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Garment Sector Development Nexus Economic Growth in Bangladesh: A Dynamic Cointegration and Causality Analysis

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Abstract: In Bangladesh the garment sector is one of the major industrial sector which occupied its foremost presence in the economy of the country in terms of foreign exchange earnings, contribution to GDP, and employment generation and as well. The garment sector plays significant roles for socio-economic development and poverty alleviation in Bangladesh. The export-oriented readymade garments (RMG) sector in Bangladesh, started its journey in late 1970s as a small non-traditional sector of export. The industry began its journey from 1978 and formally started its journey in the 1980s, after that RMG sector of Bangladesh started growing, capture the market globally and providing valuable performance. In 1979 the garment sector exported only 0.672 million $ with operating 12 garment factories by 0.39 million workers but in 2020 within a span of two decays export values have gone up to 31456.73 million USD with its 4764 export oriented garment industries including 4.23 million workers. Thus an important question is usually raised by the researchers, is there a long-run cointegration relationship between garment sector development and economic growth in Bangladesh? To give the answer of this question this paper has tried to find out whether the long-run cointegration relationship exists between garment sector development and economic growth in Bangladesh economy. The study is used the times series data from 1976-2020 for garment sector development and economic growth. The existence of long-run cointegration relationship is found between garment sector development and economic growth in Bangladesh economy. From the estimated results of the vector error correction (VEC) model it is found that there exists short run bidirectional causality between garment sector development and economic growth. The significance and negative sign of test statistic of ECM(-1) denotes the existence of long run causality between garment sector development and economic growth. Therefore, it can be presumed that there is a long-run equilibrium connection between garment sector development and economic expansion in Bangladesh economy. From the estimated values of response function it can be said that with respect to one standard deviation the variable garment sector development responds positively for the next fifteen years in the variable economic growth in Bangladesh.

Keywords: Garment Sector Development, Long-run Cointegration, VEC Model, Response Function

1. Introduction

Bangladesh is one of the fastest growing economies in the world with an average growth rate of 5.49% (1972-2020) in its Gross Domestic Product (GDP). In 1972 the GDP of Bangladesh was nearly 21.48 billion USD and in 2020 its GDP became about 214.96 billion USD which is 10 times of 1972 and it is the 41st largest economy of the world [38]. Bangladesh is also the world's third largest exporter of garment products with an average growth rate of export values is of 28.74% (1976-2020) in which the growth rate of total export values is 11.76% (1976-2020) which indicates that the growth rate export values of garment sector is 2.44 times higher than the growth rate of total export values of Bangladesh. In 1976 the export values of RMG sector was 0.012 million USD but in 2020 it reached to 31456.73 million USD (Export Promotion Bureau, 2020). Also in 1976 the total export values 417.00 million USD and in 2020 it

becomes about 38758.31 million USD. Having said that, Bangladesh has been increasing its RMG export at a fastest growth rate and it occupies 81.16% of the total export values in 2020. The export values of garment sector, and the total export values are shown below graphically in Figure 1 and the contribution of the garment sector of Bangladesh to the total export values in percentage from 1976-2020 is shown below graphically in Figure 2. Figure 1 indicates that the total export values and also the export values of the garment sector of Bangladesh are increasing at a faster rate in recent years. Figure 2 indicates that the contribution of the garment sector to the total export values is increasing at a faster rate with average contribution is 58.92% which is statistically significant at any significance level.

