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# Impact of Global Integration on the Economic Growth of India and China

*Sayed Gulzar Ganai[1*] and Javid Ahmad Khan[2]*

*[1]Research Scholar and [2]Assistant Professors, Department of Economics, Islamic University of Science and Technology, Awantipora-192122 (Kashmir)*

*[*]Corresponding author's email: saiedhusyn17@gmail.com*

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**ABSTRACT**

The study investigated the impact of global integration on the economic growth of India and China for the period of 1979 to 2019. The Granger causality test validated the direction of the trade variables and their association with economic growth. The study revealed that all the taken variables had positively wedged to the economic growth of the sample economies except trade openness, which negatively impacted the economic growth in the long run. Aptitude to absorb the FDI flow and infrastructural investments could impact the economic growth of India, like its emerging counterpart, China, in the global market.

**Keywords**
ARDL, economic growth, FDI, trade openness.

**JEL Codes**
F14, F15, F43.

## INTRODUCTION

The economic growth of India and China has received enormous applause all across the sphere and remained the two most influential economies in the global market (Wilson & Purushothaman, 2003; Ganai & Bhat, 2021; Ganai et al., 2022). It has been said that globalisation could be better understood by considering India and China's economies (Huchet et al., 2007). Trade patterns, exports and economic growth of these nations showed an astonishing figure, which made the world count them as the leading economies of the globe. The relationship between trade openness, foreign investments and economic growth was gaining momentum since globalisation. Each economy tries to maximise its strategies through different channels to benefit from such trade integration in the global market (Zaghini, 2003). Trade openness and foreign investments have often been considered a parameter of economic prosperity in both the developed and evolving economies of the globe (Sarkar, 2008). The two most populated economies in the world, India and China, have taken the lead in the world market as their economic strength was on the rise in the past few decades. This strength, however, can be partly attributed to the global trade with which these two economies integrated very well. The long-term impact of opening up with the world market has benefitted both India as well as China in the global market in terms of their respective GDP, exports and imports (Paul & Mas, 2016). The integration into the world market was a necessary step for India due to the balance of payments (BOP) crisis with which this economy suffered during the late 1980s and therefore opened up for trade in the early 1990s to counterbalance the adverse effect of such crisis (Aiyar, 2016). Thus, the liberalisation of the Indian economy started cutting down the high tariff rates and allowing foreign direct investment to bring the economy on track with development. However, China didn't liberalise following any BOP crisis like India but gradually integrated into the world market after 1978. Since then, China has been an example to other world economies

following the same suit. A meteoric rise has followed the integration of India and China into the global market in terms of their GDP or purchasing power. These economies effectively control the world market but certainly get impacted due to economic disorders like the financial crisis of 2008 (Srinivasan, 2006). Therefore, to see the trend of these two economies through an assessment of empirical data is necessary to take advantage of global trade. This study would benefit India, China, and other world economies because these two are deeply rooted in the world trade market.

The empirical studies suggested that global integration could be either beneficial (Grossman & Helpman, 1991; Harrison, 1996; Lee et al., 2004; Das & Paul, 2011; Marelli & Signorelli, 2011) or disruptive (Hye & Lau, 2014; Zahonogo, 2016), for the economic growth of participating economies. Few empirical studies displayed an insignificant relationship between the integrating trade variables and economic growth (Yanikkaya, 2003; Eris & Ulaşan, 2013; Menyah et al., 2014; Ulaşan, 2014; Hye et al., 2016). In India and China, few of the studies gave mixed results (Sharma & Panagiotidis, 2005; Goldberg et al., 2010; Aggarwal, 2015). Thus, the relationship between economic growth and global integration was still an open question. Therefore, this study aimed to highlight the instruments of global integration in these sample economies and to examine their impact on the economic growth of India and China through forming econometric links.

