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An empirical analysis of foreign direct investment, ready-made garment exports, and employment in Bangladesh

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Abstract

This study investigates the relationship between ready-made garment (RMG) exports and foreign direct investment (FDI) inflows, including the relationship between employment and RMG exports in Bangladesh. Using annual time series data from 1991 to 2020, an empirical analysis was performed employing the Johansen cointegration approach and a vector error correction model to determine the long- and short-run relationships between RMG exports and FDI inflows. The results indicate that FDI inflows and RMG exports have a negative relationship in the long run. In the short run, the dynamic adjustment of the equilibrium relationship is justified only for RMG exports. Furthermore, the econometric relationship between RMG employment and exports is examined using an autoregressive distributed lag-bounds test approach. The estimated model reveals a significant statistical relationship between RMG employment and exports in the long run. In the short term, the convergence process is found to be statistically consistent. Additionally, the findings suggest that the government should initiate proper steps in infrastructure development to attract higher FDI inflows and accelerate RMG exports for faster economic growth. Moreover, comprehensive measures are required to produce a skilled workforce or create alternative employment sources to address the huge unemployment problem if full automation occurs in manufacturing industries.

Keywords: RMG exports, FDI inflows, Employment, Vector error correction model, Autoregressive distributed lag

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1. Introduction

The increasing demand for foreign direct investment (FDI) has been observed in developing economies since the latter part of the last century. The contribution to the world's total exports from these nations has sharply increased. Moreover, most developing countries introduced a new phenomenon of export-oriented potential drivers; hence, such export-led economic development has been considered an important growth factor across developing nations around the globe. There is no debate that FDI has been recognized as one of the prime factors fostering the current development process of emerging economies, which are eager to enjoy export-driven growth in their respective countries. The host country's export performance can heavily emerge from increasing flows of FDI, which ultimately fosters the country's economic development process (Bhatt, 2013; Sultan, 2013; Anh *et al.*, 2021; Bazan Navarro and Alvarez-Quiroz, 2022).

In the globalization era, economic integration with the help of transferring technology, capital mobility, sharing knowledge, and human capital is a reasonable prerequisite for ensuring proper economic development. FDI has played a crucial role in meeting the huge demand for development by ensuring essential economic integration (Harding and Javorcik, 2012; Bouras and Raggad, 2015; Arslan *et al.*, 2018; Carril-Caccia and Pavlov, 2018; Baiashvili and Gattini, 2020). When resource-poor developing countries have experienced export-oriented growth relying on a specific exporting sector, then there is a substantial influence on boosting export performance. Resource constraint-developing economies have continuously tried to meet their vast investment demand from global sources to locally achieve the best production level in export industries, depending on the competitive advantage of production factors, as these countries need to import intermediate goods for manufacturing. In reality, the common perception is that developing economies rely heavily on FDI to accelerate their export performance; therefore, this study can be considered an essential ground to examine the influence of FDI on the export performance of the dominant sector.

On the other hand, developing countries with an excessive labor supply, as most of these countries could have dominated export industries that are mainly labor intensive, and such industries can absorb huge labor forces, i.e., those sectors mainly contribute a significant role in the creation of nationwide employment and; for example, the employment in ready-made garments (RMGs) has already been accounted for 45% of all industrial employment in Bangladesh (World Bank, 2017). In the era of the Fourth Industrial Revolution, manufacturing industries worldwide have been replaced by technology-based production instead of labor-intensive production processes (Acemoglu and Restrepo, 2019; Artuc *et al.*, 2019; Maloney and Molina, 2019; Schlogl and Sumner, 2020). Automation was adopted instead of employing unskilled or semi-skilled laborers. If the entire automation process is adopted in export industries, then a large amount of marginal labor might risk losing jobs, which could cause severe unemployment problems shortly. Most developing economies use strategies to engage their unemployed labor force by creating many jobs through export industries. In practice, considering the higher contribution of export industries to employment generation, it is also

necessary to examine whether the major export industry can enhance employment creation in light of the adoption of automation or technological advancement in manufacturing industries in the labor-intensive developing economy.

Bangladesh has achieved many developmental successes since its independence in 1971, and the economy of Bangladesh has recently graduated into the process of developing countries. The country has started producing RMGs at a limited scale and has been entering the world export market since the late 1980s (BGMEA, 2020). RMG is Bangladesh's major export-earning sector, contributing more than 83% of the country's total export earnings (Export Promotion Bureau Bangladesh, 2022). According to the World Trade Statistical Review (WTO, 2022), Bangladesh is the second largest RMG exporter after China. The primary sources of the country's foreign currency earnings are RMG and labor exports, and basically, based on those two sectors, the economy of Bangladesh has steadily begun to experience export-driven economic development since the latter part of the last century (Osmani, 2008; Islam *et al.*, 2013; ADB, 2015; Sarker, 2018; Raihan and Bourguignon, 2020; IMF, 2022; Islam and Halim, 2022; Swazan and Das, 2022).

As the economy has resource scarcity, it must depend mainly on investment from abroad to meet the massive demand for investment in supporting export-oriented industries. In such a situation, FDI could be an effective source to meet the needs for investments in export industries and further development demands. Furthermore, FDI ultimately facilitates the export industries of the economy by providing the required capital and adopting upgraded technology and advanced operational capability, creating more employment opportunities, and improving infrastructure (Hossain, 2008). Considering this broader aspect, FDI could have a substantial advantage in stimulating higher growth by advancing export-oriented industries in any economy, especially developing economies (Rayhan, 2014). The country's socio-economic condition, political stability, and economic environment should be favorable for attracting FDI (Lim, 2001; Kathuria *et al.*, 2016). As in our countries, FDI inflows might play a prominent role as a source of prerequisite investment to boost export performance. Considering the importance of higher FDI inflows in fostering the export performance of the RMG sector in developing countries like Bangladesh, it has been a comprehensive idea to carry out an analytical study that will identify the empirical relationship between the export performance of the RMG sector and FDI inflows in this country.

