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Nexus between Trade Liberalisation and Industrial Output Growth: Evidence from Bangladesh

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Abstract: *Although industrial output growth is a significant indicator for detecting the socio-economic development of a nation, any attempt has hardly been made to examine the effects of trade liberalisation in the case of Bangladesh. Thus, this paper intends to investigate the relationship between trade liberalisation and industrial output growth in Bangladesh using time series data from the period 1980-2018. This study applies the Auto-Regressive Distributed Lag (ARDL) bound testing approach to examine the existence of the short-run and long-run relationship among the variables. The findings indicate that there is a long-run positive linkage of trade liberalisation, investment, and bank credit with industrial output growth while a negative association persists between exchange rate and production cost with industrial output growth of Bangladesh. Besides, the results demonstrate that short-run bidirectional causality exists among investment and industrial output growth, and investment and exchange rate, while unidirectional causality is found from trade liberalisation to industrial output growth, from exchange rate to industrial output growth, and from investment to industrial output growth. Therefore, a large volume of investment should be put in place to increase the capital base of Bangladesh. An export diversification policy should be devised to reduce over-dependency on the ready-made garments (RMG) sector.*

Keywords: ARDL, Engle-Granger causality, Industrial output growth, Trade liberalisation

1. Introduction

The economy of Bangladesh has witnessed a splendid structural transformation over the last five decades (MoF, 2020). The agrarian rural economy was the forerunner at the time of its independence accounting for around 60 percent of the Gross Domestic Product (GDP) (MoF, 2005). With the advent of time, the latest data shows that the industry and service sectors in the Bangladeshi economy stand at 34.6 percent and 51.8 percent, whereas the share of agriculture has now declined to 13.6 percent (MoF, 2019). These shifts are mostly due to the liberalisation of trade policies in the mid-1980s (Hossain & Alauddin, 2005). Manufacturing sectors play a dominant role, within the industry sector, with a share of 23.3 percent in the GDP though it was only 4 percent in 1972 as it was practiced restrictive trade policies in that time. Bangladesh's trade policy dramatically changed in the mid-1980s prioritizing export diversification and import liberalisation. These major shifts in trade, exchange rate, monetary, and fiscal policies favoured the domestic and international competitiveness of industries by stimulating the involvement of the private sector (Hye & Lau, 2015). Those series of auspicious policy interventions eventually led to increased production, higher export growth, and hence, industrial development (Mushtaq, Nazir, Ahmed, Nadeem, & Abbas, 2014).

There exists a substantial amount of literature available on trade liberalisation and industrial output growth. Most of them found a positive impact of trade openness on industrial output growth (Adamu & Doğan, 2017; Iftikhar, 2012; Manni & Afzal, 2012; Mushtaq et al., 2014). However, another strand of literature expressed doubts over those findings claiming that the same may not be true for every country (Hye & Lau, 2015; Okumoko, Akarara, & Amaegberi, 2019; Sultan, 2008). Existing evidence showed that due to credit constraints, most of the local firms will not be able to gain efficiency which will make it challenging to invest and produce (Pack, 1994; Topalova & Khandelwal, 2011; Young, 1991). Several studies also raised concerns over the long-run impact of trade liberalisation on industrial production (Al Mamun & Nath, 2005; Ellahi, Mehmood, Ahmad, & Khattak, 2011; Ilyas, Ahmad, Afzal, & Mahmood, 2010). Therefore, the empirical evidence on the effect of the former one on the latter one is murky. Particularly, this evidence is weak in a developing country context and it varies depending upon the nature of the economy of examination. Therefore, a country-specific empirical investigation considering Bangladesh as a case of developing economies will fill the knowledge gap in the understanding of the country-specific Nexus between trade liberalisation and industrial growth.