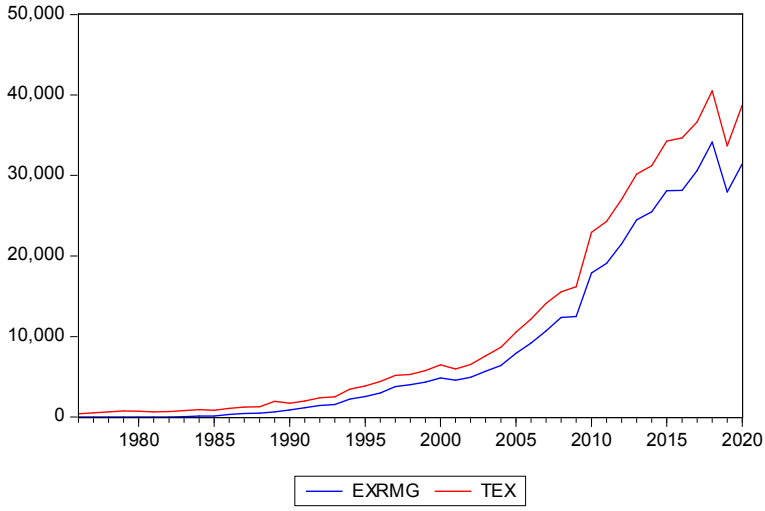

Figure 1. *Export values of garment sector and total export values.*

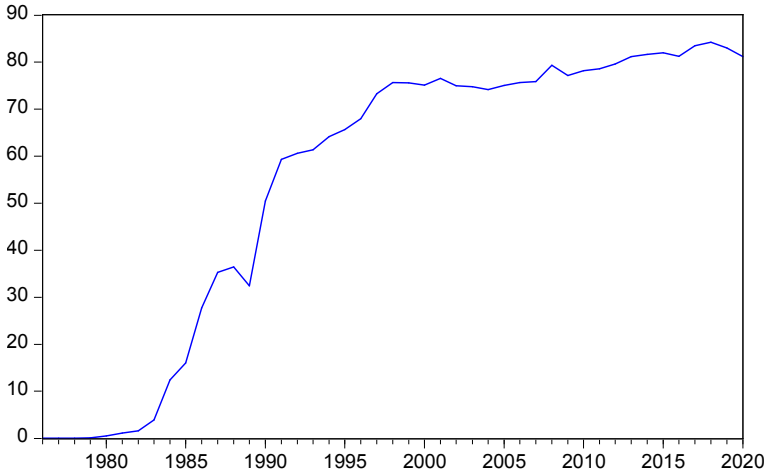

Figure 2. *Percentage of export values of garment sector to total export values.*

Thus it can be said that now-a-days garment sector development has a significant impact in the economic growth in Bangladesh including socio-economic development and poverty alleviation.

Therefore the researchers, may argue that garment sector development is a vital explanatory aspects for the economic growth since there may exits a long run cointegration relationship between economic growth and garment sector development. Next, garment sector development accelerates the economic development by boosting savings to domestic investment, mobilizing investment because of the financial intermediation which assists investment procedure [13]. Therefore, these funds are transmitted from inefficient sectors to efficient sectors and firms can take the advantages of risk spreading and sufficient liquidity level, contributing in the production level of the economy, and ultimately stimulating the economic growth. If the development of the garment sector exits, then the opportunities of capital inflows from both foreign and domestic sources are increased which stimulate the financial activities, such as boosting savings level, channeling capital into efficient sectors, diversifying risks, and contributing in movement of goods and service, of the economy. Berthelemy and Varoudaks [8] have assumed that activation of such assets for investment is positively a vital complaint for economic take off, however nature of their distributions to different investment projects is an essential catalyst for economic expansion. This is decisively what a proficient garment sector development does to the

economy. The investment level of an economy can be significantly influenced by the garment sector activism. Thus it can be said that the garment sector supplies oxygen to the financial sector including other sector of an economy. Schumpter [34] has given priority on the fruitful support of financial sector to economic expansion in the 19th and 20th centuries.

A question, therefore, arises in our mind on whether the positive impacts of garment sector development on economic growth in Bangladesh is either statistically significant or not both in short-run and long-run. To give the answer of this question the principal objective has been made to investigate both the cointegrating and causal relationships between garment sector development and economic growth using the modern econometric techniques based on time series data from 1976-2020. The conintegration test has been applied to the check the long run causal relationship.

The paper is organized as follows: The second section of the study has presented literature review. The third section of the study has presented data sources and some descriptive statistics of the variables. The fourth section of the study has presented the econometric methodology say: Unit root test, Cointegration check, Vector error correction (VEC) model and results analysis. Also GMM method is applied to estimate the short-run and long elasticities economic growth with respect to garment sector development. Impulse response function is estimated in order to know the response of the variable garment sector development due to shock in economic growth of Bangladesh for the next fifteen years. The final section of the study has presented conclusion and policy implications.

2. Literature Review

A large number of theoretical and empirical research studies have been conducted regarding the garment sector of Bangladesh. For example Absar, S. S. [1] conducted a study on the problems of wages in the garment sector of Bangladesh and found that the garment sector of Bangladesh got huge development in the word but the wage rate of the employees was not satisfactory level. Bhattacharya and Rahman [9], conducted a study about growth trends and the post-MFA challenges in the garment sector of Bangladesh. They found that more than 1.5 million workers had increased in the garment sector and 70% of the total female workers in the country's manufacturing sector. Ahamed [2] conducted a study in order to find the impact of garment industry on livelihood pattern of the women garment workers in Narayangang District of Bangladesh. This study found positive changes of socio-economic status as well as livelihood pattern of the women garment workers. This study also examined that provisions of micro credit for women garment workers were considered to be an economic as well as social relief for self-employment with a view for increasing their income and improving their living condition. Mridula and Khan [26] conducted a study on the working condition and productive health status of female garment workers of Bangladesh. In this study most of the respondents where from 16 to 30 years. This study found that most of the respondents reported a lack of awareness about occupational safety and health issues. A most dangerous finding of the study was that the female garment workers were not aware about their reproductive healthcare. This study also found that the female workers reported about their several health related problems associated with their working environment. The significant finding of this study was that most of the workers lived in slum areas with inhuman living condition. Their salary was very poor and sometimes not paid in due time. Chowdhury and Ullah [14] conducted a research work on socio-economic conditions of the female garment workers in Chittagong Metropolitan area. This study highlighted the conditions of the female workers in two perspectives namely: one was social perspective and another was economic perspective. This study found that the standard of living of the female garment workers was very poor and they were not free from vicious cycle of poverty and they were facing extreme difficulties to fulfill their basic needs to survive. Bhuiyan [11] attempted to explore the socio-economic status of the garment workers in Bangladesh. This study was based on mainly social and economic status of 100 garments workers from Rampura and Badda areas of Dhaka city. This study found that 70% of the female workers worked dawn to dusk even up to late night but their wages were not satisfactory level. This study also found that the workers were not free from vicious cycle of poverty and they were suffering at extreme level to fulfill their basic needs. It was also found that they have no additional time or scope for recreation. Islam & Chowdhury [22], conducted a study on socio-economic condition of the garment workers in Bangladesh. This paper was an endeavor to highlight the conditions of the workers from the perspective of housing condition, education, health and sanitation and services role of the female workers. The study suggested that the standard of living of the workers was very poor and they are facing extreme difficulties in obtaining their basic needs to survive in the society. Their study recommended that improvement is very much needed in some fundamental areas say housing condition, education level, health and sanitation, and service role in favor of female workers. Ahamed [3] conducted a study on improving social compliance in the garment sector of Bangladesh. This study found that the working conditions in the garment sector of Bangladesh are very poor and facing challenges regarding social compliance. He also pointed out that fair labor practices and government and entrepreneurs' role are very much needed for implementation. Akter [5] conducted a study to assess the impact of female labor migration from rural to urban area using the Sustainable Livelihood Approach (SAL). The study conducted in Tongi and Gazipur Sadar under Gazipur district. This study found positive changes in different livelihood assets say financial capital, natural capital, social capital and also decision making. Ahmed [4] conducted another study on job dissatisfaction in the garment sector of Bangladesh. This study observed that satisfied workers are more likely to be

