All variables showed positive relationships as expected and negative relationships for the real price as pre-assumed. The elasticities of real income, relative price and real exchange rates were found to be smaller than unity.

Saghaian and Soltani (2012) conducted a study on the estimation of the export demand function for the US raisins using panel data from 1992 to 2008. The study used a panel data analysis approach in a double log format to determine own-price, cross-price, and income elasticities for the US raisins. This study found that all the variables for Germany and the UK were significant except for the exchange rate. For Canada, it is found that except for price all the variables were significant on the US raisins. Zeng *et al.* (2012) carried out a study on factors affecting export demand for U.S. pistachios. The study used a panel data analysis approach. The results from their study indicated that U.S. pistachio producers should take advantage of their advanced technology and reputation for higher food safety standards to enhance international market share. Saghaian *et al.* (2014) carried out

a study on the estimation of the export demand function for US corn and soybeans to three major destinations namely China, Japan & EU for the 1980-2011 periods. The study employed a panel data analysis approach in a log-linear equation. It was found that China had more elastic demand (2.5), while the income elasticity of Japan was close to 1. It was found that the cross-price elasticity of export demand for soybeans was significant for China and the EU and cross cross-price elasticity of export demand for corn was significant only for Japan. The positive sign obtained revealed that soybeans and corn could be substitutes in those countries. Sultan (2014) carried out a study on Saudi's export demand function using a bound test approach to cointegration. The study found that there exists a long-run equilibrium relationship between demand for export, world income and real effective exchange rate.

The demand for Saudi's export with respect to world income and real effective exchange rate were found to be elastic both in the short run and long run. The exports were found to be more elastic in the short run than in the long run with respect to both variables. Takeshi (2014) conducted a study on an empirical analysis of the aggregate export demand function in post-liberalization India. The empirical results indicate that all estimated coefficients are statistically significant with expected signs and that the absolute value of the coefficient is the largest for the world price, followed by world income and domestic income. Further, the results reveal that price competitiveness has improved India's export market. Moreover, the statistically significant world income elasticity suggests that the global economic boom may contribute to an increase in India's exports, whereas the global recession has likely had an adverse impact on the Indian economy through its trade channel. Thaver and Bova (2014) conducted a study on an estimation of Ecuador's export demand function with the US. This study is based on time series data from 1965 to 2011. This study emphasized dollarization's impact on Ecuador's export to the US considering two different export demand functions. The study found that there exists a unique cointegration relationship between exports and its determinants. In the long run, in both models, GDP was positive and elastic, while exchange rate volatility was positive and inelastic. Relative prices in Model I and 'the real exchange rate in Model II were not statistically significant. Both models revealed that the short-run and long-run impacts of dollarization are significantly negative and inelastic on Ecuador's exports to the US. Verheyen (2015) conducted a study on the role of non-price determinants for export demand and he revealed that non-price factors such as patent applications and government and business characteristics have positive significant effects on export demand. Yazici (2015) carried out a study on the estimation of Turkish agricultural import and export demand function. This study is based on time series data from 1970 to 2003 and applied the bounds testing approach. This study found that Turkish agricultural export demand will be influenced by its determinants in the short-run but those effects don't carry over into the long-run. This study also found that Turkish agricultural exports will neither benefit from world economic growth nor be hurt by world economic slowdown.

Maziya et al. (2016) carried out a study on the estimation of export demand function for Swazi sugar. This study is based on panel data and applied the LSDV fixed effect model for empirical analysis. This study found that the EU reform has a significant positive impact on Swazi sugar export demand

while the export price has a significant negative effect. This study revealed that export price, foreign income, producer prices and real exchange rate were found to be inelastic with elasticities of 0.35, 0.002, 0.04, and 0.29 respectively for polled data analysis but for individual markets explanatory variables were found to be highly elastic. This study recommended that Swaziland needs to take advantage of the EU reform and invest more in sugar production. Bolaji et al. (2018) carried out a study on non-oil export demand and economic performance in Nigeria using time series data and found a unidirectional causal link from export to growth in Nigeria. Das et al. (2018) carried out a study on the bilateral export demand function of India. This study is based on time series data from 1993-2015. This study found the existence of a long-run equilibrium relationship between real exports, foreign income, nominal exchange rate and relative price. This study also found that in the long-run and short-run, real exports are influenced more by foreign income followed by relative price. The estimated results indicated that in the long-run foreign income has a significant positive impact on exports of India and it is elastic (1.63) and the relative price has a significant negative impact on exports and it is inelastic (-0.22). This study also found that in the long run and short-run, the nominal exchange rate has a significant negative impact on the export demand thus this study suggests that the depreciation of the nominal exchange rate between the Indian Rupee and US dollar would not stimulate the value of exports of India.

Research Gaps from Literature:

From the literature review, it can be said that there have been many studies in the context of export demand function in the world. While most of the studies are concentrated on developing and developed economies, there are hardly a few research works carried out to examine the export demand function so far as an emerging country like Bangladesh is concerned. For instance, Kabir (1988) conducted a study on estimating import and export demand functions in the case of Bangladesh. This study is based on time series data from 1973 to 1983. The estimated results of the export demand function revealed that the export price has a negative effect and the exchange rate has a positive effect on the aggregate export demand of Bangladesh and the elasticities of these two variables are inelastic. It is also found that in the long run, the elasticity of the exchange rate is elastic with value (1.52). Islam (2016) conducted a study on the estimation of export and import demand functions using bilateral trade data of Bangladesh and he found that GDP, exchange rate and inflation rate are important determinants of foreign trade in Bangladesh. We believe that these studies are not sufficient enough so far as an emerging country like Bangladesh is concerned. These studies are not sufficient enough to reach any definite conclusion. Hence, any new study will add value to the review of the literature and attempt to fill the gap in the literature. By keeping this in mind, the present study is carried out to investigate the export demand function for the garment sector of Bangladesh using modern econometric techniques. We believe, that the findings of this study will throw some light on the policy makers and for the scope of future research. Moreover, the study has used sophisticated econometric approaches to find out the linkage between the export demand of the garment sector of Bangladesh and its' determinants, mitigating the gap in the existing literature.