Bangladesh's labor market is the largest, with semi-skilled and unskilled workers; the economy is also famous for its cheap labor supply worldwide (Yunus and Yamagata, 2012). In the last three or four decades, labor supply has mostly been employed in RMG manufacturing industries (Raihan *et al.*, 2015). Employment opportunities in the RMG industry have hired both male and female workers and, to some extent, have solved the unemployment problem in the domestic labor market, empowering women (Rahman and Chowdhury, 2020). Approximately 4.5 million workers are employed in RMG industries (Bangladesh Bank, 2020). Owing to technological progress, like other countries around the globe, the RMG industries in Bangladesh have also begun to transform into automation processes. For this reason, labor-

intensive Bangladesh's RMG industries will lessen their unskilled or semi-skilled labor, and technological improvement will take place in production instead of labor intensity. Based on the theme of a developing country having unique export-oriented manufacturing industries with abundant labor supply, this study investigates the impact of FDI inflows in promoting export performance and the role of this manufacturing sector in employment creation. Since the era of automation, labor-intensive manufacturing has been transformed into machine-based production. The novelty of this research work is to investigate the stated rationales considering a developing economy like Bangladesh, which has all ideal characteristics in line with aims, as no proper empirical study has been realized in this field to examine this modest research gap.

The RMG sector has played a significant role in employing a considerable labor force and is recognized as an important source to mitigate the country's unemployment problem. However, employment generation in the RMG sector is not satisfactory compared with the economy's RMG export performance. In this regard, there is a demand for further investigation into the relationship between employment and export performance in the RMG sector. At the same time, the study examines the effect of RMG exports on RMG employment in Bangladesh.

Over the previous few decades, the historical movement of FDI inflows and RMG exports in the economy has been recognized as a comparable type of pace. On the other hand, employment in the RMG industry is growing gradually, but at a little slower rate than RMG exports. There may be empirical linkages in this example where the causal link between the aforementioned components could be identified.

However, from a broader theoretical perspective, FDI can be treated as a dynamic factor in enhancing the country's economic development by accelerating the overall performance of the country's export industries, especially RMG industries. In addition, the RMG sector can play a crucial role in generating employment facilities for a large part of the country's unemployed labor force. This study is a comprehensive attempt to determine the relationship between RMG export performance and FDI inflows in Bangladesh, as well as to analyze employment in the RMG sector and the relationship between RMG export performance in Bangladesh. The empirical analysis of this study was conducted to examine the impact of FDI inflows on RMG export performance and investigate the influence of RMG export performance on employment in Bangladesh's RMG sector.

The remainder of this paper is organized as follows. Section 2 reviews the literature. Section 3 presents the data, variables, and research methodology. Section 4 presents and discusses the study's empirical findings. Finally, section 5 presents conclusions, limitations, and policy implications.

2. Literature review

Several studies have been reviewed from the perspective of developing countries to understand a clear idea of the relationship between RMG export performance and FDI inflows and between employment in the RMG sector and RMG export performance. It is rare to find studies on the relationship between sector-specific employment and export performance,

despite the common analysis of the correlation between FDI and exports or economic growth, as observed globally. It has not been recognized that there is a relationship between FDI and the main export sector of a particular developing country. However, in Bangladesh, the RMG export sector is highly prominent in total exports and can provide employment opportunities for cheap labor in the country's industrial sector. Therefore, by reviewing the existing relationship between FDI and export or FDI and growth, it is possible to understand the empirical relationship among study variables using appropriate analytical frameworks.

After comprehensively reviewing the different studies that have analyzed the FDI-exports relationship across developing countries (Majeed and Ahmad, 2007; Goswami and Saikia, 2012; Mahmoodi and Mahmoodi, 2016; Mitic and Ivic, 2016; Sultanuzzaman *et al.*, 2018; Mukhtarov *et al.*, 2019; Nguyen, 2020; Jana *et al.*, 2020; Nguyen *et al.*, 2021), it has been found that no study has exclusively examined the relationship between RMG exports and FDI inflows and the relationship between RMG employment and RMG exports. However, some empirical evidence on this issue has been found in Bangladesh. All these studies revealed mixed results. Conversely, no prior and appropriate study has been found to explain the RMG exports and employment relationship in the Bangladeshi context. Using two-stage least squares (2SLS) and vector autoregression (VAR) models, Ahamad and Tanin (2010) indicated that FDI has significant merit in promoting economic growth and suggest that the attraction of FDI has a positive spillover effect, which could have dynamic effects on growth over time. Adhikary (2012) analyzed the effect of FDI, trade openness, domestic demand, and exchange rate on exports in Bangladesh from 1980 to 2009 by applying a vector error correction approach. The results of the study are found to be significant for FDI in explaining the export changes in the short and long run. However, other factors, such as trade openness, domestic demand, and exchange rate do not have any significant causal linkage with export performance. Using VECM, Hussain and Haque (2016) found a significant long-run relationship between FDI, trade, and economic growth. This study also recommends that FDI and trade are two important components of a country's economic growth. Dey and Awal (2017) indicated an inverse relationship between FDI and economic growth; the economy should attract higher FDI by improving human capital, political stability, and infrastructure development. Majumder *et al.* (2022) utilized the generalized method of moments (GMM) to investigate FDI and export processing zone (EPZ) export relationships and the ARDL bound test approach to examine FDI and EPZ employment. The findings reveal a significant positive relationship between FDI and EPZ exports, including the short- and long-run relationship between FDI inflows and EPZ employment. Shourave (2022) investigated the causal relationships among RMG exports, total exports, and net FDI inflows using time-series data from 1996-1997 to 2019-2020 in Bangladesh, employing the ARDL bound test approach. The empirical evidence suggests that bidirectional causality exists between RMG exports and total exports in the short and long run. Only bidirectional causality exists between FDI and total exports in the short run.