## METHODOLOGY

In order to investigate more precisely the impact of trade openness and allied factors on the economic growth of these two economies in question, econometric links were developed between the variables to carry out the analysis. Economic growth usually depends upon various political and economic factors. However, only a few economic factors related to this study were considered, like capital accumulation which mainly depends on fixed investments in an economy. Fixed investments are highly supported through the saving rate percentage in the economy, and foreign investments complete the required supplement. Few empirical works that exhibited the impact and interrelation of trade openness and economic growth using a cross-section or panel data approach include Edwards (1998); Frankel and Romer (1999); Milner et al. (2007); Sarkar (2008). Time series analysis, along with cointegration and VAR, was used to investigate the econometric links between economic growth and trade openness, including a few such as Liu et al. (2002); Tsen (2006); Zhao and Du (2007). Following the same suit, this study utilised the autoregressive distributed lag model (ARDL) to analyse the short-run and long-run impact of different variables on the economic growth of India and China.

### Data Source

Annual time series data from 1979-2019 was used for empirical analysis of the sample economies. The variables were taken into their real numbers with the base year of 2010 (Table 1).

The dependent variable in this study was taken as GDP per capita, a proxy variable for economic growth. Independent variables were FDIf, FDIs, GFCF and TO. All data series were taken in their natural log form. This log transformation was the best option for unbiased empirical evidence.

### Data Analysis

The autoregressive distributed lag (ARDL) model developed by Pesaran (1997) to examine the association among the variables, the and extended by Pesaran et al. (2001) was employed in this study. Furthermore, the granger causality test was used to examine the directional relationship between the variables. In the end, various diagnostic tests were applied to check the robustness of the model. The study applied the cumulative sum and cumulative sum of the square techniques to check the stability of the model. It was presumed that economic

**Table 1. Variable and their descriptions**

| Variables | Abbreviation | Measuring unit ($) | Source |
|---|---|---|---|
| Gross domestic Per capita | GDPPC | Per capita | World Bank-WDI |
| Foreign direct Investment flow | FDIf | Million | UNCTAD |
| Foreign direct Investment stock | FDIs | Million | UNCTAD |
| Gross fixed capital formation | GFCF | Million | World Bank |
| Trade openness | TO | Exports + Imports = Trade as a percentage of GDP. | Processing of World Bank data |

growth (GDPPC) was the function of FDI inflows, FDI stock, GFCF and TO. The functional form of our model could be written as

GDPPC = f(FDIf, FDIs, GFCF, TO)

Further, we wrote the functional form of our model into an econometric model:

$$GDPPC = \alpha + \beta_1 FDIf + \beta_2 FDIs + \beta_3 CFCF + \beta_4 + \varepsilon_t \quad (1)$$

We then transformed the variables into natural logarithms, and Equation 1 could be written as:

$$\ln GDPPC = \alpha + \beta_1 \ln FDIf + \beta_2 \ln FDIs + \beta_3 \ln CFCF + \beta_4 \ln + \varepsilon_t \quad (2)$$

Where ln represents the log natural, α is the intercept, $\beta_s$ are the parameter or the slope coefficients and $\varepsilon_t$ is the error term with time t. The ARDL model assesses the long-and short-run relationship between the variables. Equation 2 could be written in the ARDL framework

$$\Delta \ln GDPPC_t = \alpha_1 + \sum_{i=1}^{p} \delta_{ij} \Delta \ln GDPPC_{t-1} + \sum_{i=0}^{q1} \beta_{ij} \Delta \ln FDIf_{t-i} + \sum_{i=0}^{q2} \gamma_{ij} \Delta \ln FDIs_{t-i} + \sum_{i=0}^{q1} \Psi_{ij} \Delta \ln GFCF_{t-i} + \sum_{i=0}^{q2} \varphi_{ij} \Delta TO_{t-i} + \theta_1 \ln GDPPC_{t-1} + \theta_2 \ln FDIf_{t-1} + \theta_3 \ln FSIs_{t-1} + \theta_4 \ln GFCF_{t-1} + \theta_5 TO_{t-1} \quad (3)$$

