Journal of Empirical Studies
2023 Vol. 10, No. 1, pp. 1-18.
ISSN(e): 2312-6248
ISSN(p): 2312-623X
DOI: 10.18488/66.v10i1.3291

Export diversification and economic growth in Bangladesh

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Article History
Received: 21 November 2022
Revised: 5 January 2023
Accepted: 24 January 2023
Published: 15 February 2023

Keywords
ARDL bounds test
Bangladesh
Cointegration
Error correction model
Gross domestic product
Horizontal export diversification
Vertical export diversification.

ABSTRACT

Although the growth in exports of Bangladesh over the past few decades has been exemplary, it is enormously concentrated on just one industry which is the Ready Made Garment (RMG) sector. This over dependence on just one sector for export earnings places Bangladesh in a vulnerable position. This study examined the relationship between export diversification and growth rate of the Gross Domestic Product (GDP) of Bangladesh using annual data from 1995 to 2020. The study utilized the Autoregressive Distributed Lag (ARDL) bounds test to cointegration approach to estimate the long run relationship and the error correction model to determine the existence of a short run relationship. The results from the study indicate that there exists a significant long run cointegrating relationship between overall export diversification and economic growth in Bangladesh. In the long term, if horizontal export diversification increases by 1%, the GDP growth rate shall rise by around 1.7%. Conversely, the short run relationship between export diversification and economic growth is proven to be insignificant. The results of this study implore that Bangladesh should implement strategies and policies that will diversify its exports and shift away from the dominance of just one exporting sector.

Contribution/Originality: This is the first study that has investigated and estimated the long run and short relationship between export diversification and economic growth rate for Bangladesh by employing the ARDL bounds test to cointegration approach.

1. INTRODUCTION

Recent studies over the past few years have indicated that export diversification can have important implications for economic growth. Export diversification could take the form of adding new commodities to the country's export basket or to break into new export destinations or, a combination of both. Countries that rely mainly on exports of primary products or have a narrow range of export goods have a higher chance of suffering the consequences of unstable international demands. Therefore, the contribution of export diversification in counterbalancing the volatility of export earnings from various export sectors is one of the more broadly recognized principles (Hossain & Chowdhury, 2014; Rath & Akram, 2017). Also, studies have shown export diversification to have long run sustainable impacts on economic growth through knowledge spillover effects or learning-by-doing. Knowledge spillover effects could be technology enhancements and increased efficiency in production and management generating from competing in the international markets; which in-turn benefits other industries in the country (Hesse, 2008; Munir & Javed, 2018).

Empirical evidence of economies successfully leveraging the benefits of export diversification can be taken from the performance of East Asian economies namely Singapore, South Korea, Taiwan and Hong Kong beginning from the 1960s as well Vietnam in recent times. The East Asian tigers adopted policies that were more open to trade during the 1960s, shifting away from protectionist policies. These economies experienced annual growth rates of between 7 to 8 percent during the mid-1960s to 1990 (Kozlova & Jose, 2017). This growth was attributed to exports of textiles, clothing and other low-skilled labor-intensive products for which the economies had a comparative advantage. From 1981, the export baskets shifted towards more technologically sophisticated products requiring high-skilled labor, such as electronics, automobiles and Information Technology (IT) products (Ghani & Ahmed, 2009). This shift in export composition was possible due to the technological diffusion and skill transfers that were achieved through partaking in international trade in the initial stages of export growth.

1.1. Export Expansion of Bangladesh

The export performance and evolution of the composition of export basket of Bangladesh over the years has demonstrated both strengths and weaknesses. The past four decades has seen Bangladesh's exports grow significantly. Bangladesh's export performance bolstered during the 1990s when the country moved away from an inward-oriented economy and gave way to more trade liberalization policies. Such policies included tariff cut measures, adopting a more flexible exchange rate regime as opposed to a fixed regime, domestic deregulation and current account convertibility. These policy measures would help to utilize the country's comparative advantage to achieve gains in productivity and to attain technological enhancements and dispersions through exports (Al Mamun & Nath, 2005; General Economics Division, 2020). The foremost export processing zone was built in Chattogram during the 1980s. The subsequent years saw many more export processing zones being established throughout the country in Dhaka, Comilla, Mongla etc. Tax breaks were also implemented for export-oriented industries (Al Mamun & Nath, 2005). Consequently, the average contribution of goods and services export to GDP grew from 5% during the period 1981-1990 to around 9.9% between the period 1991-2000, then to around 14.6% between the period 2001-2010 and finally reached around 17% between the period 2011-2020 (The World Bank Database, 2021). The composition of exports also made advancements during this time by shifting away from conventional items like jute and jute goods to non-traditional or manufactured items. The proportion of manufactured commodities in aggregate exports rose from 86.31% in 1994 to around 96.78% in 2018. Figure 1 exhibits the percentage share of primary and manufactured commodities in total exports for over the past three decades. Bangladesh's economy grew at a level of 5 % on average during the 1990s and at a rate of 7 percent on average during 2009-19.

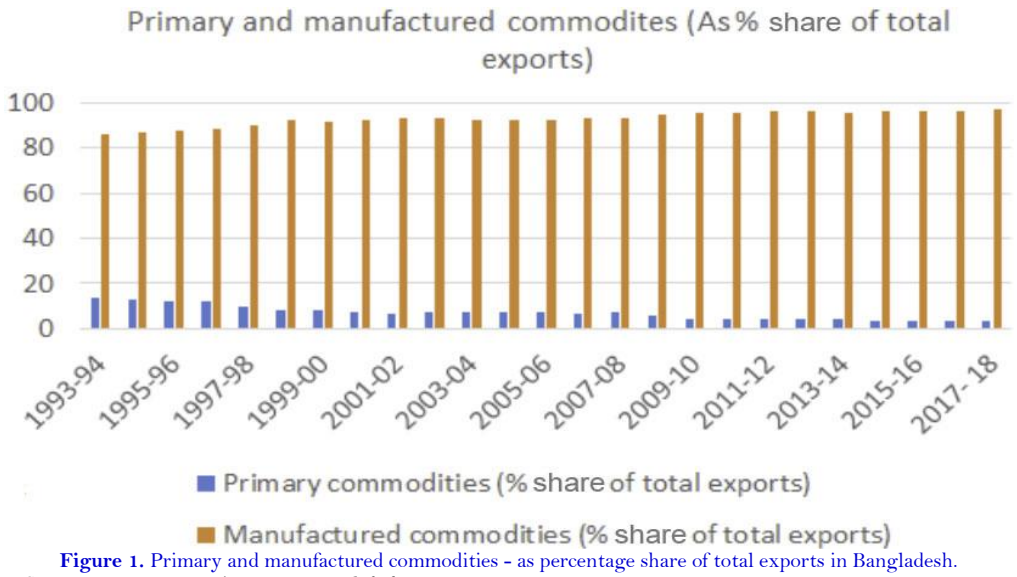

Figure 1. Primary and manufactured commodities - as percentage share of total exports in Bangladesh.
Source: Export Promotion Bureau, Bangladesh.

Despite Bangladesh's exports experiencing such a surge in growth rates, it is shrouded by the fact that one sector dominated the contribution to this growth. The readymade garment (RMG) industry is the biggest source of export earnings for Bangladesh and now constitutes 83% of total export earnings of Bangladesh. This fact has been demonstrated in Figure 2 below. Figure 3 gives an overview of the share of various commodities in total exports for the third quarter of July-June 2021 fiscal year.