Furthermore, based on the aims of this study to investigate the relationship between RMG exports and FDI inflows, along with the relationship between RMG exports and

employment in the RMG sector, other relevant determinants such as import payments, exchange rate, government development expenditure, and establishment of RMG factories have also been included in the empirical relationships. Including other important factors in the stated relationships through the control variables could provide valuable insights to explain the proper linkage by controlling the influence of those factors. The existing literature on defining the export and FDI relationship, either in country-specific or cross-country cases, has included several control variables that depend on the nature of the empirical relationship and economic phenomena. However, economic theory often relies on such a theme that explaining macroeconomic relationships through time series variables is not included in any concrete exogenous factors. All factors included in the relationships could be implied as the endogenous factor itself, and a mutual interaction exists among the factors in practice. The existing literature has described the base of methodology to identify the empirical relationships and, hence, to analyze the causal linkage among the factors with the help of advanced econometric models such as VECM and ARDL. Therefore, it is not essential or a prerequisite to discuss any prior or separate theoretical framework that explains the base of empirical relationships among the stated factors. Hence, it is necessary to examine the relationship between RMG exports and FDI inflows, including the relationship between RMG employment and RMG exports in Bangladesh, using recent time-series data and advanced econometric techniques.

3. Research data and methodology

3.1 Data collection

The empirical analysis of this research was conducted using annual time-series data from 1991 to 2020. The data for FDI inflows, import payments, and exchange rates were taken from the Bangladesh Bank; the data for RMG export receipts were collected from the Export Promotion Bureau; the data for government development expenditure were taken from the Ministry of Finance; and the data for RMG employment and the number of RMG factories were collected from the Bangladesh Garment Manufacturers and Exporters Association. Econometric analyses were conducted using the sophisticated statistical software Eviews version 10.

3.2 Estimation method

In the first phase of analysis, this study performed empirical research to verify the short- and long-run relationships between RMG export performance and FDI inflows in Bangladesh by applying a modern time series cointegration technique along with the vector error correction model (VECM) using annual time series data from 1991 to 2020. In light of modern econometric techniques, when the time-series variables are not stationary, I(0) at their level and their first difference becomes stationary, I(1), which means that the variable shows first-order integration, then they are mutually cointegrated, and their linear combination becomes I(0). In time series econometrics, VECM is more appropriate for empirical relationship estimation than other techniques if all the variables under study are first-order integrated. For this instance, the Johansen cointegration approach is a suitable method for determining cointegration towards the long-run equilibrium point. In the cointegrating relationship,

short-run dynamics are identified using the VECM, which mainly focuses on how short-run disequilibrium will be adjusted to the long-run equilibrium point.

The empirical relationship has been specified in the following equation:

$$LRMG\_EXP = f(LFDII, LIMP, EXR, LGDE) \quad (1)$$

where *LRMG_EXP* is the natural log of RMG export receipts, *LFDII* is the natural log of foreign direct investment inflows, *LIMP* is the natural log of import payments, *EXR* is the exchange rate (BDT/US$), and *LGDE* is the natural log of government development expenditures. Taking the log transformation of time-series variables represents the growth measure of the relationships, and, to some extent, this kind of transformation can reduce the heteroscedasticity of time-series data while reducing heteroscedasticity means reducing the variance among data. Considering the advantage of log transformation of variables in time-series analysis, some variables such as *RMG_EXP, FDII, IMP*, and *GDE* in the empirical relationships have been included in log form. This analysis considers the overall foreign direct investment (FDI) inflows that have contributed to the growth of the ready-made garments (RMG) industry. The RMG exports constitute over 80% of the country's total exports. FDI inflows have played a crucial role in boosting the industry by facilitating logistics, including power generation, which is necessary for higher export promotion. Although the FDI inflows to the textile sector are not particularly high (around 14%), it is the second largest after FDI inflows to the power sector in the economy.

To explain the linkage between the main factors, other relevant factors are included in the equation as control variables to account for their influence. Other important factors affecting RMG exports, such as import payments, exchange rates, and government development expenditures, are incorporated into the empirical equation. As we know, the export performance of any industry does not entirely depend on investment facilities, while import-dependent exporting countries need to rely on import facilities, exchange rate situation, and expenditure on infrastructure development of export industries. Since most resource-scarce developing countries import intermediate goods or raw materials, including machinery, for RMG export industries from abroad, import payments might be treated as one of the valuable determinants of RMG exports. The exchange rate has also been considered a crucial factor in worldwide export performance. In each developing country, government support in facilitating infrastructure development with other logistics equipment must be provided to nurture export-oriented industries that can foster rapid export growth. Bangladesh is not an exception to other countries. Government development expenditure has been utilized as a proxy for government support for infrastructure promotion in export industries, especially in RMG industries. Therefore, government development expenditure can also be considered another significant determinant of RMG exports in Bangladesh.