The current study contributes to the body of literature in several ways. Firstly, we study trade openness and industrial output growth relationship considering Bangladesh as a unique case of developing economy. Although the body of empirical literature on the relationship between openness to trade and industrial growth in both developed and developing countries is extensive, empirical studies exploring this issue in the context of Bangladesh are scarce. To the best of the authors' knowledge, existing studies are yet to examine the Nexus between trade liberalisation and industrial output growth in the context of Bangladesh. To do so, this paper investigates the relationship between trade liberalisation and industrial output growth using the ARDL bounds testing approach to co-integration which leads to the second contribution of this study. To be specific, we have used advanced econometric modeling from the period 1980-2018 due to its robustness when there is a long-run relationship among the underlying variables as well as the problem of endogenity and autocorrelation can be solved using proper lags in the model. In this regard, we hope our study will fill this gap to get a clear picture of the relationship between trade openness policy and how these policies have helped in adding value to the industrial sector of Bangladesh.

The next section briefly describes the data sources, description of variables, and model specification; section three provides the data analysis and explanation of the empirical results. Section four presents the discussion of the findings, and finally, section five concludes the paper.

2. Materials and methods

2.1 Data sources

The empirical study used publicly available data from the World Bank's World Development Indicator (WDI). Our time series data spans the period from 1980 to 2018.

2.2 Variables

While our main variable of interest is trade openness and industrial value addition, we included four other variables gross fixed capital formation, bank credit to the industrial sector, the energy cost to control for macroeconomic policy, and exchange rate to control for the exchange rate policy, respectively. In this article, we used industry value addition (INVA) as a dependent variable and trade openness (TO), gross fixed capital formation (GFC), exchange rate (ER), bank credit (BC), energy cost (EC) as our independent variables. The rationale for using these variables along with their descriptive statistics is given in Table 1.
Over the period, the mean industrial value addition was 1.9, whereas the mean trade openness, gross fixed capital formation, exchange rate, bank credit, energy costs were 0.3, 1.9, 24.9, 51.2, and 16.42 respectively. The standard deviation of industrial output growth, trade liberalisation, and investment in the data set are close to their mean. While the standard deviation of bank credit, exchange rate, and trade openness are farther away from the mean.

Table 1. Description of the variables used in the model

Variable	Mean	Med	Max	Min	Std	Description	Reference
INVA	1.9	1.2	7.8	3.7	1.9	Industrial value addition (Kaldor, 1968), a proxy variable of industrial output growth, is used as a measure that focuses on the increase in industrial output in the overall county.	Jawad, Maroof, and Naz (2020)
TO	0.3	0.3	0.5	0.2	0.1	Trade openness can be calculated as ((Export +Import)/GDP)). The more open a country is, the greater will be the amount of trade with other countries.	Yanikkaya (2003); ; Sarkar (2008); ; Dufrenot, Mignon, and Tsangarides (2010); Kim (2011); Ulaşan (2015)
GCF	1.9	1.2	8.6	2.6	2.1	Gross capital formation, a proxy variable of investment, is used to measure the total expenditure done for the acquisition of capital goods which help in the capital formation of a country.	Mohsen, Chua, and Sab (2015); Sankaran, Vadivel, and Jamal (2020)
ER	24.9	20.9	47.4	5.8	12.7	The exchange rate is a good determinant of domestic investment as well as economic growth based on the fact that increases in it discourages the purchases for foreign investment goods and encourages the purchase of domestic	Ulaşan (2015)
BC	51.2	49.1	83.5	15.5	20.6	Access to bank credit can largely affect investment decisions. Furthermore, easy access to loans can influence the investment decision of a country.	Young (1991); Pack (1994); Topalova and Khandelwal (2011)
EC	16.42	15.95	21.59	12.36	2.3	Energy cost is related to the production cost of the industries as when cost increases then production level decreases.	Kaldor (1968); Abokyi, Appiah-Konadu, Sikayena, and Oteng-Abayie (2018)

Source: Authors' calculation using WDI data

Note: INVA= Industrial value addition, TO = Trade Openness, GFC = Gross fixed capital formation, ER = Exchange rate, BC = Bank Credit, and EC = Energy Cost.