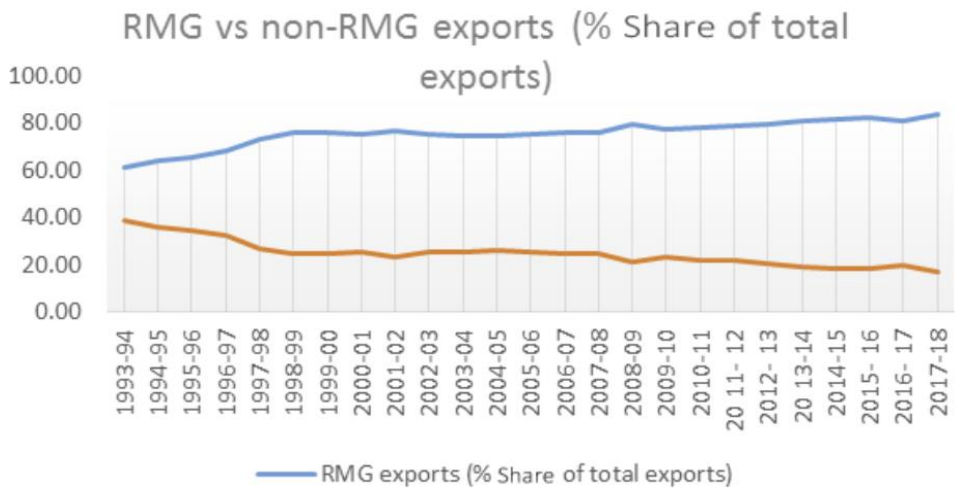

Figure 2. Percentage share of RMG and non-RMG sectors in Bangladesh's total exports.
Source: Export Promotion Bureau, Bangladesh.

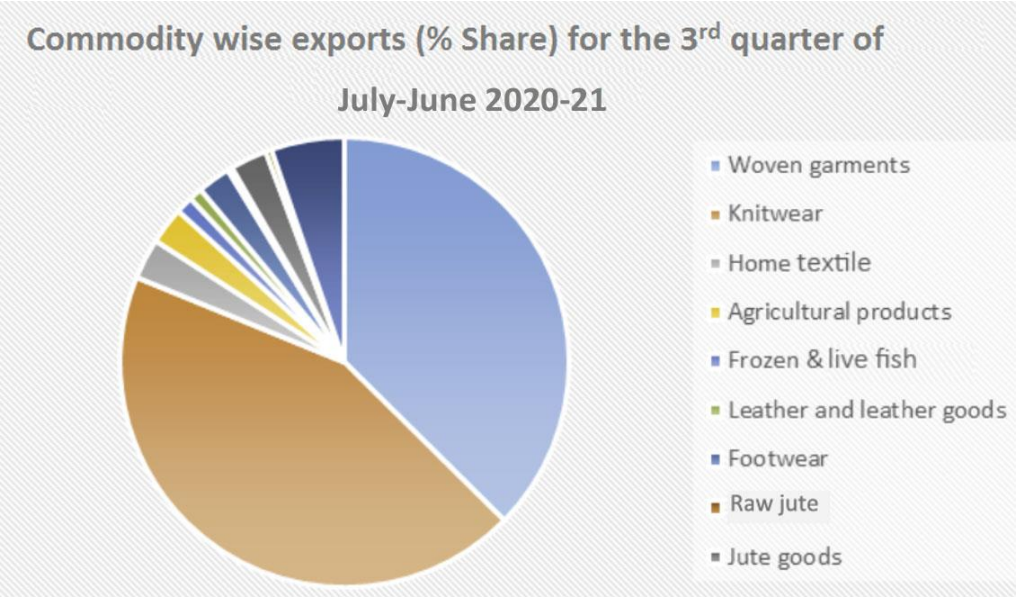

Figure 3. Commodity wise exports in Bangladesh (As percentage share)- third quarter of July-June 2021.
Source: Export promotion bureau, Bangladesh.

However, the issue of export concentration is not new to Bangladesh. Jute and jute products dominated the export sector of Bangladesh prior to the emergence of readymade garments industry. The share of jute and jute goods was around 70 percent in 1981 (Export Promotion Bureau, 2017). Hossain and Chowdhury (2014) measured the level of Bangladesh's export diversification based on the quantity of products and trading partners for the period 1980-81 to 2006-07. The study concluded that even though Bangladesh's export destinations experienced a noticeable diversification, the diversification in terms of types of commodities remained low.

Amidst the current global uncertainty, Bangladesh is also looking to graduate from a least developed country to a developing country. Hence, the consequences of export diversification or lack thereof will have important implications for the country's future. The over reliance on the RMG sector for export earnings places Bangladesh in

a susceptible position if and during the occurrence of fluctuations in international demand for this product. There is already ample empirical proof that export diversification has favorable impacts on the growth and structural transformation of an economy. This is especially important in the cases of countries such as Bangladesh with small internal markets. Export diversification can help Bangladesh achieve value added gains by advancing its manufacturing capabilities. Accordingly, this study aims to identify whether export diversification will have an impact on economic growth in Bangladesh. This study will focus on the knowledge spillover impacts of export diversification on economic growth.

Section 2 of this article will present the literature review which will then be followed by the methodology in the next section, results and discussion afterwards and lastly conclusion.

2. LITERATURE REVIEW

There are quite a number of studies that examined the causal relationship between economic growth and export diversification. A majority of these studies have been conducted in developing and least developed nations. Some literature pertains to a single country while others have covered data spanning a number of countries. An overview of a few of them will be covered in this section.

Duru and Ehidiamhen (2018) studied the consequence of diversified exports on Nigerian economic growth with data taken from 1980 till 2016. The study applied the ARDL bounds test approach to cointegration and established that export diversification had a positive but insignificant effect on Nigerian GDP per capita growth rate. Al-Marhubi (2000) analyzed data from 91 countries taking yearly data from 1961 to 1988. The results indicated that countries with higher number of export products and lower export concentration have been experiencing higher economic growth. The relationship between diversification of exports and Malaysian economic growth was examined by Arip, Yee, and Karim (2010). They employed Granger causality tests and the Johansen method of cointegration to study the long run relationship and used annual data from 1980-2007. Results from their study established the presence of a long run cointegrating connection between export diversification and economic growth. Herzer and Nowak-Lehnmann (2006) investigated the hypothesis that diversification leads to growth for the Chilean economy with yearly data stretching from 1962 to 2001. The hypothesis in this study states that export causes economic growth with the help of externalities of learning attained through the production of exports. The research applies, multivariate error correction model, dynamic Ordinary Least Squares (OLS) and Johansen trace test to test this hypothesis and finds that diversified exports has a crucial part in determining income growth.

A similar theoretical framework and hypothesis was applied in the study by Ferreira and Harrison (2012) in their study of Costa Rica. They applied the ARDL model and dynamic OLS method to test whether export diversification leads to economic growth with data from 1965 to 2006. The study found no evidence of a cointegrating relationship between export diversification and GDP in Costa Rica. Ojide, Ojide, and Ogbodo (2014) investigated whether non-oil exports contributed to Nigerian economic growth by using the ARDL approach to cointegration. The study used annual data from 1970 to 2011. The paper concluded that if the export sector is diversified into non-oil exports and if there is development in the non-oil export sector, Nigeria would be able to sustain a long run economic growth. A recent study is done by Agbonkhese and Oboro (2021) also in Nigeria where they used the ARDL model to study if export diversification impacts sustainable economic growth. The paper utilized data from 1984 to 2018 and found that export diversification had positive association for both long run and short run sustainable economic growth in Nigeria. Another study that has been conducted in Nigeria but has produced different results is by Nwosa, Tosin, and Ikechukwu (2019). The study used the ARDL method, employed yearly data from 1962 to 2016 and concluded that there does not exist any long run impact of the diversification of exports on the country's economic growth.