Model Specification and Defining Variables

The export demand of a country is affected by many factors but two of them are very important namely: (i) foreign income, which is an indicator of the economic activity and purchasing power of trading partner, and (ii) terms of trade (or competitiveness effect), which depends on the ratio of the respective price levels and the nominal exchange rate. Previously a few models have been suggested by the researchers to estimate the export function. For example, Konandreas et al. (1978) have suggested the following U.S. commercial wheat export demand function of the jth region as a whole:

$$EX_t = \beta_0 + \beta_1 Q_t + \beta_2 PE_t + \beta_3 YE_t + \beta_4 C_t + \beta_5 EX_{t-1} + \varepsilon_t \quad (1)$$

where EX_t is total U.S. commercial wheat exports to that region at time t; Qt is per capita wheat production in the region; Ct is U.S. concessional wheat exports to the region;

$PE_t = \sum_{k=1}^{K_j} (w^k)(PE_t^k)$ is the "effective" U.S. export price of wheat in that region;

$PE_t^k = \frac{P_t^{US}}{P_t^k / ER_t^k}$ is defined as the "effective" U.S. export price of wheat in the kth country, expressed as the U.S. export price over the domestic price in the kth country (expressed in U.S. currency);

$YE_t = \sum_{k=1}^{K_j} (w^k)(YE_t^k)$ is the "effective" per capita real income of that region;

$YE_t^k = \frac{Y_t^k}{ER_t^k}$ is defined as the "effective" per capita real income of the kth country expressed in the U.S. currency; and ε is the random error term.

Goldstein and Khan (1985) have suggested the following export function:

$$EX_t = A_0 . WY_t^{\beta_1} . P_{it}^{\beta_2} . P_{xt}^{\beta_3} . ER_t^{\beta_4} . e^{\varepsilon_t} \quad (2)$$

The logarithmic transformation of equation (2) has been given below:

$$\ln EX_t = \beta_0 + \beta_1 \ln WY_t + \beta_2 \ln P_{it} + \beta_3 \ln P_{xt} + \beta_4 \ln ER_t + \varepsilon_t \quad (3)$$

where EX is the export demand; WY is the world income; P_i is the price of foreign goods in the world market; P_x is the export price, ER is the exchange rate and ε is the random error term.

Bahmani-Oskooee (1986) has suggested the following export demand function:

$$EX_t = A_0 . WY_t^{\beta_1} . RP_t^{\beta_2} . ER_t^{\beta_3} . e^{\varepsilon_t} \quad (4)$$

The logarithmic transformation of equation (4) has been given below:

$$\ln EX_t = \beta_0 + \beta_1 \ln WY_t + \beta_2 \ln RP_t + \beta_3 \ln ER_t + \varepsilon_t \quad (5)$$

where EX is the real exports, WY is the word real income, $RP = \frac{PX}{PXW}$ is the relative price, PX is the domestic price of export, PXW is the world export price, ER is the nominal effective exchange rate, and is the random error term.

Kabir R. (1988) has suggested the following log-linear export function:

$$\ln EX_t = \beta_0 + \beta_1 \ln WY_t + \beta_2 \ln RP_t + \varepsilon_t \quad (6)$$

where EX is the quantity of export demand, WY is the weighted average of the real incomes of the country's trading partners, RP is the relative price index, i.e., the price of exports of the country (PX) divided by the price of similar products produced by the trading partner's (PXW) and ε is the random error term

Haider et al. (2011) have suggested the following log-linear export function for bilateral trade in Pakistan:

$$\ln EX_{jt} = \beta_0 + \beta_1 \ln REX_t + \beta_2 \ln Y_{jt} + \varepsilon_t \quad (7)$$

where ln - natural logarithm; EX_{jt} is Pakistan's exports to the trade partner j at time t; $REX_t = ER_{jt} \times \frac{CPI_{jt}}{CPI_{pt}}$ is the real exchange rate at time t, ER_{jt} is the bilateral exchange rate between Pakistan and the jth trade partner at time t ; CPI_{jt} is the consumer price index of the trade partner j at time t; CPI_{pt} is the consumer price index of Pakistan at time t; Y_{jt} is the real GDP of the trade partner j at time t, and ε is the random error term.

Thaver and Bova (2014) have suggested the following two log-linear export demand functions of Ecuador with the USA:

$$\ln REX_t = \beta_0 + \beta_1 RGDP_t + \beta_2 RP_t + \beta_3 VOL_t + \beta_4 D_t + \varepsilon_t \quad (8)$$

$$\ln REX_t = \alpha_0 + \alpha_1 RGDP_t + \alpha_2 RER_t + \alpha_3 VOL_t + \alpha_4 D_t + \varepsilon_t \quad (9)$$

where REX is real export which is calculated by dividing Ecuador's nominal exports by its export price index, RGDP is the real GDP of a country's trading partner, RP is the relative prices, VOL is the volatility of exchange rate, RER is the real exchange rate between the country and its' trading partner, D is a dummy variable representing the period of dollarization in Ecuador beginning in 2000 and ε is the random error term.

Maziya et al. (2016) have suggested the following export demand function for a commodity in Swaziland:

$$EX_{it} = \beta_0 + \beta_1 XP_{it} + \beta_2 MGDP_{it} + \beta_3 TPP_{it} + \beta_4 RER_t + \beta_5 D_t + \varepsilon_{it} \quad (10)$$

where EX_{it} is the quantity of the product exported to the major destination at time t, XP_{it} is the per unit export price of the product to the destination at time t, $MGDP_{it}$ is the gross domestic product of the importer country at time t, TPP_{it} is the trading partner producer price at time t, RER_t is the real exchange rate at time t D is the dummy variable which takes 1 after the UE reform and 0 before UE reform and ε is the random error term

Dash et al. (2018) have suggested the following bilateral export-demand function:

$$EX_t = \beta_0 + \beta_1 FY_t + \beta_2 EXR_t + \beta_3 RP_t + u_t \quad (11)$$

where EX_t = real exports of a country at time t; FY_t = foreign economic activity at time t; EXR_t = nominal exchange rate at time t between the country's currency and USD; RP_t = relative price (which is a measure of competitiveness) at time t; and u_t = the normally distributed error term with all classical properties.