2.3 Model specification

The quantitative framework is used for empirical analysis. Our analytical study follows the following functional form:

INVA=f (TO,GFC,ER,BC,EC)………………………………..(1)

The functional relationship can be represented both in mathematical and econometric form as:

$INVA= \lambda_0+ \lambda_1\ TO+\lambda_2\ GFC+\lambda_3\ ER+\lambda_4\ BC+ \lambda_5\ EC$………….............(2)

$INVA= \lambda_0+ \lambda_1\ TO+\lambda_2\ GFC+\lambda_3\ ER+\lambda_4\ BC+ \lambda_5\ EC+ \varepsilon_t$……………...(3)

The logarithmic transformation has been taken here for simplicity of calculation using the following equation:

$\ln INVA= \lambda_0+ \lambda_1 \ln TO+\lambda_2 \ln GFC+\lambda_3 \ln ER+\lambda_4 \ln BC+ \lambda_5 \ln EC+ \varepsilon_t$................. (4)

3. Results

3.1 Unit root test results

The results of the Augmented Dickey-Fuller (ADF) test are given in Table A2 (see Appendix A). The ADF test results reveal that only the exchange rate is stationary at level, that is lnER~ I(0), and others are non-stationary. But after taking the first difference of the variables: industry value addition, trade openness, gross fixed capital formation, bank credit to the industrial sector, energy cost become stationary, that is ΔlnINVA~I (1), ΔlnTO~ I (1), ΔlnGFC~ I (1), ΔlnBC~ I (1) and ΔlnEC~ I (1).

The results of the Philips-Perron (PP) test are given in Table A3 (see Appendix A). In the PP test, exchange rate and bank credit are stationary at their level which means lnER~ I (0), lnBC~ I (0) and industry value addition, trade openness, gross fixed capital formation, energy cost are non-stationary. After taking the first difference of the variables they become stationary, that is, ΔlnINVA~I (1), ΔlnTO~ I (1), ΔlnGFC~ I (1), and Δ lnEC~ I (1).

3.2 Lag length selection criteria

To determine the optimal number of lags in this paper, sequential modified LR test statistics, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and Hannan-Quinn Information Criterion (HQ) are used. In the Akaike Information Criterion, we should choose the lowest AIC value for lag selection. This is because the lower the AIC value, the better the model. The results have been presented in Table A4 (see Appendix A).

The lowest AIC & HQ values have been found at lag length number 2 which is -20.16 & -18.96. Whereas, the lowest value for SC is at lag length 1 which is -17.51. The maximum number of lowest values by different criteria could be found at lag length number 2. So, the maximum number of lags we can take for our model is 2.

3.3 Co-integration test

The summary results of the Johansen and Juselius co-integration tests are given in Tables 2.1 and 2.2 the value of the trace statistic and maximum eigenvalue indicates that there are 2 co-integrated equations at the 5% level; this is because the P-values at a 5% level are smaller than the critical value. Therefore, the dependent and independent variables have a long-run association among them.

Table 2.1. Summary of Johansen and Juseliusco-integration test using Trace statistics

Hypothesized No. of CE(s)	Eigenvalue	Trace statistic	5% Critical Value	P-value
None*	0.77	123.92	95.75	0.00
At most 1*	0.62	71.33	69.82	0.04
At most 2	0.41	36.30	47.86	0.38
At most 3	0.30	17.57	29.79	0.59
At most 4	0.10	4.56	15.49	0.85
At most 5	0.02	0.64	3.84	0.42

Source: Authors' computation

Table 2.2. Summary of Johansen and Juselius co-integration test using maximum Eigenvalue

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5% Critical Value	P-value
None*	0.77	52.59	40.08	0.00
At most 1*	0.62	35.03	33.88	0.04
At most 2	0.40	18.73	27.58	0.44
At most 3	0.30	13.01	21.13	0.45
At most 4	0.10	3.92	14.26	0.87
At most 5	0.02	0.64	3.84	0.42