Alomari and Bashayreh (2020) analyzed the influence of diversified exports on Gulf Cooperation Council (GCC) countries' economic growth for the years 1992 to 2017. The study employed the pooled mean group estimator technique. The results indicated the existence of long run connection that is also significant amid diversified exports

and economic growth in the GCC countries but no significant influence on economic growth through export diversification for the short path. The long run association of diversification of exports and GDP growth for the Algerian economy was investigated in a research by Samir, Kamel, Amal, and Abdelmadjid (2021) where they covered yearly data starting from 1980 to 2015. The study employs the ARDL bounds test to cointegration approach and established that if Algeria moved on from the dominance of its hydrocarbon industry and diversified its exports, it will lead to long run economic growth. Siddiqui (2018) inspected the role of commodities export diversification and geographical export diversification on GDP growth in Pakistan for the duration of 1972-2015. The study used the ARDL approach and dynamic OLS approach to approximate the long term dynamic relationship. The results signify the presence of an association that is significant between product diversification and economic growth but conversely an insignificant association between geographical diversification and Pakistani economic growth. Aditya and Acharyya (2013) does an extensive study on a sample of 65 countries employing data from 1965 to 2005 where they analyze the impact of not only export diversification but also export composition on growth in economy. The study uses the Generalized Method of Moments (GMM) dynamic panel estimation procedure and found a nonlinear relationship amid diversified exports and economic growth. The study furthermore shows that states with high technology exports experience faster economic growth. Alternatively, the study demonstrates that export specialization rather than export diversification will cause greater GDP growth when the level of export concentration reaches a certain critical level.

Agosin (2007) developed a theoretical model to analyze different aspects of growth in the Latin American and Asian economies. They concluded that export diversification has a causal effect on economic growth by two mediums, one of which is called a portfolio effect and the other one is successful achievement of diversifying comparative advantages. and Granger causality tests and Johansen's cointegration were applied in a study by Balaguer and Cantavella-Jordá (2004) to test the hypothesis of export led growth combined with the effect of structural changes in export in Spain. The study found that a structural change from conventional exports to partial industrial and full industrial exports has long run causal effect on economic expansion. The connection between export concentration and economic growth among other relationships was explored for the North African and Middle Eastern countries in a paper by Dogruel and Tekce (2011) and found a reverse relationship between the two variables. Gozgor and Can (2016) examined the effects of product export diversification on per capita GDP for a list of 158 nations using the system GMM panel estimations covering data from the period 1962 to 2010. The results found a positive connection between growth and diversification for the lower and middle income nations but a negative association for both the high income countries of the Organization for Economic Cooperation and Development (OECD) and non OECD region. The dynamics between diversified exports and economic growth in Cameroon was measured by Forgha, Sama, and Atangana (2014) with the Vector Autoregressive (VAR) method comprising data from 1980 to 2012 and verified that diversified exports causes a positive and significant effect on economic growth.

Moving to the context of Bangladesh, a study examined the causality among export, imports and GDP in the country and found the existence of a one directional causal relationship going from export to GDP, thus confirming the hypothesis of export led growth (Hossain, Haseen, & Jabin, 2009). Al Mamun and Nath (2005) ran an Engle-Granger cointegration test using quarterly data from 1976 to 2003 and found the presence of a positive long run cointgrating relationship running from exports to industrial production. Another study applied the Autoregressive Conditional Heteroskedasticity (ARCH) model and used annual data from 1961-1992 (Begum & Shamsuddin, 1998). The study concluded that growth in exports generates positive production externalities which subsequently leads to economic growth in Bangladesh. Hossain and Dias (2004) in their study showed that aggregate exports along with manufacturing exports had a significant positive impact on economic growth in Bangladesh for short run and long run both. The study used the Vector Error Correction Model (VECM) technique and used quarterly data from 1974-1999. The study also states that total exports rather than manufacturing exports is the main factor contributing towards economic growth in Bangladesh. Similar findings were reported from another study by Md Reza, Fan, Wang,

Bhuiyan, and Mehedi (2019) where they used Johansen cointegration and VECM approach with data covering from 1986 to 2016. Finally, Dawson (2006) applied Johansen cointegration and confirmed a unidirectional causal effect from exports to Bangladesh GDP.

As can be perceived from the review above, all the study conducted in Bangladesh have explored the hypothesis of export led growth and no study till now has explored the dynamics between diversification of exports and economic growth in this country. This study aims to fill up this gap on research.

3. THEORETICAL MODEL

The model applied in this study has been adopted from the work on export diversification led economic growth by Herzer and Nowak-Lehnmann (2006). This model had also been implemented in a similar study by Ferreira and Harrison (2012). The model that has been developed in these studies serves the purpose of testing the hypothesis that export diversification leads to economic growth through externalities of learning by doing and learning by exporting. The analogous model will be applied in this study to find out if export diversification has any influence on economic growth in Bangladesh through similar mechanisms. The assumption in this model is that the economic sector consists of a sum of n sectors and the number of export sectors within these n sectors is X, so X ϵ n. It is further assumed that each of the sectors consists of only one firm and each sector's production function f ϵ ⌈1, n⌋ at a particular point in time t is denoted by a neo classical production function:

$$Y_{ft} = F_{ft}(K_{ft,} L_{ft,} I_t) \quad (1)$$

Where Y_{ft} is the output of a sector at time t, K is capital and L is labor, both of which are standard inputs into the neo classical production function. I_t in Equation 1 is an index of knowledge available to the public at time t. This index acts as a positive externality in each sector f's production function. The positive externality occurs through knowledge spillovers generating from the exporting sectors. The knowledge spillover has two main sources namely learning by doing and learning by exporting.

Learning by doing is a process of knowledge accumulation through conventional economic activity. The concept behind this is that as individuals produce goods, they come up with better and improved methods of the production process. Thus common scientific and technological knowledge arises from learning by doing and it is contingent upon the firm's aggregate output (Aghion, Philippe, & Peter, 1998; Romer, 2012). On the other hand, learning by exporting is the state where a firm's productivity and performance is enhanced after they enter the export market. When firms are exposed to the international market, they gain greater knowledge through the buyer seller relationship. The changing demands of the overseas customers lead the exporting firms to innovate, adopt new technology and production techniques. The entry to export market gives access to information regarding better managerial and marketing practices. Thus foreign competition improves the quality of products of the firms (De Loecker, 2013; Rehman, 2017; Siba & Gebreeyesus, 2017). To sum up, firms increase their stock of knowledge through learning by doing when they expand their output and through learning by exporting when they grow their exports.