But until now no one has proposed any export demand function for the garment sector of Bangladesh. Therefore, this study investigates the long-run elasticities of exports (EX) of the garment sector of Bangladesh with respect to world income (WY), relative price (RP), real exchange rate (RER) and employment (EM). For this study, the following non-linear export demand function has been specified:

$$EX_t = A_0 . WY_t^{\beta_1} . RP_t^{\beta_2} . RER_t^{\beta_3} . EM_t^{\beta_4} . e^{\varepsilon_t} \quad (12)$$

The logarithmic transformation of equation (12) is given by

$$\ln EX_t = \beta_0 + \beta_1 \ln WY_t + \beta_2 \ln RP_t + \beta_3 \ln RER_t + \beta_4 \ln EM_t + \varepsilon_t \quad (13)$$

where ln indicates natural logarithm, $\beta_0 = \ln(A_0)$, β_1, β_2, β_3 and β_4 are export elasticities with respect to WY, RP, RER and EM respectively. ε is the random error term.

The definitions of the variables which are used for model (13) are given below in Table-1.

Table-1: Definition of the Variables

Variable	Explanation
Exports (EX)	The export value of the garment sector of Bangladesh is defined as the goods that are produced by the garment sector of Bangladesh and sold to buyers of the world.
World Income (WY)	The world income is defined as the real gross domestic product of the world.
Relative Price (RP)	The relative price is defined as the ratio between domestic export price and world export price and is given by $RP = \frac{PX}{PXW} \times 100$, where PX is the domestic price of export, PXW is the world export price,
Real Exchange Rate ($RER_)$	The real exchange rate is defined as $RER = ER \times \frac{CPI_W}{CPI_B}$, where ER is the bilateral exchange rate between Bangladesh and the trading partner; CPI_W is the consumer price index of the trade partner j i.e., world; CPI_B is the consumer price index of Bangladesh.
Employment (EM)	Employment is defined as the total number of paid people who are employed in the garment sector of Bangladesh.

Data Sources and Some Descriptive Statistics

This study uses annual time series data from 1979 to 2020 to find out the long-run and short-run impacts of world income, relative price, real exchange rate, and employment on the exports of the garment sector of Bangladesh. For this study, the secondary data are collected from different sources namely BGME publications, and the World Bank Development Indicators (WDI) of the World Bank. For this study, the variables in the model are exports of the garment sector (EX), word income (WY), relative price (RP), real exchange rate (RER), and employment in the garment sector of Bangladesh (EM). The annual data for export values (EX, in million USD) and employment (LF) of the garment sector of Bangladesh are collected from BGME publications. The annual data for world income (constant 2010 USD price), consumer price index of Bangladesh, world consumer price index, and exchange rate between BDT and USD are collected from WDI. Then the variables relative price and real exchange rate are calculated for this study. Some important descriptive statistics say mean,

median, standard deviation (Std. Dev.), coefficient of variation (CV), skewness, Kurtosis, growth rate (GR) and t values of these variables are recorded below in Table 2.

Table-2: Some Descriptive Statistics

Descriptive Statistics	EX	WY	RP	RER	EM
Mean	9407.7170	51830049	127.3403	43.2678	2129089
Median	4466.580	48899146	132.1163	39.0885	1975226
SD	10960.60	18118588	25.4317	21.9488	1202624
CV (in %)	116.51	34.96	19.9780	50.7278	56.4854
Skewness	0.9977	0.3686	0.1760	0.3924	0.3759
Kurtosis	2.4898	1.9089	2.6937	2.1595	2.0698
Min	0.6720	27412768	77.4885	11.7132	391958
Max	34133.27	87180271	196.9304	88.5270	4290282
Range	34132.60	59767503	119.4419	76.8138	3898324
t-test (Mean=0)	5.5625**	18.5388**	32.4499*	12.7755**	11.4733**
GR(in %)	22.2256	2.9420	-0.2907	4.2434	5.4142

Source: BGME Publications and WDI. Own Calculations.

From the reported values in Table-2, it is found that the variability is the highest for the variable export value followed by employment, real exchange rate, world income and relative price. The results also support that all the variables are positively skewed. The results also support that the curves of all the variables are platykurtic. It is also found that all the variables are statistically significant at any significance level from their zero mean. The growth rate is the highest for the variable export values followed by employment, real exchange rate and world income but the growth rate of the variable relative price is negative.

Econometric Methodology, Estimated Results, and Discussion

The dynamic cointegration and causal relationships between total exports of the garment sector and its determinants say word income, relative price, real exchange rate and employment are examined using modern econometrics techniques. An investigation of the dynamic causal relationships between the variables involves the following steps. In the first step, the existence of a unit root problem in each time series variable is examined. If a unit root problem is present, then the long-run cointegration relationships between the variables are tested in the second step. If a long-run cointegration

relationship between the variables is observed, then a VECM is estimated to determine the causal relationships between the variables in the third step. In the final step, the short-run and the long-run elasticities of the variable EX with respect to WY, RP, RER and EM are estimated using the GMM method. In this study also the impulse response function is estimated to find responses of the variables WY, RE, RER, and EM due to shock in the variable EX for the next 10 years.

