CHAPTER 5
ROLE OF FINANCIAL DEVELOPMENT IN MANUFACTURING EXPORTS OF BRICS COUNTRIES

5.1. Introduction

In this chapter, an attempt is made is made to check the relationship between financial sector development and manufacturing exports of BRICS countries. Few other studies also studied the linkage between financial development and manufacturing exports. But unlike them, in this study financial development index is considered as a proxy of financial development whereas other researchers used only one variable as a proxy of financial development. The financial development index and manufacturers exports (% of merchandise exports) are considered as proxy of financial development and manufacturing exports respectively. In this study, manufacturing exports sector is selected because of its high economies of scale feature (Beck. T, 2001). To check the relationship between financial development and manufacturing exports a research process is followed. In this process, at first stationarity of data series is checked by applying ADF test. After checking stationarity of data series of variables, optimal lag length is selected with the help of optimal lag length selection criteria for each country's model. Based on unit root results and lag length selection criteria, bounds test for co-integration is applied to check the co-integration among exports of manufacturing goods and financial development in BRICS countries individually. After examining bounds test results, long-run and short-run coefficients are estimated with the help of ARDL model and directional causality is also checked among

financial development and exports of manufacturing goods. And at the end, diagnostic tests are performed to check any miss specifications in the model.

5.2. Unit Root Test Results (Augmented Dickey Fuller Test)

Table 5.2.1: ADF Test Results at level and 1st difference for Manufacturing Exports and Financial Development Index of Each BRICS Country.

Country	Variable	Level	1st Difference
Brazil	LME	0.9227	0.0260
	LFDI	0.7707	0.0001
Russia	LME	0.5280	0.0010
	LFDI	0.0002	0.1853
India	LME	0.6241	0.0111
	LFDI	0.6007	0.0059
China	LME	0.0000	0.0041
	LFDI	0.8384	0.0003
South Africa	LME	0.5641	0.0000
	LFDI	0.4396	0.0001
Authors' Computation with EViews 11.			

Note-1: AIC is used for lag length selection.

Table 5.2.1 reports the results of the ADF test for the manufacturing exports and financial development index of BRICS economies with intercept at levels and the first differences. It is important to test the stationarity of each variable before the implementation of any other method as the results of stationarity test helps to decide future technique which can be implemented to check the relationship between variables e.g., if a series is stationarity at 1(2) then applying ARDL can give spurious results. So, stationarity test is applied to ensure that none of the series is not integrated of I (2) order. Here, the researcher has used Augmented Dickey Fuller (ADF) test to check the unit root in data series used in study. A stationary time series is the one, statistical properties of which mean, variance, and autocorrelation are all constant

over time. Values given in the above table are *p*-values. A *p*-value less than 0.05 means that time series is stationarity and a *p*-value above 0.05 denotes that a time series is not stationarity. Above stated results of ADF test shows that most of the data series are stationarity at I (1) orders, only LFDIR and LMEC are stationarity at I (0). Based on ADF test results, ARDL developed by Pesaran et al. (2001) and Johnson cointegration test are suitable for further analysis as none of the series is not stationarity at I (2) order. But as sample size of study is small (26 Years), in such case, ARDL method is more suitable. As bounds test for cointegration is more appropriated for small sample size. Bounds test for co-integration is first step of ARDL model. Before application of bounds test for co-integration adequate lag length of models is decided with the help of lag length selection criteria.

5.3. Lag Length Criteria Selection

Table 5.3.1: Lag Length Criteria Selection

Lag	Brazil	Russia	India	China	South Africa
0	-3.665766	-2.331366	-6.095001	-8.724302	-4.051687
1	-6.467447	**-6.028404***	**-9.254939***	**-13.88805***	**-6.606703***
2	**-6.539974***	-5.714765	-8.963233	-13.60608	-6.364667
Note: Values are of Akaike information criteria (AIC).					
Author's Computation with EViews 11.					

In the above Table 5.3.1, lag length criteria selection results are presented. Deciding adequate lag length is also very important before finding out long run relationship among explanatory variables as it helps in removing serial correlation. The optimum lag length criteria selection results are based on the AIC criterion as its values are lowest among other criteria (Appendix G). Based on the above table it is clearly

visible that lag order 2 is appropriate for Brazil's model and lag order 1 is appropriate for Russia's, China's, India's and South Africa's model. For annual data, maximum of 2 lag lengths should be selected in ARDL model (Pesaran & Shin, 1988) and (Narayan, 2005).

5.4 Bounds Test Results

Table 5.4.1: Bounds Test Results between Manufacturing Exports and Financial Development Index of Each BRICS Country.