To make things simple, it is presumed that each of the X exporting sectors creates an equal quantity of public knowledge i. If this is the case, then the economy's amount of cumulative knowledge at time t can be expressed by Equation 2:

$$I_t = X_t i_t \quad (2)$$

Here i_t is a constant parameter and is not observable. Hence the nation's aggregate level of knowledge is alternatively demonstrated as a function of the quantity of sectors that engage in exports and i_t is excluded. This is demonstrated in Equation 3.

$$I_t = G(X_t) \quad (3)$$

Herzer and Nowak-Lehnmann (2006) stated in their study that learning by doing and learning by exporting varies across the nature of products being produced. Primary products in general are unlikely to create much knowledge as a by product. Manufactured goods conversely have much higher potential to generate knowledge externality. They

therefore hypothesize that knowledge creation through learning by doing and learning by exporting will increase with the growth of the proportion of manufactured products in overall exports. Therefore, the stock of public knowledge is now expressed by the following Equation 4:

$$I_t = G\,(X_t, MN_t) \quad (4)$$

Where the quantity of exporting sectors (X) and the portion of manufactured products in entire exports (MN) are representatives for the aggregate level of public knowledge in the economy.

Another important characteristic of this model specifies I_t as a public good which is presumed to be constant across all sectors of the economy. The effect of I_t is assumed to effect all sectors of the economy equally. I_t is given and so the production function F_{ft} exhibits constant returns to scale. All of the firms are assumed to exist in a perfectly competitive market and therefore have to take the price as given. The variables of the aggregated production function of the economy at a certain time t are shown in Equation 5:

$$Y_t = \sum_{f=1}^{n} Y_{ft};\ K_t = \sum_{f=1}^{n} K_{ft};\ L_t = \sum_{f=1}^{n} L_{ft} \quad (5)$$

Y_t can now be expressed as a function which is presented in the following Equation 6:

$$Y_t = \sum_{f=1}^{n} Y_{ft} = F_t\,(K_t, L_t, I_t) \quad (6)$$

The stock of public knowledge in Equation 4 can now be placed in the production function of Equation 6.

$$Y_t = F_t\,(K_t, L_t, G(X_t, MN_t)) \quad (7)$$

Equation 7 is subsequently expressed as a production function of the Cobb Douglas nature in Equation 8.

$$Y_t = \alpha K_t^{\beta} L_t^{\gamma} X_t^{\delta} MN_t^{\psi} \quad (8)$$

In the above equation, K_t is the stock of cumulative capital at time t and L_t is labor force at time t in the economy. The parameters β, γ, δ and ψ are constants. The shift parameter α accounts for all the factors excluding capital and labor that causes economic growth. The sum of export sectors is a good representation of horizontal export diversification and the portion of manufactured products in aggregate exports is an ideal representation of vertical export diversification. The inclusion of both these variables in the production function suggests that export diversification of vertical and horizontal in nature together stimulate economic growth through externalities of learning by doing and learning by exporting.

In order to assess the long run association amid diversified exports and economic growth, Equation 8 is converted into a double log regression nature and exhibited in Equation 9:

$$lnY_t = ln\alpha + \beta lnK_t + \gamma lnL_t + \delta lnX_t + \psi lnMN_t + \mu_t \quad (9)$$

Here, ln represents the natural logarithm of all the variables in the model and μ_t is the error term. As the functional form of the regression model is log linear, the coefficients β,γ,δ, and ψ represent elasticities of all the independent variables respectively. The export diversification led economic growth hypothesis can now be tested in the following manner:

H_o: δ, ψ = 0

H_a: δ, ψ > 0

This study hypothesizes that the estimates of the coefficients δ and ψ are individually positive and statistically significant implying that export diversification causes economic growth in Bangladesh.

4. DATA AND SOURCES

The time series data employed in this study to estimate Equation 9 is yearly data and ranges within the years 1995 to 2020. The yearly growth rate of GDP of Bangladesh is taken as a representative of Y_t. The data for K_t is Gross fixed capital formation of Bangladesh in constant 2010 US$. This value includes machinery, plant and equipment purchases and the construction of various categories of physical infrastructure namely roads, railways and buildings of all sorts. Labor force participation rate, expressed as a percentage of total population aged 15 and above in Bangladesh is a representative of L_t. This labor force participation rate data has been estimated by the International Labor Organization (ILO). All of the above mentioned yearly data are sourced from the World Development

Indicators Data online. The number of product categories exported at the three-digit Standard International Trade Classification (SITC) level is used as a representative for the number of exporting sectors X_t. This annual data is collected from United Nations Conference on Trade and Development (UNCTAD) Statistics. This particular variable will portray horizontal export diversification of Bangladesh in this study. Lastly, the manufactures exports as a percentage of merchandise export has been symbolized as the variable MN_t. This data will depict vertical export diversification of Bangladesh. This yearly data set has been gathered from the World Development Indicators of World Bank Data.

All the data have been transformed into their logarithmic forms to estimate Equation 9. The trend of all the data variables in their logarithmic forms over the years 1995 to 2020 have been demonstrated in Figure 4, Figure 5, Figure 6, Figure 7 and Figure 8.