hard worker, creative, flexible, innovative, dynamic, risk taker and loyal to the industry. Khatun and Shamsuzzaman [25] conducted a study on the job satisfaction in the garment sector of Bangladesh. This study focused on working conditions of the employees and failure of existing labor laws. This study found that the workers of AKT group are satisfied with working environment, health facilities and benefits of overtime. Farhana, et. al. [18] carried out a study on wages level, age group, gender, family life, living standard and working hours of workers' in the garment sector of Bangladesh. This study found that the demand of garments of Bangladesh is very high in the international market but the wage rate of the workers was very poor. Their study recommended that improvement is very much needed in some areas like labor wages, compliance, business climate, trade logistic and skill level of the workers. Akterrujjaman & Ahmed [6] carried out a study to measure the level of satisfaction of the workers in the garment sector of Bangladesh. This study is based on 150 workers from 24 garment factories from Gazipur and Dhaka city of Bangladesh. Thus study found that most of the workers were not satisfied about their job. This study also observed that the garment factories in Dhaka Gazipur city were not so sincere in case of workers satisfaction. This study recommended that to increase the productivity and profitability garment manufacturers should give importance about the satisfaction of the garment workers. Mustafa et. al. [27] carried out a study to document the sociodemographic profile of women workers in the garment sector and to assess the impact of employment in the garment sector for livelihood change. This study is based on two garment factories from Dhaka city and another two garment factories from Gazipur city and a sample of 60 women workers was selected. This study found that the employment opportunities of women workers in the garment sector of Bangladesh play significant role to change their socio-economic condition, livelihood pattern, in case of decision making and to provide education to their children. Rahman et al. [31] carried out a study on growth, contribution and challenges of the garment sector in Bangladesh. This study is based on secondary data. This study highlighted that the garment sector is the largest exporting industry that has experienced significant growth during last 25 years. This sector provided more than 5 million direct job, 16% of GDP and more than 81% of foreign remittance in FY2013-14. Osmani & Hossen [28] conducted a study on the problems of working women in the garment sector of Bangladesh. This paper highlighted that the problems faced by garment women workers are extreme in nature. It may cause a serious threat to the development of Bangladesh economy. This paper found that the major problems faced by the garment women workers are salary discrimination due to genders, late salary payment, sexual harassment, mocking, no leave during pregnancy and sickness, inadequate medical facilities, housing problems, insufficient transportation of companies, spread of various diseases and unhygienic workplace due to industrial discharges. The research asserts that if these problems persist and not tackled effectively, the number of working women will gradually diminish; consequently, the economic growth of Bangladesh will stand far from its desired goal. Elahi et al. [16] carried out a study on comparative analysis before and after Rana Plaza incident in garment sector of Bangladesh. This paper highlighted that after Rana Plaza incident different conditions of the garment sector of Bangladesh have changed due to demand of the buyers of the world including the working condition, health & safety measurements, labor right and wages of garment workers. This paper also pointed out that more investment behind the human capital of the sector would be key factor for coming days. To secure more value addition companies must invest behind human resource. If not then the garment sector full or a portion must be transformed into world class best performing ones. Golam [19] conducted a study on new minimum wage of the garment sector of Bangladesh. This study found that the new wage structure policy has not yet been implemented effectively. This paper also highlighted that a large number of workers including graded workers are receiving lower amount than the amount approved minimum by the government. Hasan [21] conducted a study on minimum wage in garment sector of Bangladesh. This studies found that the minimum wage varies across the country based on the nature of the industry. This paper highlighted that in the garment sector of Bangladesh has been enjoying a very clear price competitiveness against its' competitors say China, Vietnam or India. This paper also highlighted increase on wage in the garment sector of Bangladesh does not ensure the well beings of the workers in their daily lives due to price hike of all commodities. It has been experienced that any announcement of new pay scale increases the prices of all commodities instantly. It is also experienced that the declaration of national budget every year in the parliament automatically increases the prices of all products including the essential commodities. As a result the revision of wages of the workers of garment sector of Bangladesh do not play any role for the well-being of their daily lives. Salam and Senasu [32] carried out a study on the development of the sustainable index for the garment sector in Bangladesh. They recommended that proper use of this index in the garment sector of Bangladesh could help in the garment sector of Bangladesh to overcome the difficulties they face regarding sustainability. Syed [36] conducted a study on review landscape of garment industry of Bangladesh in order adapt to the monopsony theory and disregard the neoclassical economic theory with regard to minimum wage policy. This study found inadequate mechanisms to implement minimum wage provisions under the Bangladesh labor legislation. Thus the present minimum wage policy has not been implemented to its fullest as required to protect workers' right in Bangladesh. This paper also pointed out that the garment industry in Bangladesh stanch with monopsony theory favoring the application of minimum wage law in the garment manufacturing industry. This paper also recommended that Bangladesh must follow different mechanisms adopted by several countries, followed by ILO