Source: Authors' computation

3.4 ARDL bounds test approach for cointegration

The long-run and short-run relationships among the variables were checked using the ARDL approach. For this study, the unrestricted error correction model (UECM) is used which considers the appropriate lags that capture the data-generating process within the general-to-specific framework (Laurenceson & Chai, 2003). In addition, unit root test results reveal that some variables are stationary at the level and some variables are stationary at the first difference. For the mixed stationarity approach, it is directed to provide justification for applying the ARDL test to examine the long-run and short-run relationship. The F- statistic value of 5.71 is higher than the upper critical bound at 1%, 5%, and 10% critical values as indicated in Table 3. This provided evidence to reject the null hypothesis of no cointegration at 1%, 5%, and 10% significance levels for this model. These results corroborated the Johansen co-integration results in which each of the trace tests and the maximum eigenvalue test indicated 2 cointegrating equations. It can therefore be concluded from the ARDL bounds test that there is a long-run relationship among the variables.

Table 3. Summary of Bound Testing Co-Integration Test

Bounds Testing to Co-integration			**Critical Value**	
Estimated Models	**F-statistics**	**Significance Level**	**Lower Bound I(0)**	**Upper Bound I(1)**
f(lnINVA, lnTO, lnGFC, lnER, lnBC, lnEC)	5.713	1%	3.41	4.68
	k = 5	5%	2.62	3.79
		10%	2.26	3.35

Note: The optimal lag is determined by AIC

3.5 Engle-Granger Causality Test

The result of the test is given in Table 4. There exists short-run unidirectional causality from trade openness to industrial value addition (lnTO⟹lnINVA), from exchange rate to industrial value addition (lnER⟹lnINVA), from trade openness to gross fixed capital formation (lnTO⟹lnGFC), from bank credit to exchange rate (lnBC⟹lnER), from bank credit to energy cost (lnBC⟹lnEC). Moreover, the bidirectional short-run causality exists between gross fixed capital formation and industry value addition (lnGFC⟺ lnINVA), and gross fixed capital formation and exchange rate (lnGFC⟺lnER).

Table 4. Engle-Granger causality test

	lnINVA	lnTO	lnGFC	lnBC	lnER	lnEC
lnINVA		3.52** (0.04)	5.75*** (0.01)	0.11 (0.89)	3.17* (0.05)	1.54 (0.23)
lnTO	0.71 (0.50)		0.03 (0.97)	1.76 (0.18)	2.32 (0.11)	0.62 (0.55)
lnGFC	13.78*** (0.00)	4.24** (0.02)		0.32 (0.72)	14.95*** (0.00)	1.10 (0.35)
lnBC	0.99 (0.38)	2.09 (0.14)	0.09 (0.91)		1.87 (0.17)	0.04 (0.96)
lnER	3.17 (0.17)	1.21 (0.31)	8.04*** (0.00)	3.73** (0.03)		0.50 (0.61)
lnEC	0.57 (0.57)	1.56 (0.23)	2.01 (0.15)	3.01* (0.07)	1.58 (0.22)	

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

Source: Authors' calculation

Thus, we can see trade openness does cause industrial value addition along with the exchange rate. Moreover, trade openness helps to form gross fixed capital in the country. Bank credit is playing a dominant part in fluctuating the exchange rate and energy costs. On the other hand, gross fixed capital formation is helping in the industrial value addition and fluctuating exchange rate where the path is bidirectional.