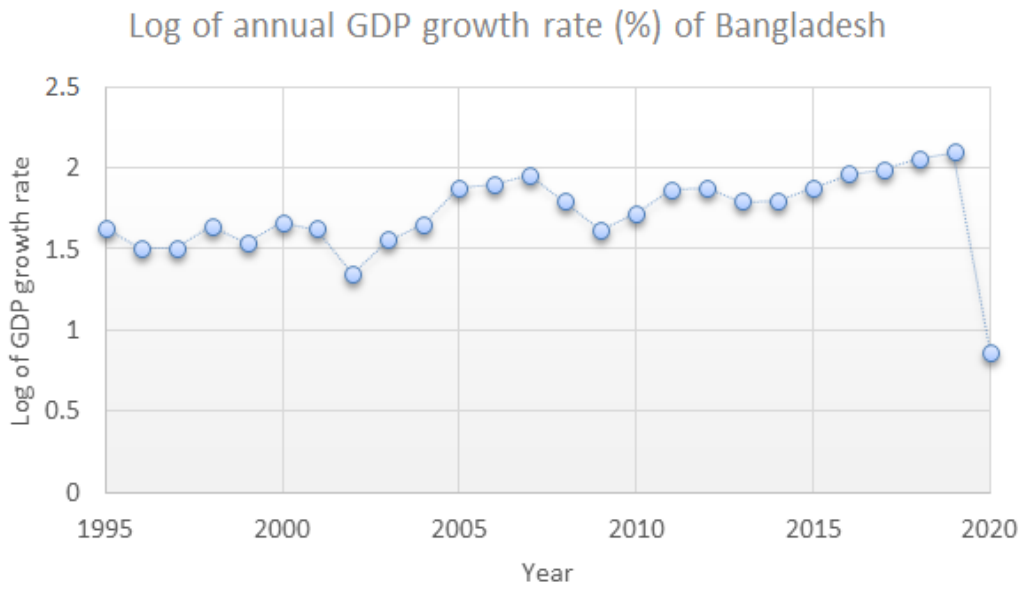

Figure 4. GDP growth rate

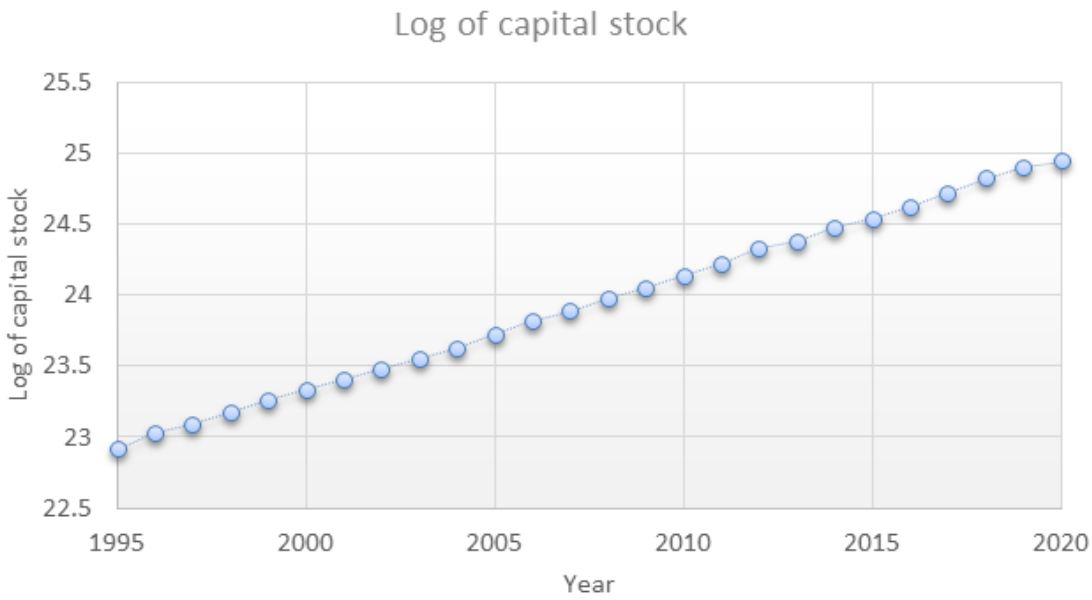

Figure 5. Stock of capital

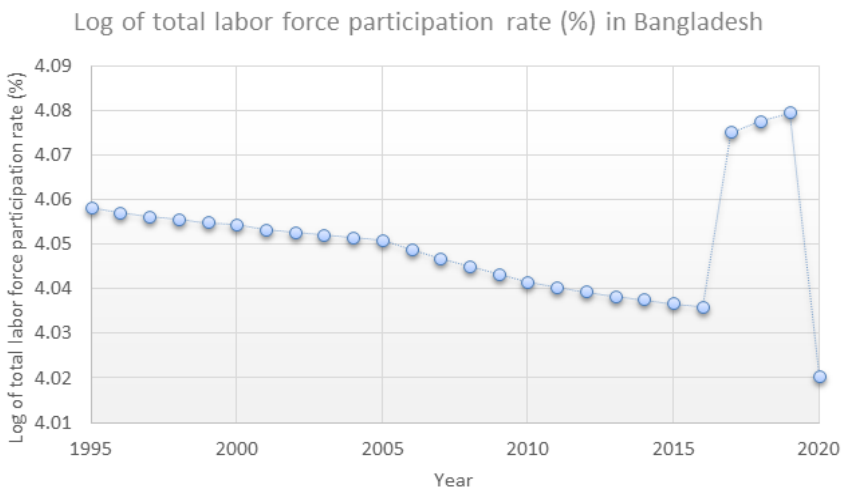

Figure 6. Labor force participation rate

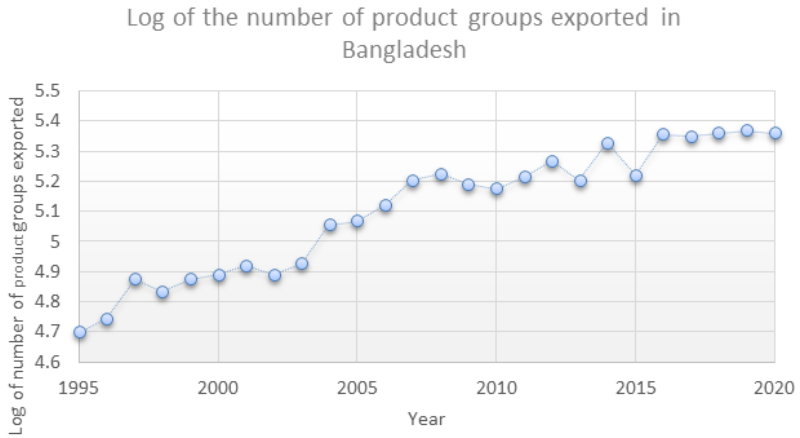

Figure 7. Number of product groups exported

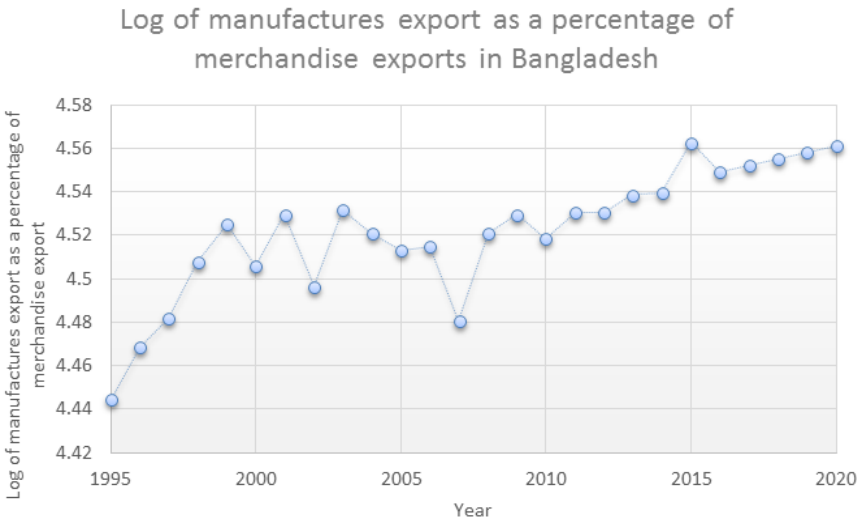

Figure 8. Manufactures exports as a percentage of merchandise export.

5. ARDL MODEL

The study employs an Autoregressive Distributed Lag (ARDL) Bounds test approach to cointegration to evaluate the long run relationship between economic growth and export diversification of Bangladesh. There are various approaches to cointegration that are being applied in recent studies to test long run relationships between variables. The Engle and Granger (1987), Johansen and Juselius (1990) and ARDL bounds test of cointegration (Pesaran, Shin, & Smith, 2001) are among those being used. The cointegration method using the ARDL approach

offers some advantages over the others. The endogenous nature of the variables is not a problem for the model and it can differentiate between dependent and independent variables. It can identify cointegrating vectors in the presence of multiple cointegrating vectors (Nkoro & Uko, 2016). The ARDL method can efficiently estimate the long run coefficients using OLS even in cases where the sample size is small. Most importantly, the ARDL approach can detect long run relationship in situations where the regressors are either stationary I(0), integrated of order one I(1) or mutually cointegrated (Pesaran et al., 2001).

For the purpose of running the ARDL bounds test for cointegration, the Equation 9 that had been developed in the theoretical framework is converted into a conditional unrestricted error correction model presented in Equation 10. This model translates the understanding developed in the theoretical framework and carries data mentioned in the previous section.

$$\Delta lngdp_t = \alpha_o + \sum_{i=1}^{p} \alpha_i \Delta lngdp_{t-i} + \sum_{j=0}^{q1} \alpha_j \Delta lngfcf_{t-j} + \sum_{k=0}^{q2} \alpha_k \Delta lnlf_{t-k} + \sum_{m=0}^{q3} \alpha_m \Delta lnexp_{t-m} + \sum_{n=0}^{q4} \alpha_n \Delta lnmn_{t-n} + \beta_1 lngdp_{t-1} + \beta_2 lngfcf_{t-1} + \beta_3 lnlf_{t-1} + \beta_4 lnexp_{t-1} + \beta_5 lnmn_{t-1} + \epsilon_t \quad (10)$$

The coefficients α_i, α_j, α_k, α_m and α_n specify interpretations of short run relationships and β_1, β_2, β_3, β_4 and β_5 indicate long run relationships amid the variables.

