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Comparative Advantage, Export Diversification, Intra-Industry Trade, and Economic Growth Nexus: Evidence from Bangladesh's Textile and Clothing Industry

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Abstract

The primary goal of this research is to determine the short-term and long-term consequences of regional export growth, regional export diversification, regional intra-industry trade, and regional revealed comparative advantage on Bangladesh's GDP growth from 1990 to 2017. In the first phase, trade indices like regional export growth (EXG), regional export diversification (RED), regional intra-industry trade (RIIT), and regional revealed comparative advantage (RRCA) for Bangladesh's textile and clothing industry in the North American market were calculated based on data from the World Integrated Trade Solution (WITS) and World Trade Organization (WTO). GDP growth is used as a proxy measure for Bangladesh's overall economic development. To check the data series' stationarity, we used several unit roots tests (e.g., ADF and PP). To ensure robustness, the Johansen cointegration test, Engle-Granger Causality test, and ARDL bound test approach were used. The results revealed that the variables have substantial long-run cointegration. In addition, the findings revealed that an improvement in regional export diversification, regional intra-industry trade, and regional revealed comparative advantage increase Bangladesh's GDP growth. In contrast, the increase in regional export growth hinders the GDP growth of Bangladesh in the long-run. According to the facts, Bangladesh's government and policymakers should be concerned about diversification among established product categories and the exploration of new regional markets for the country's long-term economic growth.

JEL: B17, F14, F17, F18, O11, O12

Keywords: International trade; export growth; export diversification; intra-industry trade; comparative advantage; economic development; Bangladesh

1. Introduction

In the 1970s, Bangladesh, which has emerged as Asia's fastest-growing economy, had an inward-looking economic ideology. Liberalization of trade and deregulation began in the 1980s and has grown steadily since then (Yunus and Yamagata, 2012, Ahmed, 2004, Chowdhury et al., 2014). Bangladesh has been Asia's most impressive and unexpected success stories in recent years. Bangladesh's consistent growth with average annual GDP growth of more than 7% in the last five years, and the boom in exports, primarily in the apparel sector, have been critical to the country's economic growth (Basu, 2018, ADB, 2018, Tribun, 2018). Textiles and Clothing play an essential role in Bangladesh's financial life (Dowlah, 1999, Bhattacharya et al., 2002). In addition to meeting domestic demand for fabrics and garments, the sector makes a major contribution to the textile and clothing export trade (Bhattacharya et al., 2002, Yunus and Yamagata, 2012). T&C currently accounts for more than 83.5 percent of the country's export earnings. The sector employs 4.5 million people and adds 40% value to the manufacturing industry, contributes 10.5 percent to GDP, employs 800,000 people indirectly in T&C-based accessory industries, and generates a large client base for banking, insurance, shipping, transportation, hotels, and other related economic activities (BGMEA, 2018, BKMEA, 2018). Bangladesh is battling to maintain its spot as the world's second-largest clothing exporter after China, facing fierce competition from its rivals. In addition to emerging players, regional rivals such as Vietnam, Cambodia, India, and Pakistan have increased their exports to major markets. Myanmar entered the fray recently by steadily growing its export of apparel (Obe, 2018). Despite the fact that textile and apparel companies are tapping into developing East Asian and Latin American markets, the United States, the United Kingdom, and the European Union remain the most common export destinations.

Furthermore, the country's roadmap to reach $50 billion increase the global market share of textile and Clothing to 8% by 2021, which could lead to double the business of backward, forward, and other allied industries to Promote "Sustainability". Bangladeshi textile and clothing industry has been facing a new phenomenon of competitiveness. Like its predecessors in the emerging markets, the industry faces challenges to keep up its growth through market and product level diversification of the industry. Future industry growth would be determined by a variety of internal and external variables that could potentially determine the sector's productivity and efficiency in comparison to its closest global competitors (Ilyas et al., 2009, Vu and Pham, 2016, Alam and Natsuda, 2016). Bangladesh's main export partners are the European Union, North America, and developing countries in Asia, South America, and Africa (Comtrade, 2018). Textiles and clothing account for roughly 85% of Bangladesh's overall export earnings. The apparel sector accounts for 83 percent of the total, which includes knit and woven shirts, blouses, pants, skirts, shorts, sweaters, sportswear, and a variety of other casual and fashion products (Hasan et al., 2016). In 2017 Bangladesh exported a total of $33.4b to different destinations. Among them, 0.52% Africa; 14% Asia; 63% Europe; 20% North America; 1.7% Oceania; and 0.98% exported to South America. Bangladesh needs to focus on other regions for their export destination and increase the cross-border cooperation (CBC) with neighbor's country like India. Cross-border cooperation (CBC) is critical for achieving sustainable development and growth investment (Wu and Wu, 2019). Of all the products Bangladesh exports to North America, almost 96% are textile and clothing products. A similar picture in Europe and Central Asia, where 94% of Bangladesh's export is textile and Clothing.

The current study differs from previous research in a number of respects. It makes important contributions to the emerging economic literature on economic development and regional trade studies. In Bangladesh, where the economy is primarily dependent on the export of readymade garments, the GDP growth rate was considered economic growth. The stationarity of the dataset sequence is tested using various unit root tests (such as ADF and PP). The ARDL approach is used to analyze the short-run and long-run relationship between regional export growth (EXG), regional export diversification (RED), regional intra-industry trade (RIIT), regional revealed comparative advantage, and Bangladesh's GDP growth. To check the long-run cointegrating combinations among the variables, Johansen cointegration test, and Engle-Granger cointegration test, and ARDL bound tests were used in this research.

The remainder of this paper is organized as follows: Section 2 discusses the literature review, and Section 3 depicts materials and econometric methods. Section 4 also includes the analytical results and discussion, while Section 5 wraps up the most recent analysis and offers some policy implications and possible recommendations.