3.6 Short-run and long-run effects

The test results of the ARDL model have been depicted in Table 5.1 below explaining the relationship of the industrial value addition with trade openness, gross fixed capital formation, exchange rate, bank credit, and energy cost. Both the short and long-run relations along with their effects are shown here:

Table 5.1 Short-run equation estimation results

Variables	Short Run
ΔlnTO	2.63***
	[0.01]
ΔlnGFC	7.96***
	[0.00]
ΔlnER	-5.13***
	[0.00]
ΔlnBC	2.36***
	[0.03]
ΔlnEC	-4.20***
	[0.00]
ECM (-1)	-1.79**
	[0.05]

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

Source: Authors' computation

The short-run results of the ARDL model imply that the variables trade liberalisation, investment, and bank credit have a positive significant impact on industrial output growth. On the other hand, an increase in the exchange rate and production cost has a significant negative impact on the output growth of the industrial sector. Moreover, the coefficient of the error correction model is also statistically significant at the 5% level suggesting a moderate rate of convergence to long-run equilibrium following a shock in the short-run, and the speed of adjustment is -1.79.

Table 5.2 Long-run equation estimation results

Variables	Long Run
Constants	1.07
	[0.29]
lnTO	0.11
	[0.92]
lnGFC	8.07^{***}
	[0.00]
lnER	-2.30^{**}
	[0.03]
lnBC	1.69
	[0.10]
lnEC	-2.04^{**}
	[0.05]

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

Source: Authors' computation

However, investment and bank credit also have a positive statistically significant impact on industrial output growth in the long run. It means a 1-unit increase in the investment and bank credit, increases the industrial output growth by 8.07 and 1.69 units respectively over the period. Whereas, the result of trade liberalisation on industrial output growth is positive but insignificant in the long run. Again the impact of the exchange rate and production cost plays a negative but significant role in the long run for the output growth of the industrial sector. That means an increase in the exchange rate and production cost reduces the industrial output growth by 2.30 and 2.04 units respectively.

3.7 Diagnostic test results

All the diagnostic tests such as the Lagrange multiplier test of serial correlation, Breusch-Pagan-Godfrey test of heteroskedasticity, Jarque-Bera normality test, and Ramsey RESET test for testing specification bias have been performed in the ARDL model which results are given below in Table A5. The test results found no evidence of serial correlation, heteroskedasticity. The JB value of 0.56 with a p-value of 0.76 indicates the variables are normally distributed. The probability value of the Ramsey RESET test is 0.09 (T-statistic) and 0.09 (F-statistic) depicts no misspecification of the model as the p-value is greater than 5%, so we can accept the null hypothesis. The stability test result is obtained using the CUSUM test shown in Appendix B. The figure indicates the dependent variable and short-run model parameters satisfied the stability condition and the coefficients in the regression model are stable. The results are significant at the 5% level.

4. Discussion

The current study explains the relationship between trade liberalisation and industrial output growth using ARDL bound testing approach to cointegration. The findings of the study demonstrated that in the short run trade liberalisation has a significant positive impact on the industrial output growth of Bangladesh. This result is consistent with the findings of previous empirical works. Unlike the existing body of literature, the current study explained how trade liberalisation aided the industrial output growth within a cointegration analysis framework. The growth of the industrial sector can be largely attributed to the adoption of different trade liberalisation policies adopted by the government in the mid-1980s.

Though trade liberalisation contributed to augmenting the industrial output in the short run, as per the finding of this study the effect of the former on the latter is statistically insignificant in the long run. This might happen due to several reasons. To begin with, though the trade liberalisation policies were initiated in the mid-1980s, like every macroeconomic policy, there was a time lag for that particular policy to come into effect. Therefore, the extent of the data period used for the econometric exercise of the current study might be wide enough to capture that lag. Future studies can extend the current exercise by supplementing it with long-time series data. In furtherance, the export basket of Bangladesh is somewhat small and dependent upon the export policies of its trading partner countries. Several countries have dealt with this problem by diversifying their export production and minimised their production cost by adopting advanced technologies (Osakwe & Kilolo, 2018). Unlike Bangladesh, they are not dependent only on the government's trade policies.