Where lngdp is the logarithm of annual growth rate of GDP, lngfcf is the logarithm of gross fixed capital formation, lnlf is the is the logarithm of labor force participation rate, lnexp is the logarithm of the number of product groups exported and finally lnmn is the logarithm of manufactures exports as a percentage of merchandise export. The Δ symbol indicates the lag differences of the variables. α_o is the constant and ϵ_t is the error term.

The coefficients of Equation 10 will be estimated using the OLS regression, and from this regression, the Wald or F statistic will be utilized to assess the overall significance of the coefficients of the lagged level variables. The alternative hypothesis implies the presence of cointegration, while the null hypothesis states that there is no cointegration or long-term link among the variables. Below are the test's null and alternative hypotheses.

H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$

H_a: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$

For two polar situations, Pesaran et al. (2001) generated two sets of asymptotic critical values. The upper level critical values assume that all regressors are integrated of order 1 I(1), while the lower level critical values assume that all regressors are simply stationary I(0). The null hypothesis can be rejected and it can be said that there is a cointegrating relationship between the variables if the estimated F statistic is greater than the upper bound critical value. The null hypothesis cannot be ruled out and it is needed to reach the conclusion that there is no cointegration between the variables if the F statistic is less than the lower bound critical value. And lastly, the inference of existence of cointegration will remain indecisive if the calculated F statistic falls in the middle of the lower bound and upper level critical values.

The next step is to create the error correction model after the variables' cointegrating relationships have been determined. The error correction model examines the short run dynamics of the cointegrating variables and introduces the error correction term. The error correction model is thus displayed in Equation 11.

$$\Delta lngdp_t = \alpha_o + \sum_{i=1}^{p} \alpha_i \Delta lngdp_{t-i} + \sum_{j=0}^{q1} \alpha_j \Delta lngfcf_{t-j} + \sum_{k=0}^{q2} \alpha_k \Delta lnlf_{t-k} + \sum_{m=0}^{q3} \alpha_m \Delta lnexp_{t-m} + \sum_{n=0}^{q4} \alpha_n \Delta lnmn_{t-n} + \gamma ect_{t-1} + \mu_t \quad (11)$$

Here ect is the error correction term and it informs about the time it takes for short run deviations to adjust to long run levels.

6. RESULTS AND DISCUSSIONS

6.1. The Order of Integration of the Variables

Before executing the ARDL model, the order of integration of the variables must be verified to make sure that not a single variable is integrated in order 2 I(2). Table 1 displays the outcomes of the unit root testing. To determine the order of integration, three unit root tests—the Augmented Dickey-Fuller (ADF), Dickey-Fuller Generalized

Least Squares (DF-GLS), and Phillips-Perron (P-P)—have been run on each of the variables. All of these tests' null hypothesis is that the variables have a unit root. The table shows that the logarithmic annual GDP growth rate is not stationary at the level form and stationary in the first difference at the 5% significance level. The logarithm of gross fixed capital formation, labor force participation rate and number of export sectors are stationary at 1 % level of significance when taking the first difference. This result implies that these variables are not stationary at their level form. The logarithm of manufactures exports as a percentage of merchandise export is stationary at 5% significance level in the ADF and P-P test and stationary at 1% level of significance when taking the first difference in the DF-GLS test. A prerequisite for the ARDL approach to cointegration is that no variables are integrated of order 2 I(2) and this requirement has been fulfilled as can be seen from the above mentioned results. Furthermore, it is seen that one of the variables is integrated of order zero I(0) while the rest are integrated of order 1 I(1). This mixed order of integration among the variables taken for this study justifies the selection of the ARDL method in this study.

Table 1. Results of the augmented dickey-fuller (ADF), dickey-fuller generalized least squares (DF-GLS) and phillips-perron (P-P) unit root tests.

T-statistics (Level)				T-statistics (First difference)			
Variable	**ADF**	**DF-GLS**	**P-P**	**Variable**	**ADF**	**DF-GLS**	**P-P**
lngdp	-2.06	-2.504	-2.096	lngdp	-2.393**	-1.968**	-2.338**
lngfcg	-3.001	-3.162*	-3.035	lngfcf	-5.952***	-5.023***	-6.164***
lnlf	-2.113	-1.909*	-2.74*	lnlf	-6.314***	0.928	-2.685***
lnexp	-1.959	-1.967	-3.193	lnexp	-6.271***	-8.235***	-6.143***
lnmn	-4.285**	-2.321	-4.315**	lnmn	-7.536***	-7.172***	-7.576***

Note: (***), (**), (*) signify the null hypothesis of unit root being rejected at 1%, 5% and 10% level of significance in that order.

6.2. Cointegration Results

In order to run the ARDL bounds test to cointegration, the optimal lag structure needs to be selected for Equation 10. The lag order pertains to the endogenous variables which in this research are yearly growth rate of GDP, the number of product groups exported and manufactures exports as a proportion of merchandise export. Gross fixed capital formation and labor force participation rate will act as independent variables in the ARDL model. The VAR model with the endogenous variables is estimated to decide on the optimum number of lags for these variables. The optimal number of lags selected under different criteria is shown in Table 2. This study chooses the Schwarz information criterion (SC) for lag order selection.

Table 2. VAR selection of lag order criterion.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	70.043	NA	5.90e-07	-5.8230	-5.682	-5.793
1	101.363	51.746*	8.56e-08	-7.771	-7.178*	-7.622
2	112.779	15.882	7.29e-08*	-7.981*	-6.944	-7.721*
3	119.145	7.197	1.04e-07	-7.752	-6.271	-7.379

Note: *Specifies order of lag chosen by the particular test; LR: Sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion.

Figure 9 below demonstrates the top 20 models chosen by SC criterion and as can be seen from the chart, the lag structure of the ARDL model that minimizes SC is (1,0,0).

Henceforth, the ARDL (1,0,0) model is selected and the long run bounds test to cointegration is conducted on this specific model. It can be observed from Table 3 that the F statistics calculated through the test falls in the range above the upper bound I(1) critical value at 5% level of significance, thus rejecting the null hypothesis of no cointegration among the variables at 5% level of significance.

This is one of the significant findings of this study which validates the existence of a significant long run cointegrating association between GDP growth and overall export diversification in Bangladesh.