2. Literature Review

Theoretical and empirical studies have previously explored the unidirectional relationship between economic growth and variables such as international trade and trade openness (Omri et al., 2015, Rahman and Mamun, 2016, Keho, 2017, Were, 2015, Hye and Lau, 2015), export (Dutt et al., 2015, Gokmenoglu et al., 2015, Kalaitzi and Chamberlain, 2019, Goh et al., 2017), export diversification (Hesse, 2009, Al-Marhubi, 2000, Dessus and Suwa-Eisenmann, 1998, Ferreira and Harrison, 2012, Herzer and Nowak-Lehnmann D, 2006, Aditya and Acharyya, 2013, Agosin, 2007, Sannassee et al., 2014, Olaleye et al., 2013), revealed comparative advantage (RCA) (Chingarande et al., 2013, Sanidas, 2007), Intra-industry Trade (Tong-sheng, 2006, Leitao, 2012), foreign direct investment (Agrawal, 2015, Iamsiraroj, 2016, Zekarias, 2016, Dike, 2018), tourism (Meyer et al., 2017, Nunkoo et al., 2019, Antonakakis et al., 2019, Wu and Wu, 2019, Roudi et al., 2019), entrepreneurial activity (Meyer and Meyer, 2017, Minniti, 1999, Acs and Armington, 2002), etc. This study has taken regional export growth, regional revealed comparative advantage, regional intra industry trade, and regional export diversification as variables to examine the short-term and long-term relationship with economic growth.

For several years, theoretical and empirical studies have studied the causal ties between exports and economic growth in Bangladesh and around the world, finding that the relationship is one of interdependence rather than unilateral causation. K. A. Al Mamun and H. K. Nath Using an error correction model, they discovered a long-run unidirectional causality from exports to Bangladesh's rise (Al Mamun and Nath*, 2005). Export growth has a major effect on economic growth, according to Shamshad Begum and colleagues (Begum and Shamsuddin, 1998). Using the Auto-Regressive Distributed Lag (ARDL) bounds test for cointegration and the Granger causality tests, Muhammad Shafiullah et al. discovered that there is a strong positive linear correlation between a country's exports and economic growth (Shafiullah and Navaratnam, 2016), (Shirazi and Manap, 2005). Another study found mixed results in terms of export and economic growth, suggesting that real exports and real GDP are only cointegrated in Bangladesh and Bhutan. While India, Nepal, and the Maldives have experienced export-led growth, Bangladesh and Bhutan have experienced the opposite. The data in two nations, Pakistan and Sri Lanka, show no evidence of causality in either direction (Love and Chandra, 2005). The previous literature took the country's total export into account to find a relationship with economic growth. Still, in our study, we took only the textile and clothing industry's export growth in the North American market as a variable to find a correlation between regional export growth of a particular sector with the country's total GDP growth.

Al-Marhubi, Fahim, In his study he discovered empirical evidence that export diversification is correlated with faster growth in his research on export diversification and economic growth. (Al-Marhubi, 2000). By estimating an augmented Cobb–Douglas production feature based on annual time series data from Chile, Dierk Herzer and et al. tested the diversification-led growth hypothesis and discovered that export diversification is important for economic growth (Herzer and Nowak-Lehnmann D, 2006).

Using cointegration and Granger causality studies, Arip and colleagues investigate the long-term relationship between export diversification and economic growth in Malaysia using time series data from 1980 to 2007. The results show that each variable has its own cointegrating vector (Arip et al., 2010). Gustavo F.C. Ferreira and R. Wes Harrison, on the other hand, used dynamic ordinary least squares models of autoregressive distributed lags. In Costa Rica, no long-term relationship between export diversification and development has been discovered (Ferreira and Harrison, 2012).

With an empirical growth model controlling for other variables that affect growth, Manuel R. Agosin tested the export diversification hypothesis. In order to comprehend per capita GDP growth from 1980 to 2003, export diversification, alone and interacting with per capital export volume growth, is of great importance (Agosin, 2007). Using the Granger Casualty test, Olaleye, Samuel Olasode, and et al. confirmed the statement of a partnership between export diversification and economic growth in Nigeria (Olaleye et al., 2013).

The majority of previous research has found a connection between export diversification and economic growth. In our study, regional export diversification was used for a particular industry rather than the country's total export to examine the relationship with economic growth.

Using Balassa's Revealed Comparative Advantage (RCA) index, Anna Chingarande and colleagues investigated the economic performance of East African Community member states and discovered that higher RCA has a positive effect on economic performance (Chingarande et al., 2013). A comparable finding was made in the analysis by Elias Sanidas (Sanidas, 2007)

According to XU Tong-sheng, the horizontally divided intra-industry trade has a negative impact on economic growth, on the other hand vertically segregated intra-industry trade has a positive impact on it (Tong-sheng, 2006). Nuno Carlos Leito discovered that marginal intra-industry trade and economic growth have a positive relationship (Leitao, 2012).

Using the ARDL cointegration approach, we investigated the long-term relationship of variables at the regional level for Bangladesh's textile and clothing industry, which is a significant contribution to previous literature.

3. Econometric Methods and Data Description

Table 1 lists the variables that were used in this analysis. Over the period 1990-2017, data from the World Trade Organization (WTO) and the World Integrated Trade Solution (WITS) were used in the empirical study.