Unit Root Tests

Commonly, that time series variable contains a stochastic trend. Since we are dealing with time series data and if the variable contains a stochastic trend, then the application of usual techniques of regression analysis can result in a highly misleading conclusion (Stock and Watson (1988), Granger and Newbold (1974)). In particular, if the dependent variable and at least one independent variable contain a stochastic trend, and if they are not co-integrated, the regression results are spurious, (Phillips (1986), Granger and Newbold (1974)). Therefore, to identify the correct specification of the model, an investigation of the presence of a stochastic trend in the variables is needed. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Tests are applied to investigate whether each of the variables contains a stochastic trend or not. The estimation technique of these two tests is described below:

Case 1: Model with the only constant term:

$$\Delta Y_t = \alpha_0 + \theta Y_{t-1} + \sum_{i=1}^{m} \phi_i \Delta Y_{t-i} + \varepsilon_t \quad (14)$$

Case 2: Model with constant and trend terms

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \theta Y_{t-1} + \sum_{i=1}^{m} \phi_i \Delta Y_{t-i} + \varepsilon_t \quad (15)$$

Case 3: Model with no constant and trend terms:

$$\Delta Y_t = \theta Y_{t-1} + \sum_{i=1}^{m} \phi_i \Delta Y_{t-i} + \varepsilon_t \quad (16)$$

Here, Y_t is the series under investigation, Δ stands for first difference and the lagged difference terms on the right-hand side of the equations are designed to correct for serial correlations of the disturbance terms. The lagged differences are selected by using the AIC, SBIC and HQIC criteria. If θ = 0, the series Y_t contains a unit root problem and therefore an I(1) process is governed by a stochastic trend. If a time series variable is integrated of order one, we have to investigate the 2nd order unit root and the equation is given by:

$$\Delta^2 Y_t = \beta_0 + \lambda \Delta Y_{t-1} + \sum_{i=1}^{m} \gamma_i \Delta^2 Y_{t-i} + \varepsilon_t \quad (17)$$

where Δ^2 is the second-difference operator. If, $\lambda = 0$, the series, Y_t is said to be integrated of order two (I(2)). Let d represent the number of times that, Y_t needs to be differenced to reach the stationary. In this case, Y_t is said to be integrated of order d and is denoted by I(d). Since the estimated θ does not have the usual asymptotic distribution, the values tabulated by MacKinnon (1991) are used; these values are more accurate than the ones originally tabulated by Fuller (1976) and Dickey-Fuller (1987). Apart from the ADF test (Dickey and Fuller, 1979), and PP test (Phillip and Perron, 1988) the KPSS test will be applied to get an overwhelming conclusion. The unit root test results have been provided in Table-3.

Table-3: Unit Root Test through ADF, PP and KPSS Tests

Case 1: Model with constant and trend term [Level Form]						
Variables	ADF test	p-value	PP test	p-value	KPSS Test	5% Critical Value
lnEX	-1.6991	0.7310	-10.3496**	0.0000	0.1867*	0.1460
lnWY	-3.5258	0.0601	-2.5729	0.2940	0.1730*	0.1460
lnRP	-2.5082	0.3228	-2.5362	0.3101	0.1846*	0.1460
lnRER	-2.1359	0.5108	-2.3389	0.4097	0.1913*	0.1460
lnEM	-2.6852	0.2477	-2.6907	0.2456	0.1629*	0.1460
Case 2: Model with the only constant term [Level Form]						
Variables	ADF test	p-value	PP test	p-value	KPSS Test	5% Critical Value
lnEX	-2.6527	0.0917	-9.9048**	0.0000	0.7424**	0.4630
lnWY	0.0033	0.9534	-0.0113	0.9520	0.8102**	0.4630
lnRP	-2.3811	0.1533	-2.5970	0.1018	0.1393	0.4630
lnRER	-1.6444	0.4513	-1.5689	0.4891	0.6702*	0.4630
lnEM	-2.2202	0.2025	-2.2202	0.2025	0.7791**	0.4630
Case 3: Model with no constant and trend terms [Level Form]						
Variables	ADF test		p-value	PP test		p-value
lnEX	0.1515		0.7243	1.0539		0.9209

lnWY	15.2837	1.0000	14.2413	1.0000
lnRP	0.0156	0.6820	0.0626	0.6971
lnRER	-0.0286	0.6674	0.1300	0.7182
lnEM	3.1208	0.9993	3.2586	0.9995

Model with constant term only [Differenced Form]						
Variables	ADF test	p-value	PP test	p-value	KPSS Test	5% Critical Value
ΔlnEX	-6.60418**	0.0000	-5.2558**	0.0001	0.3442	0.4630
ΔlnWY	-4.8869**	0.0003	-4.8934**	0.0003	0.0542	0.4630
ΔlnRP	-6.9827**	0.0000	-7.0542**	0.0000	0.0874	0.4630
ΔlnRER	-6.7288**	0.0000	-6.9050**	0.0000	0.1639	0.4630
ΔlnEM	-6.8688**	0.0000	-6.8688**	0.0000	0.2873	0.4630

**p<0.01 denotes significant at 1% level. *p<0.01 denotes significant at 5% level.

Source: BGME publications, and WDI. Own calculations.

From the tests results in Table-3, it can be concluded that all variables are integrated of order one (I(1)).

Cointegration Test

To investigate the cointegrating relationship, I also applied the Johansen and Juselius's, (JJ, 1990) test. Since the Johansen and Juselius's (1990) multivariate cointegration methodology is fairly well documented, a brief reminder of this method is given below:

$$\Delta Y_t = B_0 + \Pi Y_{t-p} + \sum_{i=1}^{p} B\Delta Y_{t-i} + \eta_t \quad (18)$$

where Y_t represents a vector of endogenous I(1) variables, B_0 represents a vector of constant terms, B is a matrix of coefficients, η_t is a vector of residuals, and p denotes the lag length. All variables in equation (18) are deemed to be potentially endogenous. The long-run equilibrium relationship among Y_t is determined by the rank of Π (say r). If r is zero, the variables in level form do not have any cointegration relationship and the equation (18) can be transformed to a VAR model of pth order. If 0<r<n, then there are $n \times r$ matrices of α and β such that

$$\Pi = \alpha\beta' \quad (19)$$

The strength of the cointegration relationship is measured by α, β is called the cointegration vector

and $\beta'Y_t$ is I(0) although Y's are I(1). The cointegrating rank can be found via the trace and the maximum eigenvalue tests. The lag length of the unrestricted vector autoregressive (VAR) model in equation (18) is determined based on the AIC, SBIC and HQC criteria and the adjusted likelihood ratio (LR) test is most commonly used. The test results are reported in Table 4.