Country	Lower Bound I (0)	Upper Bound I (1)	F-Statistic
Brazil	3.62	4.16	0.92
Russia	3.62	4.16	1.72
India	3.62	4.16	2.96
China	3.62	4.16	89.91
South Africa	3.62	4.16	0.69
Authors' Computation with EViews 11.			

Note- Critical values are at 5% and Case 2.

Bounds test is the first step of ARDL model and this procedure of bounds test is based on F statistic or Wald test. The F test applied for this procedure has non-standard distribution. Two set of critical values which are computed by Pesaran et al. (1999, 2001) for a given significance level. One set of values assume variables as I (0) and other set assumes values as I (1). If the obtained F-statistic exceeds the I (1), in such a case null hypothesis of no cointegration will be rejected and if F- statistic value comes below the I (0) than null hypothesis of no cointegration will be accepted. In another case, if F- statistic value comes between upper bounds value and lower bounds value result will be inconclusive. So, in this study to check the existence of a co-integrating relationship between financial development and manufacturing exports of BRICS

countries bound test for co-integration is applied. And results of the bound test are presented in Table 5.4.1. In bounds test the equation is estimated with 'Restricted Intercept' as it is considered in Case 2 of Pesaran and Shin. Based on the bounds test results it is evident that financial development and manufacturing exports of China have co-integrating relationship as F-statistic is higher than I(1) at 5% critical value and other BRICS countries do not have any co-integrating relation between financial development and manufacturing exports as calculated F- statistic is lower than I(0) at 5% critical value. In case of no co-integrating relationship, long-run and short-run estimates are not possible among variables. Based on bound test for co-integration results, long-run and short-run estimates are estimated among financial development and manufacturing exports of China only, as other BRICS countries bounds test results show no co-integrating relationship among manufacturing exports and financial development. Long run and short run estimates are estimated below: -

5.5. Long Run Estimation of Relationship between Manufacturing Exports and Financial Development of China

Table 5.5.1: Long-run Estimates Based on AIC-ARDL (1,1) for the Study Period.

Variable	Coefficient	*p*-value
LFDI	0.13	0.00
C	1.68	0.00
Authors' Computation with EViews 11.		

Note - Dependent Variable: LMEC

In Table 5.5.1, long-run relationship results between financial development and manufacturing exports are presented. *p*-value is 0.00 for both intercept and LFDI which shows that there is long run relationship between financial development and

manufacturing exports of China. The coefficient value of financial development is also positive which infers that 1 percent growth in financial development of China would imply 0.13 percent increase in manufacturing exports of China in long run. As per theoretical literature also, financial development increases the capacity of financial sector to supply funds to the industries for production which helps in exports of increased production capacity of industries specially in case of manufactures.

5.6. Short-Run Estimation of Relationship between Manufacturing Exports and Financial Development of China

Table 5.6.1: Error Correction Representation of Model (ARDL 1,1) for the Study Period

Variable	Coefficient	*p*-value
ECM (-1)	-0.31	0.0000
Authors' Computation with EViews 11.		

Dependent Variable: LMEC
R^2= 0.88
DW: 1.63

In above Table 5.6.1, results of short-run dynamics of China are presented. It is important to investigate short run dynamics empirically for policy makers as the signs and magnitudes of short run dynamics provide movements and directions of the variables under consideration. In this study, short-run dynamics are estimated though ECM model. In short-run, error correction term (ECM-1) is statistically significant with – sign at 5% level of significance. This negative and significant coefficient is sign of co-integration among financial development and manufacturing exports of China. The ECM coefficient shows that convergence towards the long run equilibrium is slow. Based on bounds test result, it is proved that financial development and

manufacturing exports have co-integration. In long-run and short-run also results show that financial development and manufacturing exports share relationship between each other. But the direction of causality between financial development and manufacturing exports of China is still not known. To check the direction of relationship between financial development and manufacturing exports of China VAR granger causality test is performed and its results are presented ahead.

5.7. Direction of Causality between Manufacturing Exports and Financial Development of China

Table 5.7.1: VAR Granger Causality Test Results of LME and LFDI of China.