The empirical model was written for the analytical purpose of this study as follows:

$$LRMG\_EXP_t = \pi_o + \pi_1 LFDII_t + \pi_2 LIMP_t + \pi_3 EXR_t + \pi_4 LGDE_t + \varepsilon_t \ . \quad (2)$$

This study aims to identify the relationship between RMG export performance and FDI inflows in Bangladesh. To determine the stipulated relationship, this study employs a cointegration test and multivariate VECM, including vector error correction (VEC) Granger causality or block exogeneity (Wald) test to check the relationship between study variables. After performing stationarity tests to understand the order of integration or to confirm whether each data series has a unit root, the cointegration hypothesis between the variables was tested using the Johansen cointegration approach (Johansen, 1991) to examine the long-run relationship between the considered variables. More specifically, the multivariate VECM suggested by Engert and Hendry (1998) was applied in the analysis to examine the short-run relationship and the speed of adjustment to the long-run equilibrium point between study variables in Bangladesh. Furthermore, the VEC Granger causality test (Wald test) suggested and developed by Engle and Granger (1987) is employed in this study to determine the short-run causal relationships between the variables under consideration, that is, whether the lagged variables after taking the 1st difference affect each other. In general, the Granger causality test was postulated and expanded by Granger (1969; 1980; 1988) to examine whether the lagged value of one variable affects another in the short run. In particular, this test was established to determine the lead-lag relationship between variables. In the short-run causal relationship, the Granger causality test indicates how dynamic the lag or past value of one variable is in explaining the current value of other variables or vice versa. When time series variables are I(1), that is, integrated in order 1, the modification of the Granger causality test, namely the VEC Granger causality test or Wald (Chi-square) test, is applied in 1st difference of each variable instead of their level value in implying short-run causation between variables.

In the second phase of analysis, using annual time series data from 1991 to 2020, this study examined the short-run and the long-run relationships between employment in the RMG sector and RMG exports. Such relationships were examined by employing a modern time-series cointegration technique based on the autoregressive distributed lag (ARDL) bounds test method introduced and developed by Pesaran *et al.* (2001). In econometric analysis of time series data, if all the variables under study are not stationary, which means they are not integrated at level, some of these variables may show the order of integration at their first difference I(1) instead of I(0). None of them show the order of integration beyond the first order, which means they are not integrated at order two. In such cases, these variables can exhibit a cointegrating relationship or are mutually cointegrated. In practice, if the variables are mixed with both I(0) and I(1), their combination will be integrated at level I(0). Therefore, the empirical relationship can be suitably examined using the ARDL bound test approach rather than other techniques.

A theoretical model was used to depict the empirical relationship using the following equation:

$$LRMG\_EMP = f(LRMG\_EXP, LFDII, LNOF, LGDE) \quad (3)$$

where *LRMG_EMP* is the natural log of employment in the RMG sector, *LRMG_EXP* is the natural log of RMG export receipts, *LFDII* is the natural log of FDI inflows, *LNOF* is the natural log of the number of RMG factories, and *LGDE* is the natural log of government development expenditures. Relying on the merits of log transformation in time-series econometric analysis, variables considered in statistical relationships have been used in log transformation. Moreover, the empirical equation includes some control variables, such as the *LFDII, LNOF*, and *LGDE*, to explain the possible influence of other important factors. In explaining the linkage between RMG employment and exports, determining the potential movement in RMG employment depends on other important factors besides RMG exports. Economic theory indicates that investment is required to boost employment, especially foreign investment, which helps to promote employment in exporting industries, while the establishment of industries can also stimulate employment generation; in fact, government development spending could foster nationwide employment creation. According to macroeconomic theory, wages play a crucial role in determining employment. However, the wage structure has not been taken into account in this case. In Bangladesh, the RMG sector employs a significant portion of the labor force, with around 50% of the total industrial employment. Manufacturing employment in labor-intensive industries relies on cheap labor, and wage rates are often not a crucial factor in the perspective of Bangladesh economy. Furthermore, the number of new factories established is essential in explaining the growth of RMG employment opportunities.

Equation (3) can be modified into the ARDL model as follows:

$$\begin{aligned}\Delta LRMG\_EMP_t = \beta_0 + \beta_1 LRMG\_EMP_{t-1} + \beta_2 RMG\_EXP_{t-1} + \beta_3 LFDII_{t-1} + \\ \beta_4 LNOF_{t-1} + \beta_5 LGDE_{t-1} + \Sigma\gamma_{1i}\Delta LRMG\_EMP_{t-i} + \Sigma\gamma_{2i}\Delta RMG\_EXP_{t-i} + \\ \Sigma\gamma_{3i}\Delta LFDII_{t-i} + \Sigma\gamma_{4i}\Delta LNOF_{t-i} + \Sigma\gamma_{5i}\Delta LGDE_{t-i} + \varepsilon_t \end{aligned} \quad (4)$$

where Δ represents the first difference in the variables. The bounds test procedure was utilized to test the cointegration. This bounds test relies on the Wald test or F-statistic, which belongs to a nonstandard distribution under the following hypothesis:

H0: No cointegration between the variables.

H1: Cointegration between the variables.