Table-4: The Johansen and Juselius Cointegration Test Results

	Case-1: Intercept (no trend) in CE and no intercept in VAR					
Hypothesized No. of CE	Trace Statistic	5% Critical Value	Prob.	Max-Eigen Statistic	5% Critical Value	Prob.
None	124.2832**	76.9728	0.0000	43.1972**	34.8059	0.0040
At most 1	81.0861**	54.0790	0.0000	39.1071**	28.5881	0.0015
At most 2	41.9789**	35.1927	0.0080	27.4991**	22.2996	0.0086
At most 3	14.4798	20.2618	0.2577	9.3145	15.8921	0.4008
At most 4	5.1653	9.1645	0.2658	5.1653	9.1645	0.2658
	Case-2: No intercept and trend in CE and no intercept in VAR					
Hypothesized No. of CE	Trace Statistic	5% Critical Value	Prob.	Max-Eigen Statistic	5% Critical Value	Prob.
None	96.3578**	60.0614	0.0000	42.1521**	30.4396	0.0000
At most 1	54.2057**	40.1749	0.0011	28.5346**	24.1592	0.0120
At most 2	25.6711*	24.2759	0.0332	13.5570	17.7973	0.1942
At most 3	12.1141	12.3209	0.0541	9.0332	11.2248	0.1185
At most 4	3.0809	4.1299	0.0938	3.0809	4.1299	0.0938

Note: $^{**}p<0.01$ denotes significant at 1% level, $^{*}p<0.05$ denotes significant at 5% level
Source: BGME Publications and WDI. Own Calculations.

From the estimated results of the Trace test statistic and the Max-Eigen test statistic in Table-4, it can be concluded that there exists three cointegration equations, therefore it can be concluded that there is a long-run cointegration relationship among the variables.

Causality Analysis-VEC Model:

The cointegration relationship indicates the existence of causal relationships between variables but it does not indicate the direction of causal relationship between variables. Therefore, it is common to test for detecting the causal relationship between variables using the Engle and Granger test procedure. The application of the Engle and Granger (1987) test for causality analyses in the first differenced variables using a VAR will mislead the results due to the presence of a cointegration relationship therefore an inclusion of an additional variable to the VAR system such as the error correction term would help us to capture the long-run relationship. The augmented form of the Granger causality test involving the error correction term is formulated in a multivariate pth order vector error correction model given as below:

$$\begin{bmatrix} \Delta \ln EX_t \\ \Delta \ln WY_t \\ \Delta \ln RP_t \\ \Delta \ln RER_t \\ \Delta \ln EM_t \end{bmatrix} = \begin{bmatrix} C_1 \\ C_2 \\ C_3 \\ C_4 \\ C_5 \end{bmatrix} \sum_{i=1}^{p} \begin{bmatrix} \beta_{11i} & \beta_{12i} & \beta_{13i} & \beta_{14i} & \beta_{15i} \\ \beta_{21i} & \beta_{22i} & \beta_{23i} & \beta_{24i} & \beta_{25i} \\ \beta_{31i} & \beta_{32i} & \beta_{33i} & \beta_{34i} & \beta_{35i} \\ \beta_{41i} & \beta_{42i} & \beta_{43i} & \beta_{44i} & \beta_{45i} \\ \beta_{51i} & \beta_{52i} & \beta_{53i} & \beta_{54i} & \beta_{55i} \end{bmatrix} \begin{bmatrix} \Delta \ln EX_{t-i} \\ \Delta \ln WY_{t-i} \\ \Delta \ln RP_{t-i} \\ \Delta \ln RER_{t-i} \\ \Delta \ln EM_{t-i} \end{bmatrix} + \begin{bmatrix} \lambda_1 \\ \lambda_2 \\ \lambda_3 \\ \lambda_4 \\ \lambda_5 \end{bmatrix} ECM_{t-1} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \end{bmatrix} \quad (20)$$

where t = p+1, p+3,……,T; .The C's, β's and λ's are the parameters to be estimated. ECM_{t-1} represents the one period lagged error term derived from the cointegration vector and the ε's are serially independent with mean zero and finite covariance matrix. From equation (20) given the use of a VAR structure, all variables are treated as endogenous variables. The F test is applied here to examine the direction of any causal relationship between the variables. The variable WY does not Granger cause EX in the short run, if and only if all the coefficients β_{12i}'s $\forall$ i are not significantly different from zero in equation (20). Similarly, the EX does not Granger cause WY in the short run if and only if all the coefficients β_{21i}'s $\forall$ i are not significantly different from zero in the equation (20). They are referred to as the short-run Granger causality test. The coefficients on the ECM represent how fast deviations from the long-run equilibrium are eliminated. Another channel of causality can be studied by testing the significance of ECMs. This test is referred to as the long-run causality test. The short-run and long-run Granger causality results are reported below in Table-5.

Table-5: The Causality Test Results

	ΔlnEX	ΔlnWY	ΔlnRP	ΔlnRER	ΔlnEM	ECM
ΔlnEX		5.3791**	8.1027***	11.2893**	0.0016	-2.7469***
		(0.0267)	(0.0075)	(0.0019)	0.96826	(0.0096)
ΔlnWY	0.0037		0.0928	0.0031	3.1536*	-1.6102
	(0.9516)		(0.7625)	(0.9562)	(0.0849)	(0.1168)
ΔlnRP	0.0107	0.5683		0.0045	0.1775	-0.1562
	(0.9184)	(0.4563)		(0.9463)	(0.6763)	(0.8768)
ΔlnRER	0.6899	0.5530	0.5804		0.1991	0.3759
	(0.4121)	(0.4624)	(0.4515)		(0.6583)	(0.709)
ΔlnEM	4.5148**	1.8768	0.1863	0.1616		-2.6464**
	(0.0411)	(0.1799)	(0.6687)	(0.6903)		(0.0123)

Note: ***P<0.01 denotes significant at 1% level, **P<0.05 denotes significant at 5% level, *P<0.05 denotes significant at 10% level. The reported values in parentheses are the p-values of the test.
Source: BGME Publications and WDI. Own Calculations.

From the Granger causality test results in Table-5, it can be concluded that there exist short-run bidirectional causalities from world income, relative price and exchange rate to export values of the garment sector of Bangladesh. Also, short-run unidirectional causalities are found from employment to world income and from export values to employment. The significance and negative sign of test statistic of ECM (-1) denotes the existence of the long-run causality while export values and employment are the endogenous variables which also conform to the results of the Johansen and Juseliues's conintegration test.