Table 1: Name, symbols, calculation, and source of data of the study variables

Name of the variables	Symbol	Measurement of the variables	Source of Data
GDP Growth	GDPG	GDP Growth of Bangladesh	(World Bank)
Regional Export Diversification	RED	Export Diversification of Bangladesh in North America in Textile & Clothing Industry	Calculation of the Author based on Data from World Data Trade Organization (WTO) and the World Integrated Trade Solution (WITS)
Regional Intra Industry Trade	RIIT	Intra Industry Trade of Bangladesh in North America in Textile & Clothing Industry	
Regional Revealed Comparative Advantage	RRCA	Revealed Comparative advantage of Bangladesh in North America in Textile & Clothing Industry	
Export Growth	EXG	Export Growth of Bangladesh in North America in Textile & Clothing Industry	

3.1 RED: Regional Export Diversification of Bangladesh in North America in the Textile & Clothing Industry.

Based on the Herfindahl-Hirschman concentration model, an extended model has been developed during this study to calculate the regional export product diversity/concentration of a specific country for a particular industry in one particular region (Herfindahl, 1950). The extended model is as follows:

$$RED_{iTC} = \sum_{k=1}^{n_i} \left\{ \left(\frac{x_{iTCNA}}{x_{iTNA}} \right)^2 - \frac{1}{n_i} \right\} \div \left(1 - \frac{1}{n_i} \right)$$

Where:

RED_{iTC}= Regional Export Product Heterogeneity of country 'i' in the Textile & Clothing industry, x_{iTCNA} = Country 'i's export of Textile and Clothing to the

North American market. x_{iTNA} = Country 'i's total export to the North American Market, n = number of products of the country 'i' to the North American market, Range of Values: 0 to 1. A higher index means that exports are concentrated in fewer industries, while an index close to zero indicates that a country's portfolio is entirely diversified. Limitations: If the number of goods is low, a low index might not be an accurate measure of a diversified trade portfolio: it simply means that it exports similar values of each commodity.

3.2 RIIT: Regional Intra Industry Trade of Bangladesh in North America in Textile & Clothing Industry

According to Gustafsson, The Grubel-Lloyd index is the normal calculation of Intra-Industry Trade. In 1975 Grubel and Lloyd described Intra-Industry Trade as "the value of an industry's exports that are exactly balanced by the same industry's imports" (Grubel and Lloyd, 1975). Their index takes into account trade overlap. The Grubel-Lloyd index is derived from intra- and inter-industry exchange equations (Lipsey, 1976)

$$GL_i = \left| X_i - M_i \right|$$

$$GL_i = \left(X_i + M_i \right) - \left| X_i - M_i \right| / \left(X_i + M_i \right)$$

$0 \leq GLi \leq 1$

Where X_i denotes a country's industry i exports and M_i denotes a country's industry i imports. There is only intra-industrial trade, no inter-industrial trade, if GLi = 1. This means that the country is considering exports of products as much as it is considering its imports. On the other hand there is only Inter-Industry trade If $GL_i = 0$. This means, the country either exports or imports goods of industry i. The Grubel-Lloyd index, I, was generated using the two equations (2 and 3). The Grubel-Lloyd index determines how much of total trade is made up of IIT. The index makes it possible to compare countries and industries:

$$I = \left\{ \left(X_i + M_i \right) - \left| X_i - M_i \right| \right\} / \left(X_i + M_i \right)$$

The adjusted Grubel-Lloyd index:

$$RIIT_k = 1 - \sum_i \left| X_{TCk} - M_{TCk} \right| / \sum_i \left| X_{TCk} + M_{TCk} \right|$$

In the above equation, 'TC' represents two-digit or four-digit (according to applied level) product groups and 'k' represents countries, X_{TCk} denotes export of Textile and Clothing of country k to North America. Similarly, M_{TCk} is the import of Textile and Clothing of country k from North America. IIT_K is the aggregated G&L index of country k. The Grubel-Lloyd index equals one when the exchange is balanced, implying that there is only IIT. If the index value is zero, however, there is no specialization and all trade is inter-industry trade (Manni et al., 2012).

3.3 RRCA: Regional Revealed Comparative advantage of Bangladesh in North America in Textile & Clothing Industry

In this report, the author created an extended model of Balassa RRCA (Regional Revealed Comparative Advantage) to determine the textile and apparel industry's regional revealed comparative advantage in the North American market (Balassa, 1989).

$$RRCA_{iTC} = \left(\sum_{i=1}^{n} X_{iTCNA} \div \sum_{i=1}^{n} X_{iTNA}\right) / \left(\sum X_{NATC} \div \sum X_{TNA}\right)$$

Here,

$RRCA_{iTC}$ indicates the revealed comparative advantage of country i (e.g. Bangladesh) in a certain region (e.g. North American Region). X_{iTCNA} demonstrates the export of country i (e.g. Bangladesh) in Textile and Clothing Industry to the North American market, X_{iTNA} demonstrates the total export of country i (e.g. Bangladesh) to the North American market, X_{NATC} indicates the concern regional (e.g. North American Region) export value in the textile and clothing industry, X_{TNA} indicates the total regional (e.g. North American Region) export in all products on that concern year.

The Harmonized System (HS) HS 1988/92 and SITC Revision 2 of international nomenclature for product classification in 2 digit levels were used to assess the Textile and Clothing industry's comparative advantage (UNSTATS, 2018, WITS, 2018).

3.4 EXG: Regional Export Growth of Bangladesh in North America in Textile & Clothing Industry

The equation used in this study to calculate the export growth was developed by United Nations ESCAP.

$$\left(\left(\frac{\sum_{sw} X^{1}_{sw}}{\sum_{sw} X^{0}_{sw}}\right)^{\frac{1}{n}} - 1\right) * 100 \qquad (7)$$

Where s represents the set of countries in the source, w represents the set of countries in the world, X0 represents the bilateral total export flow in the beginning, X1 represents the bilateral total export flow in the end, and n represents the number of periods (not including the start). The United Nations Commodity Trade Database was used as a data source (Comtrade, 2018).