Conventions, and it should disregard the neoclassical theory in the garment manufacturing industry setting.

Zaman and Khan [37] carried out a study on prospects, opportunities and challenges of new payout structure. This paper found that the minimum wage payout setting or increment has no significant influence as a determinant of garment sector contribution to total export of Bangladesh and the number of garment factories. This paper pointed out that the minimum wage payout has significantly act as one of the determinants of number of employees of the garment sector of Bangladesh. It is also found that higher minimum wage attracts the new workforce toward the garment sector and higher minimum wage payout in lower graded labor.

Will encourage the efficient workers not to leave the sector which may contribute toward the export from the garment sector. This paper also highlighted that due to higher minimum payout wage the contribution of per unit efficient employee play the significant role on the export performance of the garment sector of Bangladesh. This paper also pointed out that the owners of the garment factories are very much reluctant to implement the approval new payout structure due to the lack of expertise and higher employee turnover.

Research Gaps from Literature:

From the literature review it can be said that there have been many studies in the context of garment sector of Bangladesh, but still now no one has conducted any study for the dynamic cointegration and causality analyses between garment sector development and economic growth in also to find the short-run and long-run impacts of garment sector development on Bangladesh economy using the modern econometrics techniques. Therefore, this study attempts to fulfill the gap in the literature. Now-a-days, in Bangladesh, the garment sector development and economic growth have become extensive. Thus, the findings of this study could be an important implications for Bangladesh. Moreover, the study has used sophisticated econometric approaches to conduct to find out linkage between economic growth and garment sector development, mitigating gap in the existing literatures.

3. Data Source and Variable Definition

The data of export values of the garment sector and total export values of Bangladesh have been collected from the BGMEA statistics and the data of per capita GDP (PGDP, constant 2010 USD) have been collected from the time series data bank of the World Bank Development Indicators (WDI). All data have been collected from year 1976 to year 2020.

Garment Sector Development (GSD): The garment sector development (GSD) is defined as the percentage of the export values of the garment sector to total export values. Thus the GSD for time period t is defined as:

$$GSD_t = \frac{\text{Export values of the garment sector at time t}}{\text{Total export values at time t}} \times 100,\ t = 1, 2, ..., T \quad (1)$$

Economic Growth: Per capita gross domestic product (PGDP, constant 2010 USD) is used as an indicator variable of economic growth which is defined as the total gross domestic product divided by the number of total population. For the time period t the PGDP is given by:

$$PGDP_t = \frac{GDP_t}{\text{Total Population}_t};\ t = 1, 2, 3, ..., T \quad (2)$$

The descriptive statistics mean, standard deviation (Std. Dev.) and coefficient of variation (CV) of these variables are recorded below in Table 1.

Table 1. *Some Descriptive Statistics.*

Descriptive Statistics	EXRMG	TEXPORT	GSD	PGDP
Mean	8780.540	11267.97	54.9898	607.4310
Median	4019.980	5312.860	74.1500	495.6268
SD	10843.24	12968.15	31.0490	275.5301
CV	123.4918%	115.0886%	56.4632%	45.3599%
MIN	0.012	417.00	0.0100	343.9482
MAX	34133.27	40535.04	84.2100	1305.0000
Range	34133.258	40118.04	84.2000	961.0518
Skewness	1.0901	1.0545	-0.8648	1.1531
Kurtosis	2.6922	2.5921	2.0822	3.2094
Growth Rate	28.74%	11.76%	14.6087%	3.0102%
Jarque-Bera Test	9.0893	8.6509	7.18848	10.0547
Probability	0.0106	0.01323	0.0275	0.0065
Observations	45	45	45	45

EXRMG: indicates export values of the garment sector, TEXPORT: indicates total export values of Bangladesh.