Where p represents the lag order of the dependent variable, other $q_s$ represents the lag order of the explanatory variables. The t=1…. T, time index and $\varepsilon_t$ is the random error term. Further, the short-run estimation can be asses through equation (4):

$$\Delta \ln GDPPC_t = \alpha_1 + \sum_{i=1}^{p} \delta_{ij} \Delta \ln GDPPC_{t-1} + \sum_{i=0}^{q1} \beta_{ij} \Delta \ln FDIf_{t-i} + \sum_{i=0}^{q2} \gamma_{ij} \Delta \ln FDIs_{t-i} + \sum_{i=0}^{q3} \Psi_{ij} \Delta \ln GFCF_{t-i} + \sum_{i=0}^{q4} \varphi_{ij} \Delta TO_{t-i} + ECM(-1) + \varepsilon_t \quad (4)$$

To check the stationary in the data set Phillips Perron (PP) unit root and the Augmented Dickey-Fuller (ADF) tests were employed. The most important issue regarding ADF is the selection of lagged values in the ADF equation. Therefore, Test Sequential Strategy (TSS) was followed along with the test of PP for unit roots that gave robust results. On-time series of integration and implementation of it depends on lag selection. So, the number was chosen based on the formula by Schwartz, which suggests $\iota = T_{1/4,}$ where T is the sample size. After stationary, co-integration was to be checked if they were integrated at I(k). I(1) is stationary at first difference. If two or more variables are co-integrated, then the Error-Correction model would come into play.

The study further attempted to confirm the long-run relationship between the variables based on t-tests or F-tests. The variable may be stationary I(0) integrated of order I(1), or mutually co-integrated, as a major advantage of the bound testing technique because main variables should be stationary and others not. From Equation 3, long-run results were derived. An error correction model was a linear combination of the lagged level of all variables in Equation 4. The first step in estimating the ARDL model was applying either a t-test or an F-test. The F-test remained more sensitive to the order of lags. So, a lag length selection was the most important first step in ARDL. After selecting lag, t and F tests were conducted to find the co-integration.

While assuming all regressors to be stationary or I(0), a lower critical value emerged. In contrast, an upper value emerged by assuming all variables to be integrated into order one. A long-run relation emerges only when the test statistics lie above the critical level. If test statistics fell below the critical value, the null hypothesis of no cointegration would not be rejected. Error correction mechanism (ECM), first used by Sargan (1964) and later it was popularized by Engle and Granger (1987), corrects for disequilibrium. The speed at which a dependent variable put back to equilibrium after a change in other variables was estimated by Error correction mechanism. When all the variables were adapted towards their long-run equilibrium, the gap between the dependent and independent variables measured by the coefficient associated with $ECM_{t-1}$ must decline. In other words, a negative and significant co-efficient accessed for $ECM_{t-1}$ would signal adjustment towards equilibrium and an alternative way of supporting co-integration among variables. The adjustment parameter in absolute value was located between zero and one.

Besides this, the Granger-causality test was used to determine whether one-time series helps forecast another. A time series X is said to be Granger-cause Y if lagged values of X provide important information about future values of Y. The Granger causality test assumed that the information relevant to predicting respective variables, GDP, FDIf, FDIs, GFCF and TO. The cumulative sum of recursive residuals (CUSUM) was used for stability. The model would be the best fit if the difference between real and forecast observation were infinitesimal.

## RESULTS AND DISCUSSION

The direction of GDP per capita and trade openness for the sample economies are presented in Table 2. The

results revealed that the per capita income was similar in India and China until 1983. Since the mid-1990s, China exhibited a massive incline in the GDP per capita and the period of 2008 displayed that per capita for China was more than three times that of India. In 2019, China had gained almost five times per capita than India. Similarly, results presented in Table 2 showed the degree of openness, which defined as the ratio of total exports and imports of a country to the GDP of that particular economy during a particular period, as

Trade Openness (TO) = (Exports + Imports) / GDP

China changed dramatically, and its degree of openness increased from a mere 14 per cent in 1978 to a peak of almost 64 per cent in 2006. However, India remained less open than China till 2008 and is now reversing its trend. The degree of openness in India had changed quite intensely after the 2008 recession and was on an increasing trend. In 2019, the degree of openness in India was 28.62 per cent and was a bit lesser than the Chinese degree of openness, which stood at only 32.06 per cent, a few percentage points above India.