3.5 Autoregressive Distributed Lag (ARDL)

The functional form of GDP growth of Bangladesh can be specified as follows:

$$GDPG_t = f(\mathrm{EXG}_t, \mathrm{RED}_t, \mathrm{RIIT}_t, \mathrm{RRCA}_t) \tag{8}$$

The log-linear specification is used to look at how dependent and independent variables interact. The following are the details of the formulated log-linear model: $GDPG_t = \lambda_0 + \lambda_1 EXG_t + \lambda_2 RED_t + \lambda_3 RIIT_t + \lambda_4 RRCA_t + \varepsilon_t$

(9)

Where GDPG is the usual log of GDP growth of Bangladesh, EXG stands for the natural log of export growth of Bangladesh in the North American market for the textile and clothing industry, RED represents the natural log of regional (north American market) export diversification of Bangladesh in the textile and clothing industry , RIIT symbolizes natural log of regional intra-industry trade of Bangladesh in the North American market for the textile and clothing Industry, RRCA indicates natural log of regional reveal comparative advantages of Bangladesh textile and clothing industry in the North American market, $\lambda_1, \lambda_2, \lambda_3, \lambda_4$ are coefficients to be estimated, λ_0 represents the constant term and ε_t denotes the stochastic error term, respectively.

3.6 Estimation technique

Pesaran and others recommended the ARDL modeling method to determine whether or not the research variables have long-run cointegration (Pesaran et al., 2001). The technique of autoregressive distributed lag (ARDL) modeling has a few advantages over conventional approaches (Engle and Granger, 1987, Johansen, 1991). The equations for the ARDL-bounds test cointegrations are as follows:

$$\Delta GDPG_t = \delta_0 + \delta_1 \sum_{i=1}^{p} \Delta GDPG_{t-1} + \delta_2 \sum_{i=1}^{p} \Delta EXG_{t-1} + \delta_3 \sum_{i=1}^{p} \Delta RED_{t-1} + \delta_4 \sum_{i=1}^{p} \Delta RIIT_{t-1} + \delta_5 \sum_{i=1}^{p} \Delta RRCA_{t-1}$$
$$+ \phi_1 GDPG_{t-i} + \phi_2 EXG_{t-i} + \phi_3 RED_{t-i} + \phi_4 RIIT_{t-i} + \phi_5 RRCA_{t-i} + \mu_t$$

$$\Delta EXG_t = \delta_0 + \delta_1 \sum_{i=1}^{p} \Delta EXG_{t-1} + \delta_2 \sum_{i=1}^{p} \Delta GDPG_{t-1} + \delta_3 \sum_{i=1}^{p} \Delta RED_{t-1} + \delta_4 \sum_{i=1}^{p} \Delta RIIT_{t-1} + \delta_5 \sum_{i=1}^{p} \Delta RRCA_{t-1}$$
$$+ \phi_1 EXG_{t-i} + \phi_2 GDPG_{t-i} + \phi_3 RED_{t-i} + \phi_4 RIIT_{t-i} + \phi_5 RRCA_{t-i} + \mu_t$$

$$\Delta RED_t = \delta_0 + \delta_1 \sum_{i=1}^{p} \Delta RED_{t-1} + \delta_2 \sum_{i=1}^{p} \Delta EXG_{t-1} + \delta_3 \sum_{i=1}^{p} \Delta GDPG_{t-1} + \delta_4 \sum_{i=1}^{p} \Delta RIIT_{t-1} + \delta_5 \sum_{i=1}^{p} \Delta RRCA_{t-1}$$
$$+\phi_1 RED_{t-i} + \phi_2 EXG_{t-i} + \phi_3 GDPG_{t-i} + \phi_4 RIIT_{t-i} + \phi_5 RRCA_{t-i} + \mu_t$$
$$\Delta RIIT_t = \delta_0 + \delta_1 \sum_{i=1}^{p} \Delta RIIT_{t-1} + \delta_2 \sum_{i=1}^{p} \Delta EXG_{t-1} + \delta_3 \sum_{i=1}^{p} \Delta RED_{t-1} + \delta_4 \sum_{i=1}^{p} \Delta GDPG_{t-1} + \delta_5 \sum_{i=1}^{p} \Delta RRCA_{t-1}$$
$$+\phi_1 RIIT_{t-i} + \phi_2 EXG_{t-i} + \phi_3 RED_{t-i} + \phi_4 GDPG_{t-i} + \phi_5 RRCA_{t-i} + \mu_t$$
$$\Delta RRCA_t = \delta_0 + \delta_1 \sum_{i=1}^{p} \Delta RRCA_{t-1} + \delta_2 \sum_{i=1}^{p} \Delta EXG_{t-1} + \delta_3 \sum_{i=1}^{p} \Delta RED_{t-1} + \delta_4 \sum_{i=1}^{p} \Delta RIIT_{t-1} + \delta_5 \sum_{i=1}^{p} \Delta GDPG_{t-1}$$
$$+\phi_1 RRCA_{t-i} + \phi_2 EXG_{t-i} + \phi_3 RED_{t-i} + \phi_4 RIIT_{t-i} + \phi_5 GDPG_{t-i} + \mu_t$$

where δ_0 denotes the constant term and μ_t signifies the error term, the short-run error correction dynamics are symbolized as by δ whereas the long-run links are denoted by ϕ.

For large and small samples, Narayan and M Hashem Pesaran proposed the LCB (Lower Critical Bound) and the UCB (Upper Critical Bound). (Nunkoo et al., 2019, Pesaran et al., 2001). If the measured F-statistics are greater than the UCB value, there is a long-run cointegration between the variables. Furthermore, if the calculated F value is less than the LCB value and there is no long-run cointegration. If the calculated F value is between the UCB and the LCB, the result is inconclusive. The AIC (Akaike Knowledge Criterion) is used in this study to determine the lag time. If the long-run cointegration relationship occurs after the optimum lag time choices and method estimation, the ARDL model equations in both short and long-run are as follows:

$$\Delta GDPG_t = \delta_0 + \delta_1 \sum_{i=1}^{p} \Delta GDPG_{t-1} + \delta_2 \sum_{i=1}^{p} \Delta EXG_{t-1} + \delta_3 \sum_{i=1}^{p} \Delta RED_{t-1} + \delta_4 \sum_{i=1}^{p} \Delta RIIT_{t-1} + \delta_5 \sum_{i=1}^{p} \Delta RRCA_{t-1}$$
$$+\psi_1 ECT_{t-1} + \varepsilon_t$$
$$\Delta EXG_t = \delta_0 + \delta_1 \sum_{i=1}^{p} \Delta EXG_{t-1} + \delta_2 \sum_{i=1}^{p} \Delta GDPG_{t-1} + \delta_3 \sum_{i=1}^{p} \Delta RED_{t-1} + \delta_4 \sum_{i=1}^{p} \Delta RIIT_{t-1} + \delta_5 \sum_{i=1}^{p} \Delta RRCA_{t-1}$$
$$+\psi_2 ECT_{t-1} + \varepsilon_t$$
$$\Delta RED_t = \delta_0 + \delta_1 \sum_{i=1}^{p} \Delta RED_{t-1} + \delta_2 \sum_{i=1}^{p} \Delta EXG_{t-1} + \delta_3 \sum_{i=1}^{p} \Delta GDPG_{t-1} + \delta_4 \sum_{i=1}^{p} \Delta RIIT_{t-1} + \delta_5 \sum_{i=1}^{p} \Delta RRCA_{t-1}$$
$$+\psi_3 ECT_{t-1} + \varepsilon_t$$

$$\Delta RIIT_t = \delta_0 + \delta_1 \sum_{i=1}^{p} \Delta RIIT_{t-1} + \delta_2 \sum_{i=1}^{p} \Delta EXG_{t-1} + \delta_3 \sum_{i=1}^{p} \Delta RED_{t-1} + \delta_4 \sum_{i=1}^{p} \Delta GDPG_{t-1} + \delta_5 \sum_{i=1}^{p} \Delta RRCA_{t-1}$$
$$+ \psi_4 ECT_{t-1} + \varepsilon_t$$

$$\Delta RRCA_t = \delta_0 + \delta_1 \sum_{i=1}^{p} \Delta RRCA_{t-1} + \delta_2 \sum_{i=1}^{p} \Delta EXG_{t-1} + \delta_3 \sum_{i=1}^{p} \Delta RED_{t-1} + \delta_4 \sum_{i=1}^{p} \Delta RIIT_{t-1} + \delta_5 \sum_{i=1}^{p} \Delta GDPG_{t-1}$$
$$+ \psi_5 ECT_{t-1} + \varepsilon_t$$

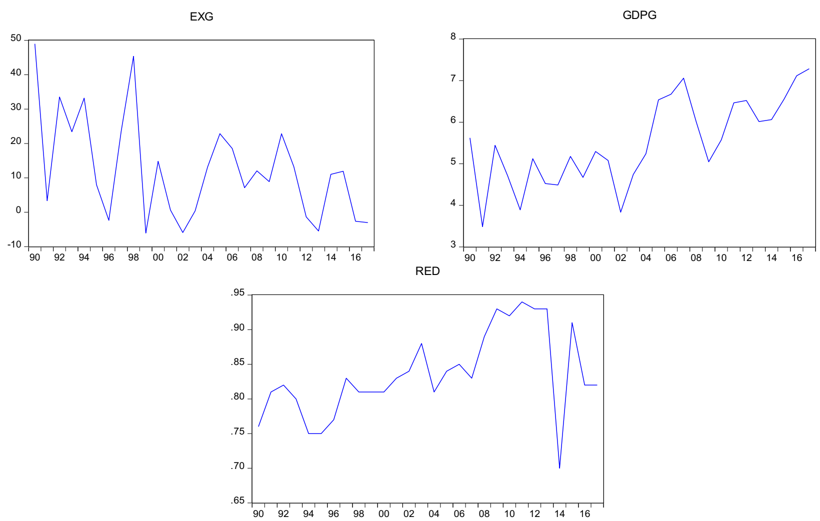
where ECT_{t-1} presents the error correction term and it is denoted for the long-run equilibrium. To check the empirical model's fitness, this study used a variety of diagnostic measures, including serial correlation and heteroskedasticity tests, as well as CUSUM and CUSUMSQ to verify the model's consistency over time.

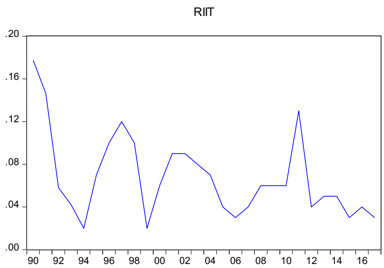
4. Result and Discussion

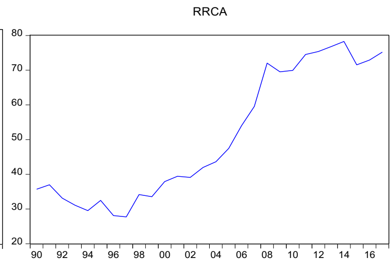
4.1 Trend of Variables

All the variables are normally distributed. The trend for EXG and RIIT is a downtrend; on the other hand, GDPG, RED, and RRCA are an upward trend.

Figure 1: Trend of variables. All individual graphs for dataset trends







*Note: Authors formulation where: EXG= Export Growth of Bangladesh in North America in Textile & Clothing Industry; GDPG= GDP Growth of Bangladesh; RED= Export Diversification of Bangladesh in North America in Textile & Clothing Industry; RIIT= Intra Industry Trade of Bangladesh in North America in Textile & Clothing Industry; RRCA=Revealed Comparative advantage of Bangladesh in North America in Textile & Clothing Industry

4.2 Descriptive Statistics and Correlation Matrix

The basic statistical definition and correlation matrix of the studied variables are presented in Table 2. The Jarque-Bera test shows that GDPG, EXG, RED, RRCA, and RIIT all have a normal distribution. The problem of non-normality can be solved using the ARDL method. The correlation matrix results reveal that RIIT has a robust negative correlation with GDP growth; on the other hand, RRCA has a strong positive correlation with GDP growth.