From the reported values in Table 1, it is found that the variability is highest for the variable.

EXRMG followed by TEXPORT, GSD and PGDP. The results also support that the variables EXRMG, TEXPORT, and PGDP are positively skewed while the variable GSD is negatively skewed. The results also support that the curves of

the variable EXRMG, TEXPORT, and GSD are platykurtic and the curve of the variables PGDP is leptokurtic. From the Jarque-Bera test results it can be said that the variables EXRMG, TEXPORT, GSD and PGDP are not normally distributed. Also it is found that the average growth rate is highest for EXRMG and followed by GSD, TEXPORT and PGDP.

4. Econometric Methodology, Results and Discussion

The dynamic cointegration and causal relationships between garment sector development and economic growth are examined using the modern econometrics techniques. An investigation of the dynamic causal relationships between the variables involves three steps. At the first step, the existence of a unit root problem in each variable is examined. If a unit root problem is present, then the long run-cointegration relationships between the variables are tested at 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 at the third step. At the final step, the GMM technique is applied to examine the short-run and the long-run relationships between the variables.

4.1. Unit Root Tests

It is well known that the usual techniques of regression analysis can result in highly misleading conclusion when variables contains stochastic trend (Stock and Watson [35], Granger and Newbold [28]). In particular if the dependent variable and at least one independent variable contain stochastic trend, and if they are not co-integrated, the regression results are spurious, (Granger and Newbold [28]). To identify the correct specification of the model, an investigation of the presence of stochastic trend in the variables is needed. The Augmented Dickey-Fuller (ADF) [15] and Phillips-Perron (PP) [29], Tests are applied in order to investigate that each of the variables contains stochastic trend or not. The estimation technique of these two tests is described below;

Case 1: Model with constant and trend terms:

$$\Delta X_t = \alpha_0 + \alpha_1 t + \theta X_{t-1} + \sum_{i=1}^{m} \phi_i \Delta X_{t-i} + \varepsilon_t \quad (3)$$

Case 2: Model with only constant term:

$$\Delta X_t = \alpha_0 + \theta X_{t-1} + \sum_{i=1}^{m} \phi_i \Delta X_{t-i} + \varepsilon_t \quad (4)$$

Here X_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 AIC and SBIC criterion. If $\theta = 0$, the series X_t contains a unit root problem and therefore an I(1) process governed by a stochastic trend. If a time series variable is integrated of order one, we have to investigate the 2^{nd} order unit root and the equation is given by;

$$\Delta^2 X_t = \beta_0 + \lambda \Delta X_{t-1} + \sum_{i=1}^{m} \gamma_i \Delta^2 X_{t-i} + \varepsilon_t \quad (5)$$

where Δ^2 is the second-difference operator. If $\lambda = 0$, the series X_t is said to be integrated of order two (I(2)). Let d represents the number of times that X_t needs to be differenced in order to reach the stationary. In this case X_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 original tabulated by Dickey-Fuller [15]. Apart from ADF test (Dickey and Fuller, [15]), PP test (Phillip and Perron, [29]) will be applied to get overwhelming conclusion. The unit root test results have been provided Table 2.

Table 2. *Unit Root Test through ADF and PP Tests.*

Variables	ADF test	p-value	PP test	p-value
Case 1: Model with constant and trend terms [Level Form]				
lnPGDP	0.1878	0.9972	0.3333	0.9983
lnGSD	-2.3543	0.1598	-2.6530	0.2602
Case 2: Model with constant term only [Level Form]				
lnPGDP	6.7059	1.0000	7.2735	1.0000
lnGSD	-2.3615	0.1594	-4.7139**	0.0004
Case 1: Model with constant and trend terms [Differenced Form]				
ΔlnPGDP	-6.6391**	0.0000	-6.6396**	0.0000
ΔlnGSD	-7.3491**	0.0000	-5.2923**	0.0005
Case 2: Model with constant term only [Differenced Form]				
ΔlnPGDP	-3.7259**	0.0070	-3.8644**	0.0048
ΔlnGSD	-7.3783**	0.0000	-3.6532**	0.0085

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

From the tests results that are presented in Table 2, it can be concluded that all variables are integrated of order one (I(1)).

4.2. Cointegration Test

To investigate the cointegrating relationship, I also applied the Johansen and Juselius's, [24] test. Since the Johansen and Juselius's [24] multivariate cointegration methodology is fairly well documented, a brief reminder of this method is given below

$$\Delta X_t = B_0 + \Pi X_{t-p} + \sum_{i=1}^{p} B\Delta X_{t-i} + \eta_t \quad (6)$$

where X_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 (6) are deemed to be potentially endogenous. The long-run equilibrium relationship among X_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 (6) can be transformed to VAR model of pth order. If 0<r<n, then there are $n \times r$ matrices of α and β such that

$$\Pi = \alpha\beta' \quad (7)$$

The strength of cointegration relationship is measured by α, β is called cointegration vector and $\beta' X_t$ is I(0) although X_t 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 (6) is determined on the basis of AIC and SBIC criteria and the adjusted likelihood ratio (LR) test is most commonly used. The test results are reported in Table 3.