The ARDL-restricted error correction mechanism (ECM) can be referred to in the following equation:

$$\begin{aligned}\Delta LRMG\_EMP_t = \beta_0 + \Sigma\gamma_{1i}\Delta LRMG_{EMP_{t-i}} + \Sigma\gamma_{2i}\Delta RMG_{EXP_{t-i}} + \Sigma\gamma_{3i}\Delta LFDII_{t-i} + \\ \Sigma\gamma_{4i}\Delta LNOF_{t-i} + \Sigma\gamma_{5i}\Delta LGDE_{t-i} + \delta ECM_{t-1} + \varepsilon_t . \end{aligned} \quad (5)$$

The coefficients of the lagged variables indicate the short-run dynamics of the model, which converge towards the long-run equilibrium over time. However, the coefficient of the error correction term δ, which refers to the dynamic adjustment of the model, is expected to be less than zero. Hence, the speed of adjustment towards the equilibrium relationship after a shock period could occur dynamically by the coefficient of the error correction term in this model.

4. Empirical results and discussions

Table 1 presents the descriptive statistics of the study variables in this research and illustrates that all study variables except for *LFDII* and *LNOF* follow the normal distribution, as the probability of the Jarque-Bera test accepts the hypothesis that observations come from a normal distribution.

Table 1. Descriptive statistics

	LRMG_EXP	LFDII	LIMP	EXR	LEMP	LNOF	LGDE
Mean	8.91	6.01	9.60	61.35	0.75	8.13	7.74
Median	8.87	6.63	9.54	63.05	0.74	8.33	7.52
Maximum	10.44	8.27	10.93	84.78	1.50	8.68	9.49
Minimum	6.76	0.34	8.04	35.74	-0.92	6.73	5.32
Std. Dev.	1.09	1.94	0.92	16.20	0.65	0.47	0.94
Skewness	-0.24	-1.58	-0.12	-0.10	-0.77	-1.42	0.02
Kurtosis	1.94	4.78	1.77	1.55	2.86	4.39	3.21
Jarque-Bera	1.71	16.45	1.97	2.67	2.96	12.47	0.06
Probability	0.426	0.000	0.373	0.262	0.227	0.002	0.970
Observations	30	30	30	30	30	30	30

Source: Author's calculation

4.1 Relationship between RMG exports and FDI inflows in Bangladesh

All chosen time series variables exhibit the first order of integration, which is presented in Table 2, which can be explained by the fact that all of these variables are non-stationary at their level and stationary at the first difference, that is, I(1) instead of I(0). Hence, these variables might be cointegrated, and long-run relationships could exist between the variables. A cointegration analysis is performed using the Johansen cointegration approach to examine the long-run equilibrium relationships. In the Johansen cointegration approach, identifying an appropriate number of cointegrating equations has been specified using two popular methods: the trace statistic test and the maximum eigenvalue test.

Table 2. Unit root test results

Variables	Level	1st Difference
Augmented Dickey-Fuller (ADF) test		
LRMG_EXP	Non-stationary	Stationary
LFDII	Non-stationary	Stationary
LIMP	Non-stationary	Stationary
EXR	Non-stationary	Stationary
LGDE	Non-stationary	Stationary
Phillips-Perron (PP) test		
LRMG_EXP	Non-stationary	Stationary

Table 2. Unit root test results *(continued)*

Variables	Level	1st Difference
LFDII	Non-stationary	Stationary
LIMP	Non-stationary	Stationary
EXR	Non-stationary	Stationary
LGDE	Non-stationary	Stationary

Source: Author's calculation

The results of the trace test and maximum eigenvalue test are shown in Table 3, and the trace test confirms that one cointegrating equation exists in the long-run relationship. The number of cointegrating vectors in Johansen's approach also reveals the existence of one cointegrating vector among the variables. Therefore, based on Johansen's approach, it could be suggested that a long-run relationship exists between variables. Table 4 shows the normalized coefficients of the single cointegrating equation, as suggested by Johansen's approach.

Table 3. Cointegration rank test results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	MacKinnon-Haug-Michelis Prob.
Unrestricted Cointegration Rank Test (Trace)				
None	0.649	70.665	69.818	0.042
At most 1	0.456	41.317	47.856	0.178
At most 2	0.374	24.221	29.797	0.191
At most 3	0.232	11.091	15.494	0.205
At most 4	0.123	3.699	3.841	0.054
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
None	0.649	29.348	33.876	0.158
At most 1	0.456	17.096	27.584	0.571
At most 2	0.374	13.129	21.131	0.440
At most 3	0.232	7.391	14.264	0.443
At most 4	0.123	3.699	3.841	0.054

Source: Author's calculation

Table 4. Normalized cointegrating coefficients result

LRMG_EXP	LFDII	LIMP	EXR	LGDE	C
1.000000	0.101***	-1.357***	0.007	-0.0137	3.105
	(0.031)	(0.190)	(0.008)	(0.054)	
	[3.187]	[-7.122]	[0.938]	[-0.254]	

Notes: *** denotes statistical significance at 1%. Standard errors are shown in parentheses, and t-statistics are presented in brackets.

Source: Author's calculation

Therefore, the long-run relationship can be written as follows:

$$LRMG\_EXP_t = -3.105 - 0.101LFDII_t + 1.357LIMP_t - 0.007EXR_t + 0.013LGDE_t + \varepsilon_t . \quad (6)$$

The estimation of the long-run relationship stated in equation (6) illustrates a highly statistically significant association between RMG exports and FDI inflows and between RMG exports and import payments. While the coefficient of FDI inflows takes an unexpected negative sign that shows a negative impact on RMG exports, import payments have an expected positive impact on RMG exports. The empirical result in the long-run equation implies that the coefficients of the exchange rate and government development expenditure are not statistically significant. Among these variables, only the coefficient of government development expenditure has taken the expected positive sign. This also reveals the right economic direction in the empirical relationship between import payments and government development expenditure on RMG exports. However, only the coefficient of import payments is statistically significant. Therefore, based on this relationship, it can be explained that in the long run, a 1% increase in FDI inflows is associated with a 0.101% decrease in the RMG exports, and a 1% increase in import payments is associated with a 1.36% increase in the RMG exports.