The openness of markets and foreign investments played an imperative role in the economic growth of an economy and is empirically found in the economic literature (Frankel & Romer, 1999; Dollar & Kraay, 2003; Bensidoun et al., 2009). Over the past few decades, China and India displayed a tremendous rise in the economic strength of their respective economies. However, China took the lead in every aspect, but India was also focusing on gaining more market, attracting more FDI to gain more advanced knowledge and technical know-how and thus paving the way for herself to counter the economic might of China.

Before going into the empirical investigation, following unit root tests were necessary to check the stationarity of the data and then follow the ARDL model analysis in the short and long-run periods.

**Unit Root Tests**

ADF and PP unit root tests were utilised, and the results are presented in Table 3. Variables like GDPPC, FDIf, FDIs, CFCF and TO were integrated at I(1) in the Indian context, whereas TO and FDIs were integrated at I(0) in China. The results suggested that the variables were non-stationary in their levels but achieved stationary status after taking the first differences. It implied the possibility of long–run relation among the variables.

**Descriptive Statistics**

The descriptive statistics for India and China shared almost the same description except for skewness (Tables 4 and 5).

**Table 2. Real GDP per capita and trade openness**

| Year | GDP per capita ($) | | Trade openness | |
|---|---|---|---|---|
| | China | India | China | India |
| 1978 | 381.10 | 402.05 | 14.10 | 10.59 |
| 1979 | 404.60 | 372.62 | 16.40 | 11.53 |
| 1980 | 430.85 | 388.82 | 19.90 | 12.59 |
| 1981 | 447.12 | 402.90 | 22.48 | 12.26 |
| 1982 | 480.31 | 407.59 | 20.29 | 12.03 |
| 1983 | 524.41 | 427.53 | 18.91 | 10.63 |
| 1984 | 596.20 | 433.93 | 20.60 | 11.65 |
| 1985 | 667.13 | 446.58 | 22.49 | 10.78 |
| 1986 | 716.10 | 457.57 | 24.55 | 9.97 |
| 1987 | 786.86 | 465.31 | 30.28 | 10.02 |
| 1988 | 861.19 | 499.08 | 32.91 | 10.90 |
| 1989 | 883.76 | 517.42 | 32.11 | 12.30 |
| 1990 | 905.03 | 534.48 | 31.99 | 12.94 |
| 1991 | 975.46 | 528.90 | 35.40 | 14.13 |
| 1992 | 1100.64 | 546.44 | 38.77 | 14.99 |
| 1993 | 1239.13 | 560.80 | 44.00 | 15.88 |
| 1994 | 1384.93 | 586.18 | 41.93 | 15.85 |
| 1995 | 1520.03 | 618.14 | 38.24 | 18.13 |
| 1996 | 1653.43 | 651.96 | 33.56 | 18.08 |
| 1997 | 1787.76 | 665.47 | 33.81 | 18.38 |
| 1998 | 1909.62 | 693.41 | 31.48 | 18.14 |
| 1999 | 2038.20 | 740.92 | 32.96 | 18.01 |
| 2000 | 2193.89 | 755.48 | 39.15 | 20.05 |
| 2001 | 2359.57 | 777.73 | 38.05 | 19.31 |
| 2002 | 2557.89 | 793.10 | 42.21 | 20.54 |
| 2003 | 2797.17 | 840.82 | 51.26 | 21.64 |
| 2004 | 3061.83 | 892.38 | 59.05 | 24.88 |
| 2005 | 3390.71 | 947.76 | 62.20 | 29.56 |
| 2006 | 3800.76 | 1008.67 | 63.97 | 31.93 |
| 2007 | 4319.02 | 1070.13 | 61.31 | 31.19 |
| 2008 | 4711.64 | 1087.58 | 55.79 | 43.03 |
| 2009 | 5128.90 | 1156.88 | 43.27 | 31.46 |
| 2010 | 5647.06 | 1238.01 | 48.86 | 34.41 |
| 2011 | 6152.69 | 1285.28 | 48.23 | 42.09 |
| 2012 | 6591.65 | 1337.48 | 45.32 | 43.03 |
| 2013 | 7056.41 | 1404.54 | 43.46 | 42.02 |
| 2014 | 7532.77 | 1490.03 | 41.06 | 38.53 |
| 2015 | 8016.43 | 1590.17 | 35.74 | 31.47 |
| 2016 | 8516.51 | 1701.18 | 32.81 | 27.29 |
| 2017 | 9053.21 | 1795.91 | 33.36 | 28.25 |
| 2018 | 9619.19 | 1891.14 | 33.27 | 31.05 |
| 2019 | 10155.49 | 1941.81 | 32.06 | 28.62 |