Table 3. *Johansen and Juselius Cointegration Test Results for SMD Equation.*

Hypothesized Number of CE	Trace Statistic	Max-Eigen Statistic
Case-1: Intercept (no trend) in CE and VAR		
None*	63.7599***	48.4848***
	[15.2750]	[14.2646]
	(0.0000)	(0.0000)
At most 1*	15.2750**	15.2750**
	[3.8415]	[3.8415]
	(0.0001)	(0.0001)
Case-2: Intercept and trend in CE and no intercept in VAR		
None*	73.9753***	48.6795***
	[25.8721]	[19.3870]
	(0.0000)	(0.0000)
At most 1	25.2562**	25.2562**
	[12.5180]	[12.5180]
	(0.0002)	(0.0002)

Note: ***p<0.01 denotes significant at 1% level, **p<0.05 denotes significant at 5% level, *p<0.10 denotes significant at 10% level.

From the Table 3, it can be concluded that there exists long run cointegration relationship between garment sector development and economic growth in Bangladesh.

4.3. Causality Analysis- VECM

The cointegration relationship indicates the existence of causal relationship 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. There are three different models that can be used to detect the direction of causality between two variables X and Y depending upon the order of integration and the presence or absence of cointegration relationship. If two variables say X and Y are individually integrated of order one i.e. I(1) and cointegrated, then Granger causality test may use I(1) data because of super consistency properties of estimators. If X and Y are I(1) and cointegrated, the Granger causality test can be applied to I(0) data with an error correction term. If X and Y are I(1) but not cointegrated, Granger causality test requires transformation of the data to make I(0). For this paper, the presence of cointegration relationship the application of Engle and Granger [16] causality test in the first differenced variables by means of a VAR will misleading the results, 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 mth order vector error correction model given as below:

$$\begin{bmatrix} \Delta \ln PGDP_t \\ \Delta \ln GSD_t \end{bmatrix} = \begin{bmatrix} C_1 \\ C_2 \end{bmatrix} + \sum_{k=1}^{m} \begin{bmatrix} \theta_{11k} & \theta_{12k} \\ \theta_{21k} & \theta_{22k} \end{bmatrix} \begin{bmatrix} \Delta \ln PGDP_{t-k} \\ \Delta \ln GSD_{t-k} \end{bmatrix} + \begin{bmatrix} \delta_1 \\ \delta_2 \end{bmatrix} ECM_{t-1} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad (8)$$

where, t = m+1, m+2, m+3,……., T;. The $C's, \theta's$, and $\delta's$ 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 the equation (8) 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

GSD does not Granger cause PGDP in the short run, if and only if all the coefficients θ_{12k}'s $\forall$ k are not significantly different from zero in equation (8). Similarly the PGDP does not Granger cause GSD in the short run if and only if all the coefficients θ_{21k}'s $\forall$ k are not significantly different from zero in the equation (8). There 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 ECM's. 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 4.

Table 4. *Causality Test Results.*

Variables	ΔlnPGDP	ΔlnGSD	ECM(-1) [t-test]
ΔlnPGDP		9.5031** (0.0037)	-3.1695*** (0.0029)
ΔlnGSD	3.29791** (0.0187)		0.6622 (0.5134)

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

From causality analysis results in table 4, it can be concluded that there exists short run bidirectional causality between garment sector development and economic growth. The significance and negative sign of test statistic of ECM(-1) denotes the existence of long run causality between garment sector development and economic growth which also conform the results of the Johansen and Juseliues's conintegration test.

4.4. Short-run and Long-run Elasticities of Economic Growth

Since, it has been found that there exists a cointegrating vector among the variables, the following ARDL (m, p) model is projected here in order to find the long-run impacts of GSD on economic growth.

$$\ln PGDP_t = \delta_0 + \sum_{i=1}^{m} \delta_{1i} \ln PGDP_{t-i} + \sum_{i=0}^{p} \delta_{2i} \ln GSD_{t-i} + \varepsilon_t \quad (9)$$

The selection of the orders of lags in the above models is very sensitive which is done by using two criterion AIC and SBIC. The results are given below in Table 5.

Table 5. *The Long-run Elasticities of Economic Growth.*

Dependent Variable lnPGDP	Coefficient	t-Test	Probability
Constant	6.4147**	130.4982	0.00000
lnGSD	0.1354**	9.5262	0.0000

**: indicates significant at 1% level.

From estimated results in Table 5, it has been found that for a 100% increase in garment sector development leads to increase in economic growth 13.54%, in the long-run and which is statistically significant at any significance level.