After investigating the long-run relationships among RMG exports, FDI inflows, import payments, exchange rates, and government development expenditures by applying the Johansen cointegration approach, this study identifies the estimation of short-run dynamic adjustment by which the disequilibrium in the short run converges towards a long-run equilibrium relationship. Table 5 presents the estimates of the VECM with the respective standard errors and t-values of the coefficients. The VECM estimation usually includes a cointegrating equation term or error correction term (ECT) to adjust the deviation from the long run through a series of partial adjustments over time. The negative and statistically significant coefficient of ECT indicates that the economy converges towards the long-run equilibrium point through short-run dynamic adjustments.

Table 5. The VECM estimation results

Vector Error Correction Estimates					
Error Correction:	D(LRMG_EXP)	D(LFDII)	D(LIMP)	D(EXR)	D(LGDE)
CointEq1	-0.445***	-2.961***	-0.224	1.856	-0.543
	(0.161)	(0.669)	(0.191)	(3.629)	(0.894)
	[-2.756]	[-4.420]	[-1.167]	[0.511]	[-0.607]

Notes: *** indicates the 1% level of significance. Standard errors are shown in parentheses, and t-statistics are presented in brackets.

Source: Author's calculation

The VECM estimation results shown in Table 5 suggest that the coefficients of ECT in the D(LRMG_EXP) and D(LFDII) equations have negative and statistically significant outcomes, but only the coefficient of ECT in the D(LRMG_EXP) equation represents statistically

consistent and meaningful adjustment towards the equilibrium relationship, while D(LFDII) shows oscillatory movement in short-run adjustment. The speed of the adjustment process towards long-run equilibrium from disequilibrium in the short run is approximately 45% in the RMG exports equation. This means the convergence process towards the equilibrium point through short-run adjustment has only occurred in the RMG export growth equation, i.e., 45% of disequilibrium in RMG exports is adjusted yearly to the long-run equilibrium relationship. On the other hand, in an equilibrium relationship, the convergence movement from FDI inflows does not have the same pace of adjustment by a year, which means the disequilibrium is adjusted by an unequal pace year by year.

After estimating the VECM to identify short-run dynamics, this study carries out a VEC Granger causality test or block exogeneity Wald (chi-square) test to investigate short-run causal links between study variables. Whether the lagged variables affect each other using the "differences" form of variables as they are non-stationary at their level and showed 1st order of integration. The following part discusses the results of the VEC Granger causality test.

Table 6. Results of the VEC Granger causality test

Causal/Excluded Variable	Chi-square	Prob>Chi-square
Dependent variable: D(LRMG_EXP)		
D(LFDII)	0.776	0.378
D(LIMP)	0.007	0.930
D(EXR)	0.220	0.638
D(LGDE)	0.173	0.677
Dependent variable: D(LFDII)		
D(LRMG_EXP)	0.260	0.609
D(LIMP)	0.333	0.563
D(EXR)	0.107	0.743
D(LGDE)	0.169	0.680
Dependent variable: D(LIMP)		
D(LRMG_EXP)	0.023	0.877
D(LFDII)	0.875	0.349
D(EXR)	0.265	0.606
D(LGDE)	1.633	0.201
Dependent variable: D(EXR)		
D(LRMG_EXP)	0.003	0.949
D(LFDII)	0.001	0.972
D(LIMP)	2.996	0.083*
D(LGDE)	0.080	0.777

Table 6. Results of the VEC Granger causality test *(continued)*

Causal/Excluded Variable	Chi-square	Prob>Chi-square
Dependent variable: D(LGDE)		
D(LRMG_EXP)	0.474	0.491
D(LFDII)	0.013	0.907
D(LIMP)	0.177	0.673
D(EXR)	0.621	0.430

Notes: * denotes statistical significance at 10%.

Source: Author's calculation

The VEC Granger causality test results in Table 6 show that no statistically significant Granger causal links have been found in the short-run relationship between the variables. However, to some extent, among the long-run convergence processes, the dynamic adjustments from the short-run divergence towards the long-run equilibrium relationship are found to be statistically significant. However, these variables are not statistically significant in terms of short-run causal links, while Granger causality does not run between unidirectional or bidirectional variables.

The empirical outcomes of the estimated model indicate a significant statistical relationship between RMG exports and FDI inflows in the long run. However, considering the economic direction, this relationship shows a negative association between RMG exports and FDI inflows. Among the other important variables, only import payments show a statistically significant positive relationship with RMG exports. Since a long-run relationship exists between RMG exports and FDI inflows, it has been found that in the short run, the dynamic adjustment to the long-run equilibrium is statistically well justified in RMG exports only. Therefore, the appropriate sign of the coefficients of the error correction term in all indicators except the exchange rate indicates that the adjustment process has taken place consistently over the time. In comparing existing studies, this study gives opposite results, such as a negative relationship between RMG exports and FDI inflows in Bangladesh, while the existing literature mainly reveals a positive relationship between exports and FDI around the globe. The RMG export industry in Bangladesh is not heavily reliant on FDI inflows. Instead, it relies on cheap labor and low-cost materials for production. The raw materials required for exports are mostly imported. Although FDI inflows are not significant, the export industries are mainly labor-intensive. However, import payments indicate a significant relationship with RMG exports, as expected in the Bangladeshi context. Furthermore, the exchange rate and government development expenditure do not focus on any significant linkage with RMG exports, as import-dependent export performance could hamper exchange rate depreciation, and government development expenditure is mostly spent meeting domestic demand instead of boosting export performance.