***Source: Processing of World Bank data.***

**ARDL Estimation**

**Short-run estimation for India and China**

The outcome of the short-run estimation of ARDL is presented in Table 6. The magnitude and sign of the coefficient of ECM determined the short-term adjustment process. The results showed that ECM for India was statistically significant (-0.08), revealing convergence towards the equilibrium path could take less than a year. The ECM for China took the value of (-0.57) and was statistically significant. However, it showed that China could take longer to converge towards equilibrium than India.

FDI in terms of flow and stock both had a positive and significant impact on the GDPPC of India and China. The magnitude of the coefficient for *FDIf* and *FDIs* remained at 0.0581 and 0.298413, respectively, for India. As for China, it stood at 2.22 and 0.33, respectively, for FDI flow and FDI stock. The results also found the negative impact of trade openness on economic growth in India in the short-run period. However, China had taken the lead in

**Table 3. Unit root results**

| Variables | Order | India | | China | |
|---|---|---|---|---|---|
| | | ADF | PP | ADF | PP |
| GDPPC | Level | 0.2991 | 0.4903 | 0.9749 | 0.9938 |
| | First difference | 0.0001 | 0.0001 | 0.0109 | 0.0092 |
| GFCF | Level | 0.4597 | 0.461 | 0.4932 | 0.7942 |
| | First difference | 0.0001 | 0.0001 | 0.0089 | 0.0001 |
| TO | Level | 0.8215 | 0.8021 | 0.0389 | 0.0476 |
| | First difference | 0.0002 | 0.0002 | 0.0003 | 0.0003 |
| FDIf | Level | 0.7461 | 0.8144 | 0.1297 | 0.0002 |
| | First difference | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| FDIs | Level | 0.8431 | 0.9326 | 0.0065 | 0.0469 |
| | First difference | 0.0057 | 0.006 | 0.056 | 0.0365 |

***Source: Authors' calculation.***

**Table 4. Descriptive statistics (India)**

| India | GDPPC | FDIs | FDIf | TO | GFCF |
|---|---|---|---|---|---|
| Mean | 2.736384 | 4.133659 | 3.304724 | 1.415981 | 1.425541 |
| Median | 2.645421 | 4.177589 | 3.554851 | 1.394725 | 1.416344 |
| Maximum | 3.322136 | 5.630355 | 4.703747 | 1.746585 | 1.554039 |
| Minimum | 1.361728 | 2.654898 | 0.751279 | 1.087045 | 1.293942 |
| Standard error | 0.37525 | 1.037297 | 1.147372 | 0.223932 | 0.074012 |
| Skewness | -0.78151 | 0.011797 | -0.37942 | 0.026615 | -0.03629 |
| Kurtosis | 5.520009 | 1.507615 | 1.884581 | 1.502422 | 2.032921 |

***Source: Authors' calculation.***

**Table 5. Descriptive statistics (China)**

| China | GDPPC | FDIs | FDIf | TO | GFCF |
|---|---|---|---|---|---|
| Mean | 3.038919 | 4.953479 | 4.21097 | 1.523158 | 1.538666 |
| Median | 2.941157 | 5.269954 | 4.655686 | 1.553517 | 1.524442 |
| Maximum | 4.011218 | 6.247847 | 5.149912 | 1.809418 | 1.648543 |
| Minimum | 2.264778 | 3.031004 | 0.088976 | 1.044798 | 1.380008 |
| Standard error | 0.592014 | 0.973465 | 1.100243 | 0.190297 | 0.078235 |
| Skewness | 0.313422 | -0.58035 | -1.72019 | -0.66008 | -0.11883 |
| Kurtosis | 1.661481 | 2.186467 | 6.228532 | 2.896812 | 1.826849 |

***Source: Authors' calculation.***

trade openness and exhibited a significant positive impact on its economic growth during the short-run estimation, which stood at 0.128037 (Table 6). Gross fixed capital formation revealed a positive and significant impact on economic growth for both the economies in question. However, its magnitude in India had a firm hold on economic growth as it stood at 0.497, then the Chinese coefficient of 0.012.