Long-Run and Short-Run Elasticities of Exports

Since it has been found that there exists a co-integrating vector among the variables, therefore the following ARDL(m, p, q, r, s) model is projected here to find out the long-run impacts of WY, RP, RER and EM on EX:

$$\ln EX_t = \delta_0 + \sum_{i=1}^{m} \delta_{1i} \ln EX_t + \sum_{i=0}^{p} \delta_{2i} \ln WY_{t-i} + \sum_{i=0}^{q} \delta_{3i} \ln RP_{t-i} + \sum_{i=0}^{r} \delta_{4i} \ln RER_{t-i} + \sum_{i=0}^{s} \delta_{5i} \ln EM_{t-i} + \xi_t \quad (21)$$

The short-run association among the variables can be calculated considering the following error correction model:

$$\Delta \ln EX_t = \psi_0 + \sum_{i=1}^{m} \psi_{1i} \Delta \ln EX_{t-i} + \sum_{i=1}^{p} \psi_{2i} \Delta \ln WY_{t-i} + \sum_{i=0}^{q} \psi_{3i} \Delta \ln RP_{t-i} + \sum_{i=0}^{r} \psi_{4i} \Delta \ln RER_{t-i} + \sum_{i=0}^{s} \psi_{5i} \Delta \ln EM_{t-i} + \lambda ECM_{t-1} + u_t \quad (22)$$

where, ECM_{t-1} is the error correction term which will be obtained from the following estimated co-integration equation:

$$ECM_{t-1} = \ln EX_t - \delta_0 - \sum_{i=1}^{m} \delta_{1i} \ln EX_t - \sum_{i=0}^{p} \delta_{2i} \ln WY_{t-i} - \sum_{i=0}^{q} \delta_{3i} \ln RP_{t-i} - \sum_{i=0}^{r} \delta_{4i} \ln RER_{t-i} - \sum_{i=0}^{s} \delta_{5i} \ln EM_{t-i} \quad (23)$$

The appropriate lag lengths of equations (21) and (22) have been selected using the AIC, SBIC and HQC criteria. Here, the parameter λ represents the speed of adjustment to approach into the long-run equilibrium if there is any shock to the variable exports due to changes in world income, relative price, real exchange rate and employment. It is expected that the sign of λ will be negative and significant and $|\lambda| < 1$. The GMM method is applied to equations (21) and (22) and the estimated results are given below in Table-6.

Table-6: The Long-Run and Short-Run Elasticities of Exports

Estimated coefficients of the equation-21: Long-run elasticities			
Dependent Variable (LnPGDP)	Coefficient	t-Test	Probability
Constant	-3.0933	-0.7429	0.4631
lnWY	5.4766***	2.6612	0.0078
lnRP	-1.2560**	-2.0992	0.0358
lnRER	-1.1942**	-2.0906	0.0365
lnEM	-0.0363	-0.1745	0.8614
Estimated coefficients of the equation-22: Short-run elasticities			
Dependent Variable (Δ lnPGDP)	Coefficient	t-Test	Probability
Constant	0.1161*	1.6643	0.0961
Δ lnWY	4.1707**	2.0776	0.0377
Δ lnRP	-0.4147	-0.5372	0.5911
Δ lnRER	-0.3364	-0.4420	0.6585
Δ lnEM	-0.0654	-0.3688	0.7122
ECM{-1}	-0.9705***	-5.2844	0.0000

Sensitivity Analysis: The short-run diagnostic test results		
LM Test for Autocorrelation	0.2362	0.6269
LM test for Heteroscedasticity	2.9292	0.5697
ARCH Test	0.1186	0.7305
F-Test for Misspecification	1.1079	0.3018
JB Test for Normality of Errors	1.5670	0.1171

Note: ***P<0.01 denotes significant at 1% level, **P<0.05 denotes significant at 5% level, *P<0.05 denotes significant at

Source: BGME Publications and WDI. Own calculations.

From our empirical analysis it is found that in the long-run and in the short-run, exports are influenced by more world income followed by relative price and real exchange rate. It is found that world income carries a positive sign and it is statistically significant at any significance level which implies that 1% increases in world income the export will be increased by 5.4766% in the long-run. Likewise relative price, real exchange rate and employment carry negative signs for both in long-run and short-run. But the effects of relative price and real exchange rate are statistically significant at a 5% significance level in the long run which implies that for 1% increase in relative price will decrease exports 1.256% or conversely it can be said that for a 1% decrease in relative price exports will increase by 1.256% and 1% increases in real exchange rate will decrease exports by 1.1942% in the long-run. It is also found that in the short-run 1% increase in world income will increase exports by 4.1707% and it is statistically significant. The effects of relative price, real exchange rate and employment on exports in the short run are negative but not statistically significant at all. Table-6 shows that the coefficient of ECM (-1) is statistically significant at any significance level indicating that the speed of adjustment for the short-run to reach the long-run equilibrium is significant. The error correction term is statistically significant and its magnitude is quite higher indicating a faster return to equilibrium in the case of disequilibrium. The error correction term is -0.9705 with the expected sign, suggesting that when the export value is above or below its equilibrium level, it will adjust about 97.05% within the first year. The full convergence process to reach the equilibrium level takes about more than a year. Thus, the speed of adjustment is significantly faster in the case of any shock to exports of the garment sector of Bangladesh. From the estimated short-run and long-run elasticities of EX it can be said over time due to higher world income, and more declining relative price will boost more exports of the garment sector of Bangladesh in the long run.

Sensitivity Analysis: Diagnostic tests for serial correlation, heteroscedasticity, autoregressive conditional heteroscedasticity, functional form for misspecification and non-normal errors are conducted and the results are reported in Table-6. The test results indicate that there are no problems of correlation, heteroscedasticity, and autoregressive conditional heteroscedasticity in the short-run model. The test results also support that there is no problem of normality of random error terms in equation (22).