Table 6. *Short-run Elasticities of Economic Growth.*

Dependent Variable (Δ lnPGDP)	Coefficient	t-Test	Probability
Constant	0.0223	1.3258	0.1926
Δ lnGSD	0.0117	1.7129**	0.0867
ECM{-1}	-0.2292	6.2964*	0.0000
Sensitivity Analysis: The Short-run Diagnostic Test Results			
LM Test for Autocorrelation		0.7671	0.3811
LM test for Heteroscedasticity		2.9043	0.2341
ARCH Test		1.2536	0.2629
F-Test for Misspecification		0.4654	0.4991
JB Test for Normality of Errors		4.9092	0.0900

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

$$\Delta \ln PGDP_t = \psi_0 + \sum_{i=1}^{m} \psi_{1i} \Delta \ln PGDP_{t-i} + \sum_{i=0}^{p} \psi_{2i} \Delta \ln GSD_{t-i} + \lambda ECM_{t-1} + \omega_t \quad (10)$$

The appropriate lag length of the equation (10) is selected using the AIC and SBIC criterion. Here, the parameter λ represents the speed of adjustment for short-run to reach in the long-run equilibrium if there is any shock to the economic growth due to changes in the garment sector development. It is expected that the sign of λ will be negative and significant and $|\lambda|<1$. The ECM_{t-1} is the one period lagged error term which has been derived from the long-run equation (9). The short-run coefficients of economic growth with respect to GSD are given below with the diagnostic test results in Table 6.

The Table 6 shows that the coefficient of ECM (-1) is

statistically significant at any significance level indicates that speed of adjustment for short-run to research in the long-run equilibrium is significant. The error correction term is statistically significant and it's magnitude is quite higher indicates a faster return to equilibrium in the case of disequilibrium. The error correction term is -0.2292 with the expected sign, suggesting that when per capita real GDP is above or below its equilibrium level, it adjusts by almost 22.92% within the first year and the adjustment is statistically significant. The full convergence process to its equilibrium level takes about more than 4 years. Thus the speed of adjustment is very high in the case of any shock to the economic growth in Bangladesh. It is found that the variable garment sector development has significant positive impact on economic growth in the short-run at 10% significance level.

It is also found that the long-run elasticity [see Table 5] of economic growth with respect to garment sector development is higher than the short-run elasticity this implies that over time the garment sector development will contribute more economic growth in Bangladesh as a result the standard of living of the peoples of Bangladesh will be increased.

Sensitivity Analysis: Diagnostic tests for serial correlation, autoregressive conditional heteroscedasticity, heteroscedasticity, functional form misspecification and non-normal errors are conducted and the results are reported in Table 6. The test results indicate that there is no problem of heteroscedasticity. Also the serial correlation and autoregressive conditional heteroscedasticity problems are not present in the short-run model. The test results also support that there is no problem of normality of random error terms in equation (9).

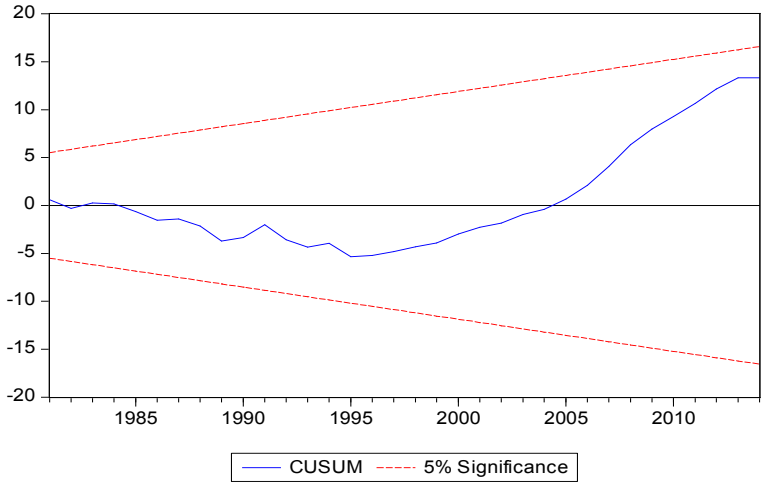

Figure 3. *Plot of cumulative sum of residuals.*

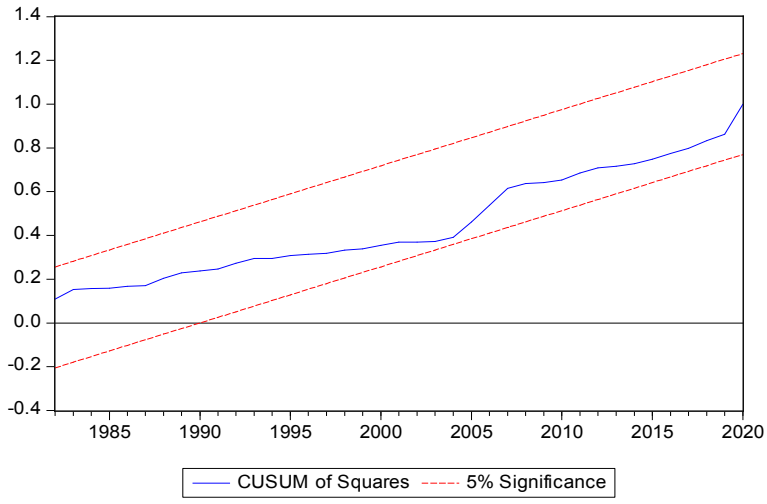

Figure 4. *Plot of cumulative sum of squares of recursive residuals.*

4.5. CUSUM and CUSUMSQ Tests

Finally the stability of the long-run parameters together with the short-run movements for the equations has been examined using cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests proposed by Borensztein et al. [12]. The related graphs of these tests are presented below in Figures 3 and 4.