Table 2. Descriptive statistics and Correlation Matrix

	GDPG	**EXG**	**RED**	**RIIT**	**RRCA**
Mean	5.507997	12.49714	0.835357	0.067990	50.77550
Median	5.367990	11.47016	0.825000	0.060000	42.80716
Maximum	7.284184	48.98158	0.940000	0.177437	78.27434
Minimum	3.485228	-6.056475	0.700000	0.019993	27.73366
Std. Dev.	1.030012	15.03205	0.062032	0.039241	18.72163
Skewness	-0.050121	0.790448	0.063034	1.094235	0.289276
Kurtosis	2.166209	2.970667	2.469538	3.656727	1.373501
Jarque-Bera	0.822799	2.916771	0.346831	6.090807	3.476923
Probability	0.662722	0.232611	0.840788	0.047577	0.175791
Sum	154.2239	349.9199	23.39000	1.903731	1421.714
Sum Sq. Dev.	28.64495	6100.987	0.103896	0.041577	9463.483
Observations	28	28	28	28	28
GDPG	1.000000				
EXG	-0.073591	1.000000			
RED	0.297176	-0.251428	1.000000		
RIIT	-0.379672**	0.275485	-0.094093*	1.000000	
RRCA	0.729551***	-0.340556*	0.552875**	-0.326404*	1.000000

Source: Authors' computation. Notes: ***. **, * Significant at 1%, 5%, and 10% levels, respectively

4.3 Empirical Results and Discussion

Before verifying the cointegration relationship between the study variables, their integration order need to be evaluated.

Table 3 shows the effects of these well-known unit root methods, which show that all of the study variables are stationary in the I(0) and I combination (1). This supports Pesaran's proposed Autoregressive Distributed Lag (ARDL) binding test process. (Pesaran 2010, Pesaran et al., 2001)

Table 3. Result of unit Root tests

Intercept/Trend	**Variables**	**ADF**		**PP**	
		t stat.	*p* value	*t* stat.	*p* value
At level Intercept	GDPG	-2.078585	0.2542	-1.990818	0.2888
	EXG	-5.204647	0.0002***	-5.202762	0.0002***
	RED	-3.581683	0.0132***	-3.593413	0.0128***
	RIIT	-3.983836	0.0051***	-3.992537	0.0050***
	RRCA	-0.017541	0.9488	-0.062909	0.9440
Intercept and trend	GDPG	-3.079053	0.1318	-4.647338	0.0050***
	EXG	-5.821860	0.0003***	-6.181436	0.0001***
	RED	-4.165062	0.0147***	-4.224675	0.0129***
	RIIT	-4.024754	0.0200**	-4.018389	0.0203**
	RRCA	-2.131997	0.5060	-2.147571	0.4978
At First Difference Intercept	GDPG	-7.803436	0.0000***	-11.00888	0.0000***
	EXG	-5.516824	0.0001***	-24.71878	0.0001***
	RED	-9.084956	0.0000***	-11.57517	0.0000***
	RIIT	-5.301779	0.0002***	-5.461814	0.0001***
	RRCA	-4.486445	0.0016***	-4.483537	0.0016***
Intercept and Trend	GDPG	-7.585522	0.0000***	-11.14490	0.0000***
	EXG	-5.395839	0.0010***	-25.77381	0.0000***
	RED	-8.965083	0.0000***	-11.97301	0.0000***
	RIIT	-5.232419	0.0014***	-5.345957	0.0011***
	RRCA	-4.511901	0.0071***	-4.513730	0.0070***

Source: Authors' computation. Notes: ADF; and PP indicate the Augmented Dickey-Fuller test; and the Phillips-Perron test, respectively.

***. **, * Significant at 1%, 5%, and 10% levels, respectively

The ARDL bounds test is used to determine whether or not there is a long-run cointegration. All variables and outcomes in this analysis were tested for cointegration, as shown in Table 4. When GDP growth is used as the dependent variable, the ARDL cointegration test results of first equation F_{GDPG}(GDPG/EXG, RED, RIIT, RRCA) show that there is a strong (at 5% level) long-run cointegrating association between variables. Likewise, in both equations second and fifth F_{EXG}(EXG/ GDPG,RED,RIIT,RRCA) and F_{RRCA}(RRCA/EXG,RED,RIIT, GDPG) when export growth and regional revealed comparative advantage are used as dependent variables, indicates that there is a strong (at 5% level) long-run cointegrating correlation between variables. Regional export diversification, on the other hand, was used as a dependent variable in the third equation of the ARDL bound test F_{RED}(RED/EXG,GDPG,RIIT,RRCA), and the result shows a long-run cointegration exist (at 10 percent level) between the variables. Similarly, the results of the fourth equation of ARDL bounds test F_{RIIT}(RIIT/ RED,EXG,GDPG,RRCA) When the dependent variable is regional intra-industry trade, the results show that there is long-run cointegration among variables.

Table 4. Cointegration under ARDL bound testing approach

Model for Estimation		F-Statistics	Decision
F_{GDPG}(GDPG/EXG,RED,RIIT,RRCA)	ARDL(1, 0, 0, 0, 1)	4.136677**	Cointegration exist
F_{EXG}(EXG/ GDPG,RED,RIIT,RRCA)	ARDL(1, 1, 0, 0, 0)	3.970290**	Cointegration exist
F_{RED}(RED/EXG,GDPG,RIIT,RRCA)	ARDL(1, 0, 0, 0, 0)	3.451026*	Cointegration exist
F_{RIIT}(RIIT/ RED,EXG,GDPG,RRCA)	ARDL(1, 0, 0, 0, 1)	3.530800*	Cointegration exist
F_{RRCA}(RRCA/EXG,RED,RIIT, GDPG)	ARDL(1, 0, 1, 1, 1)	4.325933**	Cointegration exist
Critical Value Bounds	I(0) Bound	I (1) Bound	
1%	3.29	4.37	
5%	2.56	3.49	
10%	2.2	3.09	

Source: Authors' computation. Notes: ***. **, * Significant at 1%, 5%, and 10% levels, respectively

The Johansen cointegration test was used to ensure that long-run cointegration results based on Trace statistics and Max-Eigenvalue statistics were robust. Table 5 shows the approximate results of the (Trace and Max–Eigenvalue) test. At a 5% significance level, the statistical values of Trace and Max-Eigenvalue are greater than the critical value, suggesting a long-term cointegration relationship between the variables.