Stability of the Parameters: CUSUM and CUSUMSQ Tests

Using the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests proposed by Borensztein et al. (1998), the stability of the long-run parameters together with the short-run movements for the equation has been examined. The related graphs of these tests are presented below in Figure-6

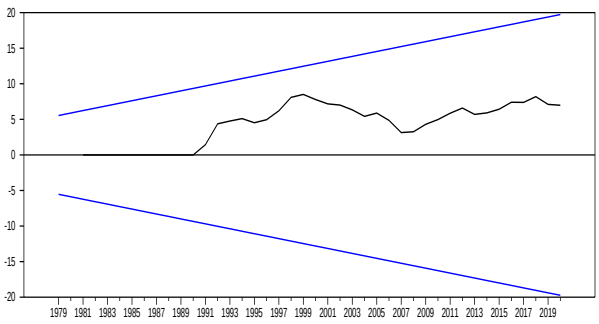

Figure 6(a): Plot of Cumulative Sum of Residuals

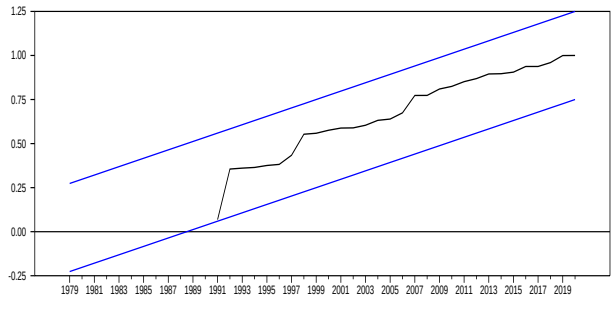

Figure 6(b): Plot of Cumulative Sum of Squares of Recursive Residuals

Source: Own Calculations.

From Figures 6(a) and 6(b) it can be seen that the CUSUM and CUSUMSQ tests results are within the critical bounds implying that all the coefficients in the error correction model are stable. Therefore, the preferred export demand function can be used for policy decision making purpose, such that the impact of policy changes considering the explanatory variable of the export demand function for the garment sector of Bangladesh that will not cause major distortion in the level of exports, since the parameters in this equation seem to follow a stable pattern during the estimation period.

Impulse Response Analysis

Impulse response function is estimated to find out the response of one variable due to shock in another variable for the next 10 years. The responses of the variables world income (WY), relative price (RP), real exchange rate, and employment (EM) with respect to one standard deviation shock in the variable exports are depicted below in Figure-7.

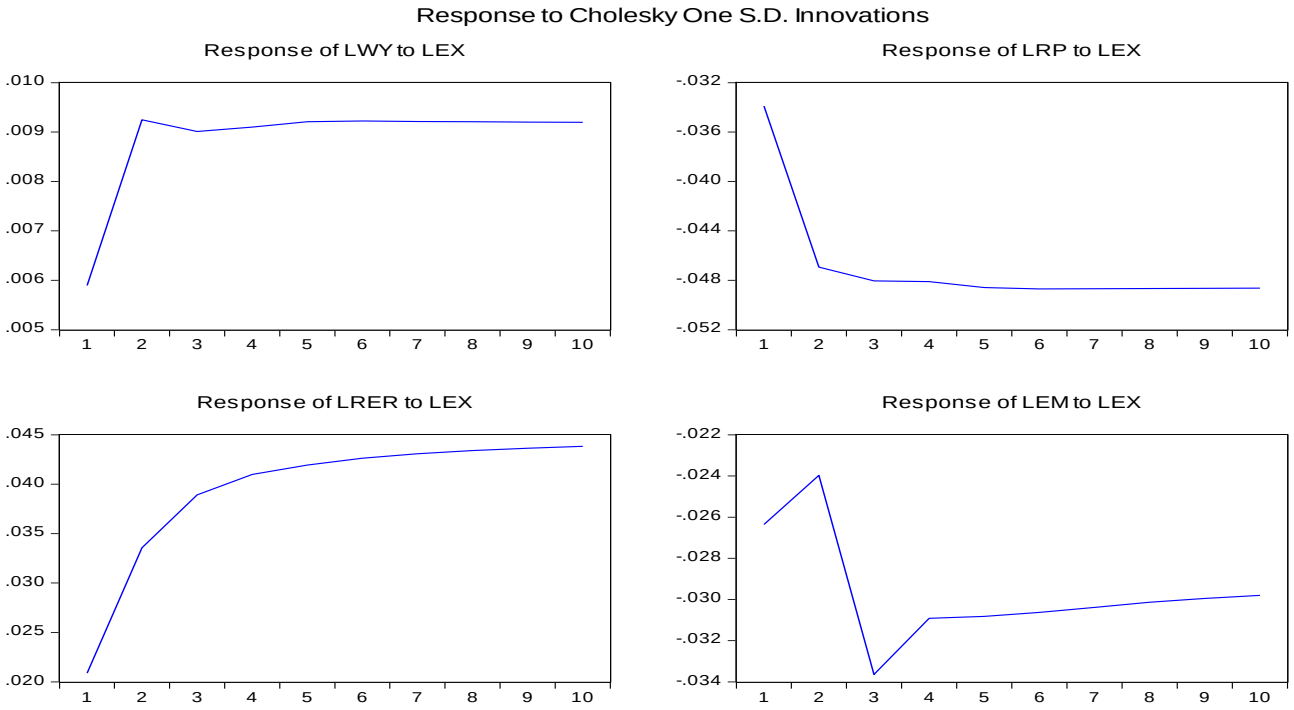

Figure 7: Response of WY, RP, RER, EM in EX : Source: BGME Publications and WDI. Own Calculations.

From Figure-7, it can be said that with respect to one standard deviation the variables WY and RER respond positively for the next 10 years but the variables RP and EM respond negatively for the next 10 years in the variable exports of the garment sector of Bangladesh.