The result indicates that there is a positive association between industrial output growth and bank credit and investment but the relationship is negative for the exchange rate and energy cost. This is because an increase in domestic investment and easy access to bank credit increases industrial production both in the short and long run. Therefore, our finding is consistent with the previous work, which found significant positive relationships between bank credit and industrial output growth both in the short run and long run, thereby suggesting to channel of sufficient credit to the industrial sector at affordable interest rates (Hacievliyagil & Eksi, 2019; Iorember & John, 2016; Ume, Obasikene, Oleka, Nwadike, & Okoyeuzu, 2017). Likewise, several studies have also found an optimistic positive significant relationship between investment and industrial output growth (Afamefuna Angus, Nnaji, & Nkalu, 2019; Okere Peter. Okere, & Ugonma, 2020). However, the current study is different in the sense that it shows the relative contribution of each of the independent variables to the industrial value addition; where the previous study had worked considering only one or two factors individually.

There are also a few specific policy lessons to be learned from this study. The current study revealed that trade liberalisation does not produce any significant impact on industrial output growth in the long run. This signifies that both government and entrepreneurs should take initiatives to diversify exports to reduce the over-dependence on the RMG sector. In addition, efforts should be given topromote private investment in export-oriented sectors. This can be done by providing injecting funds through bank loans on easy terms and conditions.

5. Conclusion

This paper empirically examines the relationship between trade liberalisation and industrial output growth using the ARDL bounds testing approach to cointegration analysis. The results indicate that trade liberalisation along with investment, exchange rate, bank credit, and production cost has significant short-run relationships with industrial output growth. The relation between bank credit and investment is positive but it's negative for the exchange rate and energy cost. However, investment and bank credit also have a positive statistically significant impact on industrial output growth in the long run. The impact of the exchange rate and production cost plays a negative but significant role in the long run for the output growth of the industrial sector. The diagnostic tests confirm the acceptability of these results. The Engle-Granger Causality test also indicates a short-run unidirectional causal relation of trade liberalisation with industrial output growth.

The present investigation has some limitations. Firstly, the findings show the relationship between trade liberalisation and industrial output growth in Bangladesh. However, this finding does not provide the details of this relationship or the specific policies that can be formulated to stabilize the relationship. Secondly, due to the lack of real effective exchange rate data in Bangladesh, this study uses the official exchange rate at the current USD.

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Appendix A

See Tables A1–A5

Table A-1. Export Receipts of Bangladesh by Major Commodities

Commodity	2018-2019	% of total	2017-2018	% of total	2016-2017	% of total
Knit wear	119039.5	48.3	105713.9	48.1	93087.9	46.9
Woven Garments	93316.2	37.9	79697.9	36.3	73673.2	37.1
Jute and Jute Manufacture	6432.9	2.6	7436.6	3.4	7497.7	3.8
Leather and Leather Manufacture	5137.1	2.1	5805.8	2.6	6232.9	3.1
Fish, Shrimps and Prawns	3556.3	1.4	4087.7	1.9	3679.8	1.9
Home Textile	3397.6	1.4	3827.0	1.7	3001.1	1.5
Vegetable Products	976.4	0.4	872.7	0.4	971.2	0.5
Pharmaceutical Products	846.5	0.3	988.4	0.4	702.3	0.4
Plastic and Plastic Products	705.0	0.3	607.0	0.3	586.6	0.3
Bicycle	436.0	0.2	358.0	0.2	432.3	0.2
Petroleum and Petroleum Products	188.4	0.1	80.2	0.0	136.1	0.1
Others	12276.4	5.0	10177.0	4.6	8373.8	4.2
Total	246308.3	100.0	219652.2	100.0	198374.9	100.0

Source: Bangladesh Bank

Table A-2. Summary of Augmented Dickey-Fuller (ADF) test

ADF Test at Level with trend and intercept			ADF Test at 1st Difference with trend and intercept		
Variable	T-Statistics	P-Value	Variable	T-Statistics	P-Value
lnINVA	-0.12	0.99	ΔlnINVA	-5.55	0.00***
lnTO	-2.95	0.16	ΔlnTO	-6.58	0.00***
lnGFC	-3.12	0.12	ΔlnGFC	-6.86	0.00***
lnER	-4.40	0.01***	ΔlnER	-6.03	0.00***
lnBC	-3.52	0.05	ΔlnBC	-5.43	0.00***
lnEC	-2.44	0.35	ΔlnEC	-5.97	0.00***