From Figures 3 and 4 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 economic growth model can be used for policy decision making purpose, such that the impact of policy changes considering the explanatory variable of economic growth model will not cause major distortion in the level of economic growth, since the parameters in this equation seem to follow a stable pattern during the estimation period.

4.6. Impulse Response Analysis

Impulse response function is estimated in order to find response of the variable garment sector development due to shock in the variable economic growth for the next 15 years. The responses of the variable GSD with respect to one standard deviation shock in the variable economic growth is depicted below in Figure 5.

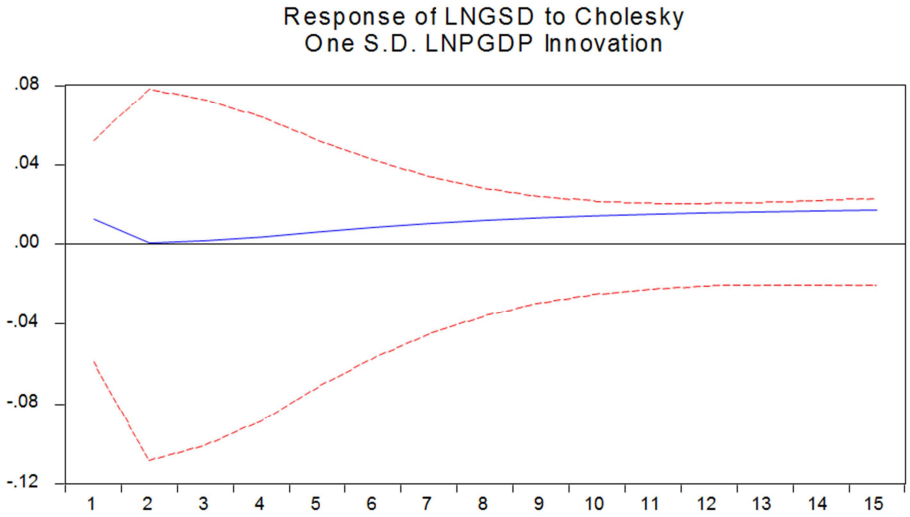

Figure 5. *Response of lnGSD in lnPGDP.*

From Figure 5 it can be said that with respect to one standard deviation the variable GSD responds positively for the next fifteen years in the variable economic growth (PGDP).

5. Conclusion and Policy Implications

This paper has intended to address the long-run cointegration relationship between garment sector development and economic growth in Bangladesh economy. For this study, export values of the garment sector as percentage of total export values has been taken as the proxy variable of garment sector development and per capita GDP has taken as proxy variable of economic growth. After checking unit root problem through ADF and PP tests, we go for cointegration check. It reveals that the long-run cointegration relationship exists between garment sector development and economic growth in Bangladesh economy. The vector error correction model (VECM) analysis has been conducted to check the causality between garment sector development and economic growth. It has been found that there exists short run bidirectional causality between garment sector development and economic growth. The significance and negative sign of test statistic of ECM (-1) denotes the existence of long run causal relationship between garment sector development and economic growth. Thus it can be said that there is a long-run equilibrium connection between garment sector development and economic expansion in Bangladesh economy. It means that these two variables have mutual dependence for economic expansion of Bangladesh. The short-run and long-run elasticities of economic growth with respect to garment sector development are estimated. It has been found that for a 100% increase in garment sector development leads to increase in economic growth 13.54%, in the long-run and which is statistically significant at any significance level [see Table 5]. The error correction term is -0.2292 which is statistically significant at any significance level implies that when economic growth is above or below its equilibrium level, it adjusts by almost 22.92% within the first year. The full convergence process to its equilibrium level takes about more than 4 years. Thus the speed of adjustment is very high in case of any shock to the economic growth in Bangladesh. It is also found that the variable garment sector development has significant positive impact on economic growth in the short-run at 10% significance level. It is also found that the long-run elasticity [see Table 5] of economic growth with respect to garment sector development is higher than the short-run elasticity this implies that over time the garment sector development will contribute more economic growth in Bangladesh as a result the standard of living of the peoples of Bangladesh will be increased. From the estimated values of response function it can be said that with respect to one standard deviation the variable garment sector development responds positively for the next fifteen years in the variable economic growth in Bangladesh.

Policy Implications

Since there is a long-run equilibrium connection between

garment sector development and economic expansion in Bangladesh economy thus the two variables have mutual dependence for economic expansion of Bangladesh. Therefore, in the long-run the government and 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 economic growth in Bangladesh.

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