CONCLUSION AND POLICY IMPLICATIONS

In this paper we empirically examine the short-run and long-run elasticities of the export demand function for the garment sector of Bangladesh using modern econometric techniques based on the time series data from 1979 to 2020. For this study a log-linear model is proposed based on the macroeconomic variables namely exports of the garment sector of Bangladesh, world income, relative price, real exchange rate and employment of this sector. The empirical investigation involves the following four steps. In the first step, the unit root problem for each time series variable is examined using ADF, PP and KPSS tests. From the test results it is found that all the variables are integrated of order one. The existence of unit root problem indicates the existence of long-run cointegration relationships among the variable. Therefore, in the second step, the Johansen and Juselius's (1990) multivariate cointegration test is applied to find the number of cointegration equations. From the estimated results of the Johansen and Juselius's (1990) test it is found that there are at most three cointegration equations indicating that there exits long-run cointegration relationships among the variables.

The existence of long-run cointegration relationships among the variables indicating the existence of causal relationship between variables but it does not indicate the direction of causal relationship between variables. Therefore, the Engle and Granger test for causality analyses is applied to the VEC model in order to detect the short-run and long-run causal relationships. The Granger causality test results [see Table-4], indicates the existence of bidirectional causalities from the world income, relative price and exchange rate to exports, from employment to world income and from export values to employment. The estimated coefficient of ECM(-1) of the VEC model indicates the existence of long-run causality when exports and employment are the endogenous variables which also conform the results of the Johansen and Juseliues's cointegration test. From the estimated results of the short-run and long-run equations it is found that the variable world income has the significant positive effects on the exports for both short run and long run. It is found that in the short run 1% increase in world income the exports of the garment sector will increase by 4.1707% but in the long run it will increase by 5.4766%. Since the long-run effect is higher than the short-run effect implies that over time due to the higher world income the exports of the garment sector of Bangladesh will increase more and more.

The long-run and short-run effects of the variables relative price, real exchange rate and employment on exports are negative but the long-run effects of relative price and real exchange rate are statistically significant but the short-run effects of relative price, real exchange rate and employment on exports are not statistically significant at all. It is found that in the long-run for 1% decrease in relative price and real exchange rate the exports will be increased by 1.256% and 1.1942% respectively. From the estimated short-run and long-run elasticities of EX it can be concluded that over time the decline of relative price will boost more exports of the garment sector of Bangladesh in the long run. Since the short-run as well as long-run effects of employment on exports are negative but not statistically significant which implies that there exists excess unskilled workers in the garment sector of Bangladesh. The estimated coefficient of ECM (-1) [see Table-6] of the short-run equation is statistically significant at any significance level indicating that the speed of adjustment for the short-run to reach into the long-run equilibrium is significant. The error correction term is statistically significant and its magnitude is quite higher indicating a faster return to equilibrium in the case of disequilibrium. The estimated coefficient of ECM(-1) is -0.9705 with the expected sign, suggesting that when the export value is above its equilibrium level, it will adjust about 97.05% within the first year. The full convergence process to reach the equilibrium level takes about more than a year. Thus, the speed of adjustment is significantly faster in the case of any shock to exports of the garment sector of Bangladesh. For robustness check of our results, the CUSUM and CUSUM square tests, LM test for autocorrelation and heteroscedasticity, ARCH test, F-test for misspecification and JB test for normality of errors are applied. It is found that both the CUSUM and CUSUM square tests do not cross the 5% critical lines indicating that all the coefficients in the error correction model are stable. LM test results for serial correlation, and heteroscedasticity indicate that there are no problems of autocorrelation and heteroscedasticity in the model. ARCH test implies that autoregressive conditional heteroscedasticity is absent in the model. The F-test result indicates that there is no problem with misspecification of the model. The JB test results also support that there is no problem

of the normality of random error terms in the model. The stability of the estimated parameters during the estimation period suggests that the preferred export demand function can be used for policy analysis and forecasting, such that the impact of policy changes considering the explanatory variable of exports for the garment sector of Bangladesh will not cause major distortion in the level of exports.

Policy Implications:

From the estimated results the following points can be implemented to promote exports of the garment sector of Bangladesh:

(i) Since there is a long-run equilibrium connection among the variables, these variables have mutual dependence on expansion of exports of the garment sector of Bangladesh. Therefore, in this regard, the government and the stakeholders of the garment sector including Bangladesh Garment Manufacturers and Exporters Association (BGME), Bangladesh Knitwear Manufacturers and Exporters Association (BKMEA), Best Practice Garments Bangladesh (BPGB), Bangladesh Textile Mills Association (BTMA), Global Alliance for Fair Textile Trade (GAFTT), International Apparel Federation (IAF), National Skill Development Corporation (NSDC) and Owners and Workers of the Garment Sector of Bangladesh have to take different measures for garment sector development which causes promote of exports of the garment sector in Bangladesh.

(ii) It is found that in the long-run 1% decrease in relative price will increase exports by 1.25% which is statistically significant. Therefore, from the point of view of policy, the policy makers including the government should focus more on controlling inflation for which the garment products will be more competitive in the global market which may play a significant role in boosting out exports.

(iii) Since the effects of the real exchange rate are negative for both short-run and long-run but statistically significant for long-run, which suggests that depreciation of the exchange rate would not stimulate the export volume. Hence for point of view of policy, if policymakers want to boost exports of the garment sector of Bangladesh by depreciating the BDT will not get desirable results in the long run

(iv) It is also found that employment-generating effects of exporting garment products are negative for both short-run and long-run but not statistically significant. This can be explained by the existence of an abundance situation of the unskilled workers currently available in this sector. Therefore, the owners of the industry and other stakeholders have to provide different training programs to make employees skilled workers.

(v) The world income has positive effects on exports (in both short-run and long-run) thus it can be said the increase in world income plays an important role in promoting exports of the garment sector of Bangladesh, but policymakers have no controlling power behind this factor and this factor is influenced exports as an external factor.

Limitation of the Study

This study provides useful information to the policymakers to formulate appropriate policies to promote exports of the garment sector of Bangladesh. This study proposed the export demand function for the garment sector of Bangladesh by considering the rest of the world as a trading partner of Bangladesh. This is one of the limitations of this study which provides further opportunity for

future research. Moreover, further research has the scope to investigate the bilateral analysis of the export demand function for the garment sector of Bangladesh with 10 major trading partners which may further contribute to the existing literature.

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