The concluding remark could be that trade openness negatively impacted India's economic growth more than that of China in the short-run estimation. Other factors positively impacted the economic growth of both these economies. The coefficient of the lagged error correction term was significant with the correct sign, supporting the evidence of a stable long-run relationship among variables.

**ARDL Long-run Estimation for India and China**

The long-run relationship between economic growth and independent variables could be considered by the significance and correct sign of the error correction coefficient. The value of F exceeded the upper critical bound in both the economies of India and China, which indicated that there exists a long-run relationship between the taken variables. The result of the ARDL bounds test is presented in Table 7.

**Table 6. Results of ARDL short-run estimation**

| Variable | India | | China | |
|---|---|---|---|---|
| | Coefficient | Probability | Coefficient | Probability |
| GDPPC (-1) | 0.751395*** (0.07053) | 0.011 | 0.403145*** (0.287673) | 0.0050 |
| GFCF | 0.497564*** (0.220934) | 0.0014 | 0.012139*** (0.03152) | 0.0038 |
| TO | -0.03095*** (0.126686) | 0.0001 | 0.128037*** (0.064124) | 0.0542 |
| FDIf | 0.0581*** (0.0172) | 0.0001 | 2.224744* (5.363853) | 0.0823 |
| FDIs | 0.298413*** (0.0748) | 0.0001 | 0.329571* (0.160301) | 0.0766 |
| C | 0.029148*** (0.221938) | 0.0001 | 0.21733 (0.206513) | 0.3003 |
| Ect (-1) | -0.08140*** (0.01451) | 0.0000 | -0.57010** (0.10901) | 0.0310 |
| $R^2$ | 0.61 | | 0.72 | |
| Adjusted $R^2$ | 0.54 | | 0.67 | |

***Source: Author's calculation.***
******, ** and * Significant at one, five and ten per cent levels.***
***Figures in parentheses are standard errors.***

**Table 7. Results of the F-Bounds Test**

| Country | F-Bounds Test | | Null Hypothesis: No levels of relationship | | |
|---|---|---|---|---|---|
| | Test statistic | Value | Significance (Percent) | I(0) | I(1) |
| | | | | Asymptotic: n=1000 | |
| India | F-statistic | 6.693032*** | 10 | 2.2 | 3.09 |
| | k | 4 | 5 | 2.56 | 3.49 |
| | | | 2.50 | 2.88 | 3.87 |
| | | | 1 | 3.29 | 4.37 |
| China | F-statistic | 7.39905*** | 10 | 2.20 | 3.09 |
| | k | 4 | 5 | 2.56 | 3.49 |
| | | | 2.5 | 2.88 | 3.87 |
| | | | 1 | 3.29 | 4.37 |

***Source: Author's calculation.***
****** Significant at 1 per cent levels.***

The long-run estimation of economic variables linked with the growth of India and China is presented in Table 8. Foreign direct investments, both in terms of flow and stock, presented a significant impact statistically on the GDPPC of India. The estimated results also found that Gross Fixed Capital Formation had a positive relationship with GDPPC, and this relationship was statistically significant. Similar results were for China except for the magnitude of GFCF, which remained relatively low for the Chinese economy than that of India (Table 8). Besides this, FDIf shared the most effective contribution to the economic growth in China both in the long as well as in the short runs, followed by FDIs. However, the coefficient of the variable TO was negative for both economies, but this relationship was not found to be significant in the long run for the Indian economy. The results indicated that in the long-run, FDI (both flow and stock) and GFCF contribute positively to economic growth in terms of an increase in GDPPC for both India and China. Besides this, FDIf (flow) contributed significantly to the growth of the Chinese economy, whereas FDIs (stock) have a larger contribution to the Indian economy in the long run.