Table 5. Johansen Cointegration test using Trace statistics and Max–Eigenvalue statistics

Hypothesized		**Trace**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	Prob.
None ***	0.797877	91.78819	69.81889	0.0003
At most 1 **	0.698387	50.21733	47.85613	0.0295
At most 2	0.390210	19.05345	29.79707	0.4891
At most 3	0.210521	6.192776	15.49471	0.6727
At most 4	0.001800	0.046852	3.841466	0.8286
Hypothesized		**Max-Eigen**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	Prob.
None ***	0.797877	41.57086	33.87687	0.0050
At most 1 ***	0.698387	31.16389	27.58434	0.0166
At most 2	0.390210	12.86067	21.13162	0.4651
At most 3	0.210521	6.145924	14.26460	0.5945
At most 4	0.001800	0.046852	3.841466	0.8286

Source: Notes: ***. **, * Significant at 1%, 5%, and 10% levels, respectively

Table 6 shows the predicted outcomes of the ARDL strategy in both the long and short term. In this empirical analysis, the dependent variable is Bangladesh's GDP growth, while the independent variables are regional export growth, regional export diversification, regional intra-industry trade, and regional revealed comparative advantage. In the short run, regional export growth has a slight positive impact on Bangladesh's GDP growth; however, in the long run, it has a negative impact on Bangladesh's GDP growth, but the effect is minimal. On the other hand, the empirical findings of this study indicate that regional textile and clothing industry export diversification enhances economic growth in both the long and short run. This suggests that diversifying Bangladesh's textile

and apparel exports to the North American market could help the country's overall economic development.
Similarly, both in the long and short run, regional intra-industry trade has a huge effect on economic development. Increased textile and clothing intra-industry trade between Bangladesh and North America will significantly improve Bangladesh's overall economic development. The textile and clothing industry of Bangladesh's revealed competitive advantage is also positively linked with economic growth in the long run at a 5% significance level and in the short run at a 1% significance level.

Table 6. The ARDL model's long-run and short-run coefficients estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Long-run Estimation				
EXG	-0.015074	0.006566	-2.295587	0.1486
RED	14.37650**	2.537540	5.665526	0.0298
RIIT	28.45211**	6.305314	4.512402	0.0458
RRCA	0.026519**	0.006673	3.973998	0.0579
C	-9.305524	1.617190	-5.754134	0.0289
Short-run Dynamics				
D(EXG)	0.021447**	0.001074	19.96726	0.0025
D(RED)	7.569013**	0.401531	18.85039	0.0028
D(RIIT)	20.72949***	0.690304	30.02950	0.0011
D(RRCA)	0.079065***	0.003733	21.18015	0.0022
CointEq(-1)*	-0.909893	0.020257	-44.91831	0.0005
R-squared	0.998653			
Adjusted R-squared	0.995573			
F-statistic	96.07881			
Durbin-Watson stat	2.918818			

Source: Notes: ***. **, * Significant at 1%, 5%, and 10% levels, respectively

We used a number of diagnostic tests to determine the ARDL model's stability, including Breusch-Godfrey for serial correlation and CUSUM and CUSUMQS for parameter stability; the results are reported in Table 7. All diagnostic tests were passed successfully by the ARDL model, according to the results of the diagnostic tests. Furthermore, the CUSUM and CUSUMQS results in Figures 1 and 2 demonstrate that the parameter values are stable over time.

Table 7. Diagnostic checks for the ARDL model's stability

LM Test of Breusch-Godfrey Serial Correlation:			
F-statistic	1.698748	Probability	0.2110
Obs*R-squared	4.287062	Probability	0.1172
Heteroskedasticity Test by Breusch, Pagan, and Godfrey:			
F-statistic	7.431963	Probability	0.1251
Obs*R-squared	23.69634	Probability	0.3080
Model Misspecification in the Ramsey RESET Test			
F-statistic	**71.72902**	**Probability**	**0.0748**

Source: Authors' computation.

Figure 2. The cumulative sum of recursive residuals plot

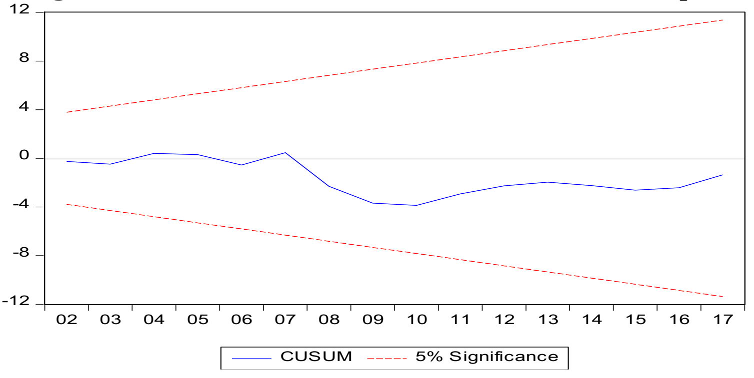
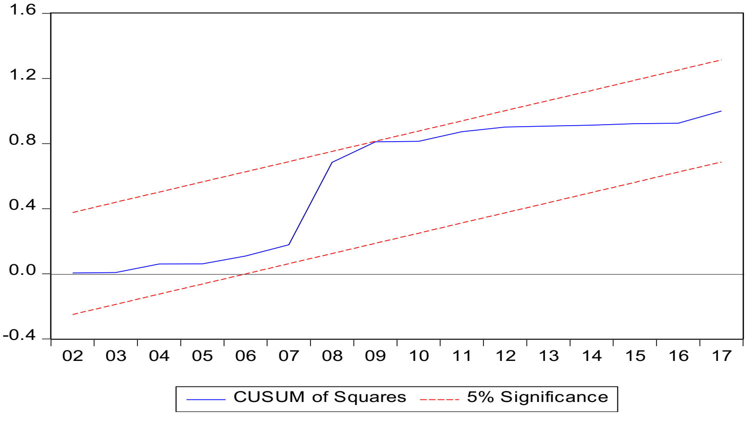