4.2 Relationship between RMG employment and RMG exports in Bangladesh

The results and discussions of the ARDL vector error correction bound test estimation and the outcomes of different diagnostic tests have been incorporated to scrutinize the relationships between RMG employment and RMG exports in Bangladesh.

Based on the theoretical aspect, there is no requirement to conduct stationarity or cointegration tests to determine the order of integration and the long-run relationships in the ARDL bounds test approach. However, unit root tests, that is, tests for stationarity, have also been performed to check whether the time series variables are stationary, as we know that the ARDL bounds test method is suitable when the time series contains mixed types of variables, that is, the combination of I(0) and I(1) variables.

Table 7. Unit root test results

Augmented Dickey-Fuller (ADF) Test		
Variables	**Level**	**1st Difference**
LRMG_EMP	Stationary	Stationary
LRMG_EXP	Non-stationary	Stationary
LFDII	Non-stationary	Stationary
LNOF	Stationary	Stationary
LGDE	Non-stationary	Stationary
Phillips-Perron (PP) Test		
Variables	**Level**	**1st Difference**
LRMG_EMP	Stationary	Stationary
LRMG_EXP	Non-stationary	Stationary
LFDII	Non-stationary	Stationary
LNOF	Stationary	Stationary
LGDE	Non-stationary	Stationary

Source: Author's calculation

The results from the unit root test show that some variables, namely *LRMG_EMP* and *LNOF*, are stationary at their level, while other variables are non-stationary and exhibit the first difference stationary. It can be clearly stated that the cointegrating relationship could be examined using the ARDL bounds test approach, and the bounds test method for cointegration is applied using the F test in this study. Table 8 presents the bound test results for the cointegration of the variables.

Table 8. Bound test for cointegration (F-test)

Test Statistic	**Value**	**Significant level**	**I(0)**	**I(1)**
F-statistic	9.06	10%	2.20	3.09
		5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Author's calculation

Table 8 shows cointegration between variables using the bounds test approach, which specifically implies that the estimated value of the F-statistic (9.06) exceeds the upper bound critical value at a 1% level of significance. Therefore, the cointegrating relationship between the variables can be pointed out. Furthermore, we can easily comment that long-run relationships have also been established between the variables.

Table 9. Estimations of the long run relationship

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LRMG_EXP	0.454	0.075	6.062	0.000
LFDII	-0.035	0.039	-0.891	0.382
LNOF	0.467	0.153	3.038	0.006
LGDE	-0.038	0.048	-0.810	0.426
C	-6.537	1.010	-6.469	0.000

Source: Author's calculation

In Table 9, the estimations of the long-run relationship using the ARDL approach illustrate that the coefficients of LRMG_EXP and LNOF are statistically significant at the 1% level, and both have taken the expected positive sign. This relationship reveals that a 1% increase in RMG exports is associated with a 0.45% increase in RMG employment and a 1% increase in some RMG factories is associated with a 0.47% increase in RMG employment.

Table 10. Estimations of the short-run dynamics with error correction

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LFDII)	0.052	0.020	2.528	0.019
CointEq(-1)	-0.525	0.064	-8.167	0.000

Notes: D(LFDII) denotes the first difference of the FDI inflows growth and CointEq(-1) represents the one-period lagged error correction term.

Source: Author's calculation

Table 10 shows that the short-run estimation and the coefficient of error correction term possess a negative sign, which is also statistically significant and has a value of less than 0. Such a relationship indicates that the speed of adjustment from short-run disequilibrium towards long-run equilibrium is around 53% in the RMG employment equation, which elaborately means 53% of the disequilibrium in RMG employment is adjusted in a consistent statistical process at each year or less than a year to the long run relationship. The error has been corrected, or the adjustment process has been taking place significantly from short-run disequilibrium to long-run equilibrium relation through FDI inflows in an appropriate statistical manner.

Table 11. Residual diagnostics and model specification test

Test	Test Statistic	p-value
Serial Correlation	F-statistic = 0.610	0.443
Normality test	Jarque-Bera = 1.242	0.537
Heteroscedasticity	F-statistic = 1.596	0.195
Ramsey Reset	F-statistic = 0.027	0.869

Source: Author's calculation

After evaluating the coefficients of the ARDL model, different diagnostic tests were performed on the estimated residuals to verify OLS assumptions, such as autocorrelation, normality, and heteroscedasticity. A model specification test was also performed to verify the strength of the specified model. Table 11 presents the results of various diagnostic tests, including the model specification test. The results suggest that the estimated residuals follow the normality assumption, which is free from the heteroscedasticity problem, and that there is no serial correlation among disturbance terms. The outcome of the Ramsey Reset test indicates that the model specification is sufficient to explain the relationship adequately.

The empirical findings of the estimated model show a significant statistical relationship between RMG employment and RMG exports in the long run. The other included study variables, except for the number of RMG factories, such as FDI inflows and government development expenditure, did not have any significant statistical relationship with RMG employment. Since a long-run relationship between RMG employment and RMG exports has been revealed, the dynamic adjustment to the long-run equilibrium is statistically well justified in the short run. However, the negative coefficient of the error correction term indicates that the adjustment process takes place consistently over time. The positive relationship between RMG exports and employment supports the study's findings (Majumder *et al.*, 2022), although this shows the relationship between EPZ exports and employment. However, the lower elasticity of employment growth to RMG exports indicates that technological changes in manufacturing have somewhat limited the employment creation of the unskilled labor force. The number of factory establishments shows a significant relationship with RMG employment, as the establishment of factories has increased the employment generation of both skilled and unskilled labor in RMG manufacturing. Other factors, such as FDI inflows, do not show any significant relationship with employment in the RMG sector as FDI inflows influence EPZ employment. However, many RMG industries in Bangladesh are established outside the EPZ, so it does not relate much to RMG employment. Conversely, in Bangladesh, government expenditure is spent to meet domestic demand instead of employment generation activities, so the insignificant relationship between RMG employment and government development expenditure indicates a real economic scenario.