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

Table A-3. Summary of Philips-Perron (PP) test

Phillips-Perron Test Statisticat Level with trend and intercept			Phillips-Perron Test Statisticat 1st Difference with trend and intercept		
Variable	Adj. T-Statistics	P-Value	Variable	Adj. T-Statistics	P-Value
lnINVA	-0.19	0.99	ΔlnINVA	-5.58	0.00***
lnTO	-3.03	0.14	ΔlnTO	-6.57	0.00***
lnGFC	-0.94	0.94	ΔlnGFC	-6.73	0.00***
lnER	-4.17	0.01***	ΔlnER	-4.13	0.01***
lnBC	-6.47	0.00***	ΔlnBC	-5.82	0.00***
lnEC	-2.51	0.32	ΔlnEC	-5.97	0.00***

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

Table A-4. Lag length selection criteria

VAR Lag order selection criteria						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	124.68	NA	6.59	-6.41	-6.15	-6.32
1	399.75	446.06	1.66	-19.34	-17.51*	-18.69
2	450.92	66.39*	8.55*	-20.16*	-16.76	-18.96*

Source: Authors' computation

Table A-5. Diagnostic test results

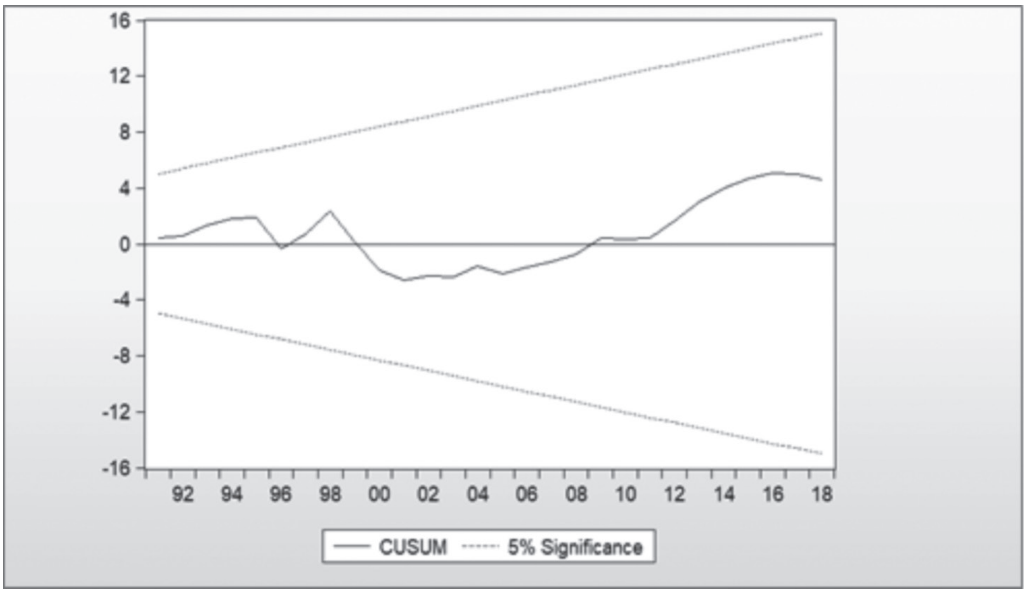
Tests	F-Stat	n*R^2	Probability F-Stat	Probability (Chi-Square)
Serial Correlation LM Test	1.55	4.05	0.23	0.13
Breusch-Pagan-Godfrey	0.68	6.79	0.72	0.66

Normality Test	
Jarque-Bera	**Probability**
0.56	0.76

Source: Authors' computation

Appendix B

Figure 1. Plot of the CUSUM test;



Source: Authors' calculation