Figure 3. The cumulative number of squares of recursive residuals is plotted



To test the direction of causality between the variables, we used the pairwise Granger causality test. Bidirectional causality, unidirectional causality, and no causality are three forms of Granger causality systems. Table 7 reports the pairwise Granger causality outcomes. The pairwise Granger causality test results show that the null hypothesis of GDP growth does not Granger Cause EXG is rejected at 5% significance level. However, the null hypothesis that EXG does not Granger cause GDPG is accepted. There is proof of unidirectional causality that runs from GDPG → EXG at the 5% significance level. The Granger causality test results failed to reject the null hypothesis that RED (regional export diversification) does not Granger cause GDP growth, as well as GDP growth, does not Granger cause RED (regional export diversification). Similarly, the Granger causality test results failed to reject the null hypothesis that RIIT (regional intra-industry trade) does not Granger cause GDP growth, as well as GDP growth, does not Granger cause RIIT (regional intra-industry trade). Moreover, the null hypothesis that the RRCA (regional revealed comparative advantage) does not Granger-cause GDP growth is rejected at a 5% significance level. There is evidence of bidirectional causality between RRCA ↔GDPG.

Table 8: Granger causality test between GDPG and its determinants

Null Hypothesis	F-Statistic	Prob.
EXG does not Granger Cause GDPG	2.64159	0.1172
GDPG does not Granger Cause EXG	4.98469	0.0352**
RED does not Granger Cause GDPG	1.44958	0.2403
GDPG does not Granger Cause RED	1.24673	0.2752
RIIT does not Granger Cause GDPG	2.72939	0.1115
GDPG does not Granger Cause RIIT	1.13136	0.2981
RRCA does not Granger Cause GDPG	6.47240	0.0178**
GDPG does not Granger Cause RRCA	4.39289	0.0468**

Source: Authors' computation. Note: *, **, *** indicate rejection of null hypothesis at 10%, 5%, 1% level of significance, respectively

5. Conclusion and Policy implications

For the period 1990-2017, this study looked at the effects of regional export growth, regional export diversification, regional intra-industry trade, and regional revealed comparative advantage of Bangladesh's textile and clothing industry on Bangladesh's GDP growth. GDP growth was used as a proxy measure of Bangladesh's economic development. The stationarity of the dataset sequence is tested using several unit root tests (ADF, PP). To ensure their robustness, cointegration methods such as Johansen cointegration, Engle-Granger cointegration, and ARDL cointegration were used. The long-run cointegration relationship between regional export growth (EXG), regional export diversification (RED), regional intra-industry trade (RIIT), regional revealed comparative advantage (RRCA), and GDP growth in Bangladesh is established using the ARDL bounds process. The results of the ARDL bounds process, Engle-Granger, and Johansen cointegration tests all showed that the variables had a long-term cointegrating relationship. In the short run, regional export growth has a slight positive impact on Bangladesh's GDP growth; however, in the long run, it has a negative impact on Bangladesh's GDP growth, but the effect is minimal. The previous studies found significant long-term cointegration while taking overall export growth as a variable (Al Mamun and Nath*, 2005, Begum and Shamsuddin, 1998, Shafiullah and Navaratnam, 2016, Shirazi and Manap, 2005). Between regional export diversification (RED) and Bangladesh's GDP growth, both long-run and short-run cointegration was discovered. Our study considered 'regional export diversification' instead of 'overall export diversification' as a variable. The previous researcher explored similar results while they took Export diversification as a variable (Herzer and Nowak-Lehnmann D, 2006, Arip et al., 2010, Ferreira and Harrison, 2012, Agosin, 2007, Olaleye et al., 2013). Both regional intra-industry trade (RIIT) and regional revealed comparative advantage (RRCA) have significant cointegration with Bangladesh's GDP growth.

The pairwise Granger causality test was also used to check the causality direction among the study variables. The Granger causality test revealed a unidirectional causality between regional export growth and GDP growth in Bangladesh. However, there was a bi-directional causality between Bangladesh's GDP growth and its regional comparative advantage.

Based on the results, this study indicates that Bangladesh's government and policymakers are more concerned about rising global exports than regional exports, as our analysis found a long-term negative correlation between regional export growth and Bangladesh's GDP growth. Instead of focusing on the EU and North American markets, new regional export markets may help boost GDP growth.

As perceived from the empirical evidence, the regional export diversification (RED) and GDP growth of Bangladesh are directly associated. Therefore, our study suggested that increasing the regional export diversification will boost up GDP growth and the country's overall economic condition. Out of 34 product groups in the textile and clothing industry, Bangladesh only exports few products to the North American market and the world. Instead of depending on a few products, the government should focus on diversification among existing product categories and developing new products. Bangladesh's GDP growth is also correlated with regional intra-industry trade. Rising regional intra-industry trade leads to increased GDP and overall economic growth in Bangladesh. Increased intra-industry trade between Bangladesh and the North American market in the textile and apparel industry, as well as other industries, should be a priority for policymakers.

The regional revealed comparative advantage of Bangladesh's textile and clothing industry was exposed, as well as the country's GDP growth, which showed a strong positive connection both in the short and long run. Through comprehensive research, infrastructure growth, and the establishment of a more important local sector in the country, the government and policymakers can boost the industry's comparative advantages.

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