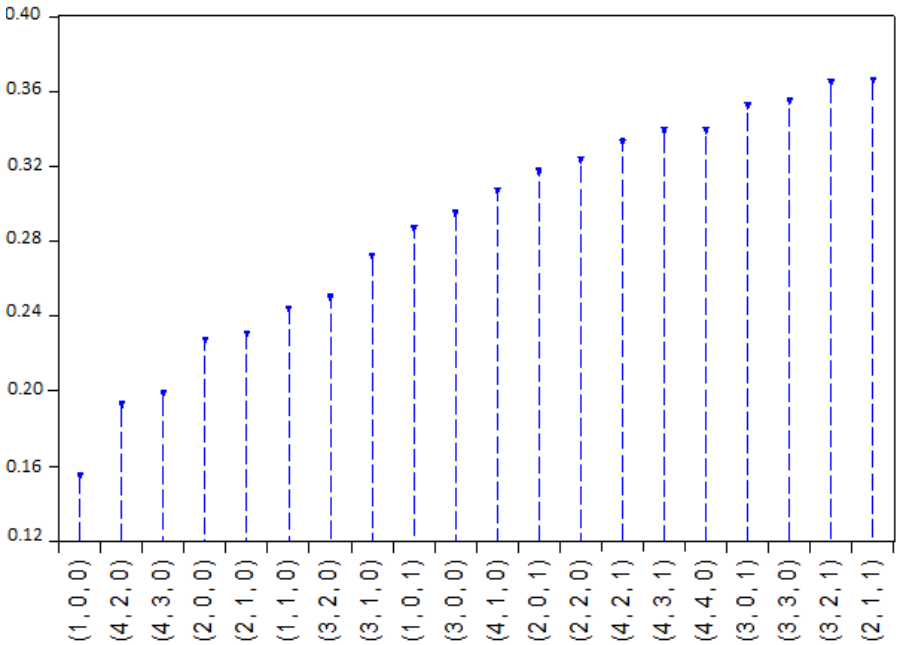

Figure 9. Schwarz information criterion: Top 20 ARDL models.

Table 3. ARDL (1,0,0) bounds test result.

Null hypothesis: No cointegration		
Bounds test F statistic: 6.390**		
Significance level	**Critical value bounds for a finite sample size**	
	I(0)	**I(1)**
10%	3.437	4.470
5%	4.267	5.473
1%	6.183	7.873

Note: (**) indicate the null hypothesis being rejected at 5% level of significance.

Table 4. Results of the diagnostic tests on the ARDL (1,0,0) model.

Diagnostic tests	**F-statistic**	**Probability**
Breusch-Godfrey serial correlation LM test	0.107	0.899
Heteroskedasticity test: ARCH	0.540	0.470
Jarque-Bera normality test	3.900	0.142

Note: LM: Lagrange multiplier; ARCH: Autoregressive conditional heteroskedasticity.

A diagnostic test is done on the model before moving on to the analysis of the long run and short run associations. Serial correlation, heteroscedasticity, normal distribution, and model stability are the diagnostic tests carried out here. The null hypothesis that there is no serial correlation and no heteroscedasticity among the residuals is not rejected, according to the F statistics shown in Table 4. Furthermore, by failing to reject the null hypothesis of normal distribution, the F statistic denotes that the data are normally distributed. The model is stable, according to the results of the cumulative sum of recursive residuals (CUSUM) test in Figure 10, which also shows that the residuals are inside the critical boundaries at a 5% significance level. Therefore, it is safe to conclude that the residuals in the estimated model are homoscedastic, there is no serial correlation among the residuals, the data are normally distributed, and last of all, the model is stable.

The results of the conditional error correction regression followed by the long run coefficients of the cointegrating variables are presented in Table 5. The number of products being exported has a significant positive long term connection with the GDP growth rate of Bangladesh. The coefficient of this regressor is significant at 5% significance level. The value and significance of the coefficient indicate that if horizontal export diversification in Bangladesh increases by 1%, the annual GDP growth rate of Bangladesh will increase by around 1.7% in the

long term. In contrast, the long run coefficient of manufactures exports as a percentage of merchandise export has a negative sign which is unexpected and is also insignificant, signifying that vertical export diversification does not have a significant long term association with GDP growth in Bangladesh.

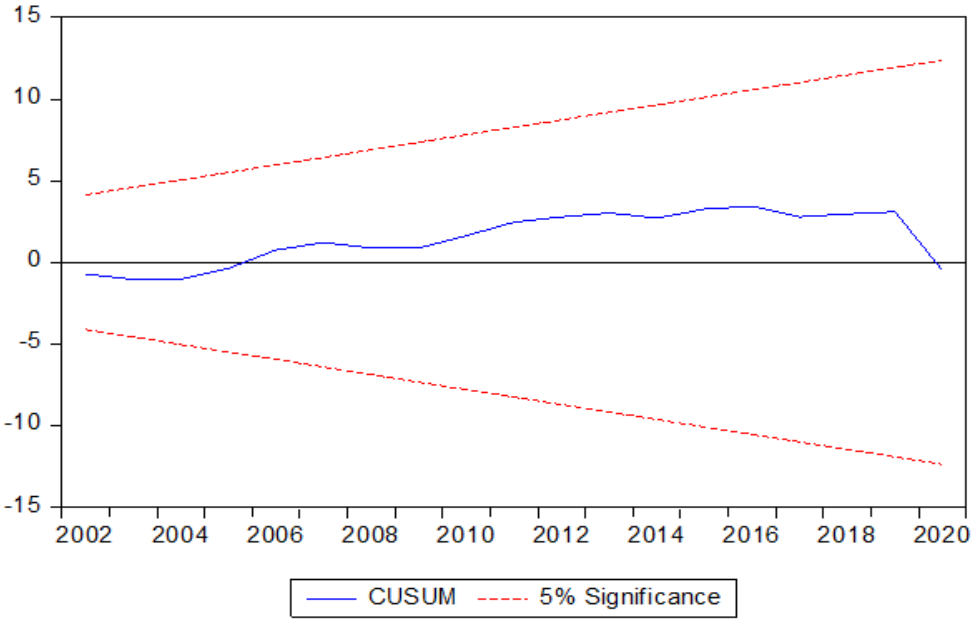

Figure 10. Cumulative sum of recursive residuals.

Table 5. Long run results of the ARDL (1,0,0) model.

Conditional error correction regression				
Variable	**Coefficient**	**Standard error**	**T-statistic**	**Probability**
C	-41.298	16.320	-2.530	0.020
LNGDP(-1)	-1.446	0.392	-3.685	0.002
LNEXS	2.457	0.830	2.958	0.008
LNMN	-0.235	3.176	-0.074	0.942
LNGFCF	-0.479	0.335	-1.429	0.169
LNLF	10.808	3.043	3.551	0.002
Long run coefficients				
Variable	Coefficient	Std. error	T-statistic	Prob.
LNEXS	1.699	0.672	2.529	0.020
LNMN	-0.162	2.184	-0.074	0.942

Note: LNGDP: Logarithm of annual growth rate of GDP, LNGFCF: Logarithm of gross fixed capital formation, LNLF: Logarithm of labor force participation rate, LNEXP: Logarithm of the number of product groups exported, LNMN: Logarithm of manufactures exports as a percentage of merchandise export.

Now that the prevalence of a long run cointegrating association between GDP growth rate and export diversification in Bangladesh has been established, the error correction model from Equation 11 is calculated to examine short run dynamics and degree of adjustment. Table 6 displays the short run coefficients and the error correction term. It is observed that the coefficient of the lagged error correction term is negative which implies that the model is stable and furthermore, the coefficient is significant at 10% level of significance. The coefficient signifies that around 70% of the short run deviation from the long run equilibrium level is adjusted within a year during the occurrence of a short run disequilibrium. However, the short run coefficients of the cointegrating variables are insignificant. This implies that there is no short run causal relationship between export diversification and economic growth in Bangladesh.

Table 6. Error correction representation of the ARDL (1,0,0) model.