Null Hypothesis	Chi-sq.	*p*-value	Casual Relation
LFDIC does not Granger Cause LMEC	13.44	0.0002	FDIC Promotes MEC
LMEC does not Granger Cause LFDIC	1.31	0.2512	No Causality.
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In Table 5.7.1 VAR Granger causality test results are presented. This test shows the direction of causality among variables. In this study, to check the direction of causality among the variables VAR Granger causality test is applied. If *p*-value in test is greater than 0.05 than null hypothesis (does not granger cause) is accepted and if it is smaller than 0.05 than null hypothesis (does not granger cause) is rejected. Based on the *p*-values given above, null hypothesis of financial development of China does not cause manufacturing exports of China is rejected which means that financial development of China promotes manufacturing exports of China. On the other side, null hypothesis of manufacturing exports of China does not Granger cause financial development of China is accepted which means that manufacturing exports of China

do not causes financial development of China. Results of VAR granger causality test are also supported by Pairwise Granger Causality Test (Appendix M). Based on Granger causality results, it can be said that financial development of China promotes manufacturing exports but manufacturing exports do not promote financial development of China which also proves the validity of supply side hypothesis. At last, for stronger validation of results some diagnostic tests are also performed on selected ARDL models. Diagnostic tests performed on the models are heteroskedasticity, serial correlation, normality test and stability test. And the results for these diagnostic tests are depicted ahead.

5.8. Diagnostic Test Results

The robustness of the results is investigated with the help of diagnostic tests. Serial correlation, normality and heteroscedasticity in the models are checked. CUSUM & CUSUMSQ test are applied against stability test. And the results of the same tests are presented below in a sequential manner.

Table 5.8.1: Serial Correlation Results of ARDL Models Used for BRICS Countries (LM Test)

Countries	*p*-value
Brazil	0.24
Russia	0.67
India	0.76
China	0.47
South Africa	0.55
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5.8.1. Serial Correlation Test Results

In Table 5.8.1 results of serial correlation are presented. To check serial correlation LM test is applied. In LM test, if *p*-values are greater than 0.05 than we accept null hypothesis of no serial correlation among variables. And the results of this test shows that models are free from serial correlation as *p*-values are greater than 005.

Table 5.8.2: Normality Test Results of ARDL Models Used for BRICS Countries. (Jarque- Bera Test)

Countries	*p*-value
Brazil	0.90
Russia	0.79
India	0.53
China	0.30
South Africa	0.06
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5.8.2. Normality Test Results

To check the normality of models Jarque-Bera test is applied and the results of the same are presented in Table 5.8.2. In the above table *p*-values are above 0.05 which means that models also pass the normality test.

Table 5.8.3: Heteroscedasticity Results of ARDL Models Used for BRICS Countries (Breusch – Pagan Test)

Countries	*p*-value
Brazil	0.63
Russia	0.71
India	0.32
China	0.25
South Africa	0.27
Authors' Computation with EViews 11.	

5.8.3. Heteroscedasticity Test Results

In Table 5.8.3 heteroscedasticity results are presented. To check heteroscedasticity Breusch-Pagan test is applied. In this test, if *p*-value is greater than 0.05 than null hypothesis is accepted which states that model is free from heteroscedasticity. And in case of this study, *p*-values are greater than 0.05 which means that models are free from heteroscedasticity.

5.8.4. Stability Test of Models

It is also very important to check the stability of models used in the study. In this study, to check the stability of models CUSUM and CUSUMSQ test (Brown et al (1975) are employed and the results of the same are enclosed in Appendices (Appendix P). This does not require structural break point like Chow test. Examination of plots shows that statistics of these test are within 5% critical bounds which implies that long-run and short-run coefficients of ARDL-ECM model are very stable. It is also evident form CUSUM and CUSUMSQ test that models do not suffer from any structural instability over the study period.

5.9. Conclusion of the Chapter

In this chapter, an attempt is made to check the relationship between financial development and manufacturing exports of each BRICS countries. In this process of examining ADF test is applied to check the unit root in time series of variables. After ADF test results, lag length of models is decided. Based on ADF test results and sample size ARDL model is selected to examining this relationship between variables. Next bounds test for co-integration (ARDL model) test is applied to check the co-

integration between financial development and manufacturing exports of BRICS countries. Results of bounds test for co-integration reveals that only China's financial development and manufacturing exports have co-integration, remaining BRICS country's financial development and manufacturing exports do not have co-integration. Based on bounds test results, long-run and short-run estimates (ARDL model) were estimated to check the long-run and short-run relationship between financial development and manufacturing exports of China and results of long-run estimates and short-run estimates supports the result of bounds test that financial development and manufacturing exports of China also have a significant and positive relationship in long-run and short-run. After estimating long-run and short-run estimates, direction of causality is also checked with the help of VAR Granger causality test and results of this test show that financial development of China promotes manufacturing exports of China. At last, in this chapter, some diagnostic tests were performed to check any misspecifications in the selected ARDL models and diagnostic test results shows that model does not suffer from any misspecification.