5. Conclusion

This study aims to determine the relationship between RMG exports and FDI inflows and between RMG employment and exports in Bangladesh. Using annual time series data from 1991 to 2020, this study applied the Johansen cointegration approach and VEC technique to examine the long- and short-run relationships between RMG exports and FDI inflows in Bangladesh. The empirical findings from the estimated model illustrate a significant statistical relationship between RMG exports and FDI inflows in the long run, but such a relationship shows a negative association between these variables. Interestingly, this finding completely differed from the results of the literature reviewed in this study. More specifically, the estimated relationship does not support empirical evidence from previous studies conducted in Bangladesh, and this study shows somewhat opposite results regarding the relationship between FDI inflows and RMG exports in the case of Bangladesh. Except for import payments, other important factors, such as exchange rate and government development expenditure, do not have a significant statistical influence on RMG exports in Bangladesh. The main reason behind the negative relationship between FDI inflows and RMG exports in Bangladesh is that FDI inflows into the economy are not substantial enough to boost the export performance of the RMG sector. As FDI inflows mostly depend on other factors, RMG exports in Bangladesh are not heavily reliant on FDI inflows. On the other hand, Bangladesh is a highly import-dependent country, as it imports a large portion of raw materials for RMG exports, so the relationship between RMG exports and import payments has been explained with proper implications in this empirical model.

However, regarding economic insight, government development expenditure shows the right economic direction by taking the appropriate sign in the estimated coefficient, which means that, to some extent, RMG exports have a remarkable association with government development expenditure in Bangladesh. In the long run, the estimated relationship indicates the positive impact of government development expenditure on RMG exports. It also has an economic implication that in Bangladesh, government development expenditure boosts RMG exports and domestic demand through infrastructure development. There exists a long-run empirical relationship between RMG exports and FDI inflows. In the short run, the dynamic adjustment to the long-run equilibrium point is statistically well justified in the RMG exports equation. Hence, the appropriate sign of the coefficients of the error correction term in all the other equations, except for the exchange rate equation, indicates that the adjustment process has taken place in a consistent statistical manner over time.

In addition, this study attempts to determine the relationship between RMG employment and exports in Bangladesh. Using the ARDL bounds test method with annual time-series data from 1991 to 2020, the findings of this study support the significant statistical relationship between RMG employment and RMG exports in the long run in Bangladesh. Regarding economic direction and a statistically significant relationship, another important factor, the number of RMG factories, has a huge insightful linkage with RMG employment in Bangladesh. In the long run, the association between RMG exports and the number of RMG factories with RMG

employment growth is not very high. The primary reason behind this might be that RMG manufacturing industries have recently been steadily entering the automation process, which reduces the demand for unskilled or semi-skilled labor forces in RMG industries. So far, there exists a long-run relationship between RMG employment and RMG exports, while it has been found that in the short run, the dynamic adjustment process is statistically well justified in the long-run equilibrium relationship. However, the negative coefficient of the error correction term indicates that the adjustment process took place in a consistent statistical procedure over the study period.

Since FDI inflows can play a crucial role in accelerating the overall export performance of the economy, the government of Bangladesh should take proper initiatives for infrastructure development in the export-oriented industrial sector, especially in the RMG sector, to attract huge FDI inflows. As RMG is the primary exporting industry of the economy and considering the experience of the developing world, enhancing more FDI inflows would help foster the country's RMG export performance; as a result, rapid economic development could also occur. On the other hand, due to the rapid industrial revolution, RMG manufacturing industries are entering the automation process, and many RMG workers will be losing their jobs soon. As Bangladesh's RMG industries are abundant with unskilled workers and employment growth in this sector is not that high, the government of Bangladesh should adopt effective strategies to produce a skilled workforce or create alternative employment opportunities to overcome the huge unemployment problem in the future.

Therefore, this study can provide insightful measures for the policymaking process in RMG export-led economic development by attracting larger FDI inflows that could promote RMG exports. This study might also be supportive in suggesting meaningful realizations to mitigate the upcoming unemployment problem, where how to cope with unemployment problems that could occur from the automation process that occurred in the RMG industries in Bangladesh. Bangladesh has recently graduated from the least developed economy and has entered the process of becoming a developing country. Hence, innovative steps could be essential in enhancing greater RMG exports and generating substantial employment opportunities.

The empirical analysis in this study utilized yearly time-series data due to the unavailability of higher-frequency data, such as quarterly or monthly data. In practice, using higher-frequency data to analyze the empirical relationship in a time series, econometrics may produce better findings than annual data. Thus, conducting an empirical analysis with annual time-series data is a valid limitation of this study. This study considered several selected variables, while other important indicators may not be included in the empirical relationship owing to time and information constraints, which could be another study limitation. The analysis was carried out by considering some key variables so that other excluded variables might have contributed to explaining the empirical relationship. However, further research could be carried out to fill the research gap by including more explanatory factors, higher-frequency data with possibly a large number of observations, and other suitable advanced methodologies.

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