Error correction model				
Variable	**Coefficient**	**Standard error**	**T-statistic**	**Probability**
C	-0.223	0.286	-0.781	0.445
D(LNGDP(-1))	-0.025	0.377	-0.067	0.947
D(LNGFCF)	2.542	3.610	0.704	0.491
D(LNLF)	14.027	3.388	4.140	0.001***
D(LNEXS)	1.161	0.706	1.643	0.119
D(LNMN)	-0.338	2.099	-0.161	0.873
ECT(-1)	-0.689	0.349	-1.973	0.065*

Note: (***), (*) signify 1% and 10% level of significance in that order.
LNGDP: Logarithm of annual growth rate of GDP, LNGFCF: Logarithm of gross fixed capital formation, LNLF: Logarithm of labor force participation rate, LNEXP: Logarithm of the number of product groups exported, LNMN: Logarithm of manufactures exports as a percentage of merchandise export, ECT: error correction term.

To conclude, the results of the ARDL bounds test indicates the presence of a long run cointegrating connection between export diversification and economic growth in Bangladesh. Conversely, the results from the error correction model suggests the non-existence of short run association between diversification of exports and economic growth.

6.3. Comparison with DOLS Method

A comparison is carried out by calculating the long run dynamics of the same regressors applying the Dynamic Ordinary Least Squares (DOLS) method. The coefficients obtained from this regression will be compared with the coefficients obtained in Table 5. The DOLS method has been chosen in this particular case because this is considered as a comparatively robust approach to calculate long run coefficients in small samples. This method was proposed by Stock and Watson. This method can estimate long run relationships among variables that have different order of integration which is the case in this research. The method includes lagged and lead values of the differenced estimators to solve endogeneity and small sample bias among the estimators (Masih & Masih, 1996). The long run coefficients obtained from the DOLS estimation is presented in Table 7.

The results from the DOLS approach indicate similar results for number of products exported to the one acquired from the ARDL (1,0,0) model. The long run coefficient has almost similar value and significance. If horizontal export diversification increases by 1%, the annual GDP growth rate in Bangladesh will increase by around 1.9% in the long run. The DOLS method however produces completely different results for the coefficient of manufactures exports as a ratio of merchandise export to what was obtained from the ARDL (1,0,0) approach. This parameter is now significant at 10% significance level and has the expected positive sign. The results specify that if vertical export diversification rises by 1%, the GDP growth rate in Bangladesh will increase by about 4.5% over the long run.

Table 7. Results of the dynamic OLS.

Variable	Coefficient	Standard error	T-statistic	Probability
LNGFCF	9.454	1.128	8.383	0.000***
LNLF	3.694	1.907	1.937	0.110
LNEXS	1.883	0.369	5.106	0.004***
LNMN	4.467	1.901	2.350	0.066*
C	-259.105	24.789	-10.452	0.000***
@TREND	-0.805	0.092	-8.736	0.000***

Note: (*), (***) signify 10% and 1% level of significance respectively.
LNGFCF: Logarithm of gross fixed capital formation, LNLF: Logarithm of labor force participation rate, LNEXP: Logarithm of the number of product groups exported, LNMN: Logarithm of manufactures exports as a percentage of merchandise export.

6.4. Discussion and Policy Suggestions

The results have indicated that export diversification leads to long run economic growth in Bangladesh. There are however, mixed results regarding the implications of horizontal and vertical export diversification on growth. The impact of horizontal export diversification has been strongly validated by the results without ambiguity whereas the results of vertical export diversification indicate otherwise. Moreover, the results demonstrated the insignificance

of short run causal relationship between export diversification and economic growth. An analogy can be made with some of the long run elasticities of export diversification that have been estimated in other countries. The elasticity value for Nigeria for example has been estimated to be 0.78 (Agbonkhese & Oboro, 2021), for Chile is 0.49 (Herzer & Nowak-Lehnmann, 2006) and lastly for Pakistan is about 0.89 (Siddiqui, 2018). The long run elasticity of export diversification for Bangladesh calculated in this study is about 1.7 which is quite larger than the ones in the three countries mentioned. This could imply that Bangladesh is considerably far away from it's potential for diversifying exports and is now in the advantageous position to reap huge benefits from it.

There are various policy options that should be considered to promote horizontal export diversification and most of them have already been documented in the long term economic plans of Bangladesh. The primary concern here is the inefficiency in implementing these policies.

Bangladesh has one of the highest protectionist tariffs on consumer goods that creates an anti-export bias. These tariffs on final consumer goods raise their domestic prices which makes producing these import substitute goods for the local market much more profitable than exporting them at lower international prices. These diverts resources away from producing exports to only producing for the domestic market. The industries that fall under these protectionisms range from ceramics, plastics, tableware, kitchenware, footwear, biscuits to lamps whose domestic prices far exceed export prices (General Economics Division, 2020). The disincentives created to export these items hinders these industries' potential to become prominent export sectors. It is therefore imminent upon the government to gradually phase out these high import tariffs. The East Asian economies that have experienced growth miracles did begin their industrialization with protectionists trade policies but subsequently decreased their protection on import substituting industries thus removing almost all anti export bias policies.

Bangladesh can imitate policies that countries like Japan, Korea, Taiwan and Singapore had implemented where they focused on developing and promoting individual industries and sectors. Some non RMG exports that Bangladesh can focus on to create a diversified export basket and whose potential for growth remains to be tapped into include light engineering products, repair of transport equipment (bicycle and ship building), telecommunications (software and Information Communications Technology (ICT)), leather and footwear products, pharmaceuticals, ceramics, jute goods etc. For example, policies can be implemented that provide incentives to local and foreign manufacturers in the leather industry to manufacture better designed and more diversified leather products and moreover produce them in an environment friendly and sustainable manner to meet rising global demand and meet international business practice standards. The pharmaceutical industry on the other hand lacks specialized human resources and knowledge infrastructure to conduct essential pharmaceutical processes like technical manufacturing, reverse engineering, quality assurance, production of active pharmaceutical ingredients and innovative research. The development of sufficient human and knowledge resources will enable this industry to synthesize and export new and patented drugs instead of just old and conventional drugs. In a similar manner, policies and incentives can be designed to target specific industries to expand their exports.

Apart from horizontal export diversification strategies, vertical export diversification should not be completely ignored. Bangladesh can diversify into intermediate goods exports by taking advantage of the cross border production network. Foreign direct investment can be attracted from multinationals who are searching for locations that offer lower costs for producing parts and components or for assembly of final products.

Finally, following the example of Vietnam, Bangladesh should work to form both bilateral and multilateral free trade agreements (FTAs). This is of special urgency now since Bangladesh is set to graduate from LDC in 2024 and lose its existing preferential trade facilities gradually.

7. CONCLUSION

Bangladesh has experienced noteworthy growth rates in its export over the past few decades. However, the export basket is concentrated in one sector which places Bangladesh in a vulnerable position with regards to possible

volatility in international demands. In this study, the relationship between Bangladesh's GDP growth rate from 1995 to 2020 and export diversification was examined.

Overall export diversification and economic growth have a significant long-run cointegrating relationship, according to the study, which used the ARDL Bounds test approach to examine cointegration. In contrast to vertical export diversification, which has a negative long-run coefficient, horizontal export diversification is expected to have a positive long-run coefficient.

Additionally, the results of the error correction model showed that there was no short-term link between export diversification and economic growth. Since there is evidence that export diversification will affect economic growth in the long run, Bangladesh should move quickly to put all the suggested techniques and policies to diversify the export portfolio into effect.

Funding: This study received no specific financial support.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: Both authors contributed equally to the conception and design of the study.

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