**Sensitivity Analysis and Stability Test**

A cumulative sum (CUSUM) chart monitors small shifts in the process mean (Figure 1 and 2). The concept of (CUSUM) was propounded by (Brown et al., 1975) and depicted below at 5 per cent level of significance.

**Diagnostic Tests**

The results of diagnostic tests are depicted in Table 9. The results revealed that there were no serial correlation and heteroscedasticity issues in the model. Besides this, the result of the Jarque-Bera Test showed that all the series were normally distributed.

**Granger Causality Analysis**

A cointegration relationship indicate that there must be Granger causality among the variables in at least one

**Table 8. Results of ARDL long-run estimation**

| Variable | India | | China | |
|---|---|---|---|---|
| | Coefficient | Probability | Coefficient | Probability |
| Ln GFCF | 0.4032*** (0.287673) | 0.0050 | 0.1303*** (0.0293) | 0.000 |
| Ln TO | -0.1245 (0.4979) | 0.8045 | -0.93** (0.0402) | 0.021 |
| Ln FDIf | 0.7743*** (0.170301) | 0.0001 | 2.061*** (0.1162) | 0.000 |
| Ln FDIs | 1.2004*** (0.183439) | 0.0001 | 0.473*** (0.213) | 0.050 |
| C | 0.1173 (0.888942) | 0.8961 | 0.115 (0.074) | 0.153 |

******, ** and * Significant at one, five and ten per cent levels.***
***Figures in parentheses are standard errors.***

**Table 9. Results of diagnostic tests**

| | | | | | |
|---|---|---|---|---|---|
| **Godfrey Serial correlation LM Test** | | | | | |
| F-statistic | | 0.395693 | Prob.F(2,20) | | 0.6784 |
| Obs*$R^2$ | | 0.989644 | Prob. $\chi^2$ (2) | | 0.6097 |
| **Heteroskedasticity test: Breusch-pagan-Godfrey** | | | | | |
| F-statistic | | 1.255059 | Prob.F(3,22) | | 0.3141 |
| Obs*$R^2$ | | 3.799491 | Prob. $\chi^2$ (3) | | 0.2839 |
| Scaled explained SS | | 1.975629 | Prob. $\chi^2$(3) | | 0.5775 |
| **Normal Distribution** | | | | | |
| | | **GDPPC** | **FDIS** | **FDIF** | **TO** | **GFCF** |
| India | Jarque-Bera | 15.02218 | 3.805774 | 3.109149 | 3.836189 | 1.606705 |
| | Probability | 0.000547 | 0.149137 | 0.211279 | 0.146887 | 0.447825 |
| China | Jarque-Bera | 3.731965 | 3.432158 | 38.02691 | 2.995521 | 2.447633 |
| | Probability | 0.154744 | 0.17977 | 0 | 0.22363 | 0.294106 |

***Source: Author's calculation.***

direction for the directional relationship. The results of Granger causality are presented in Table 10. For India, in the first instance, FDI in both stock and flow does not cause GDPPC, and its probability value was insignificant, so we accepted the null hypothesis. GDPPC affects *FDI* stock and flow, which was significant at 0.0001 and 0.0541, respectively, a sign of a unidirectional relationship. So, we reject the null hypothesis.

In the second instance, GFCF does not granger cause GDPPC and the probability value was insignificant, so we accepted the null hypothesis. GDPPC affects GFCF, which was significant at 0.0070, a sign of a unidirectional relationship, which rejected the null hypothesis that GDPPC does not affect GFCF.

As for China, FDI (stock) does not Granger cause GDPPC, and its probability value was non-significant, so we accepted the null hypothesis, but significant for FDI (flow) and therefore rejected the null hypothesis. Similarly, other variables followed the same standards and were either accepted or rejected based on probability values (Table 10).

The findings of the present study are in consonance with the studies of Hye and Lau (2014); Sengupta (2020) that showed the negative impact of trade openness on Indian

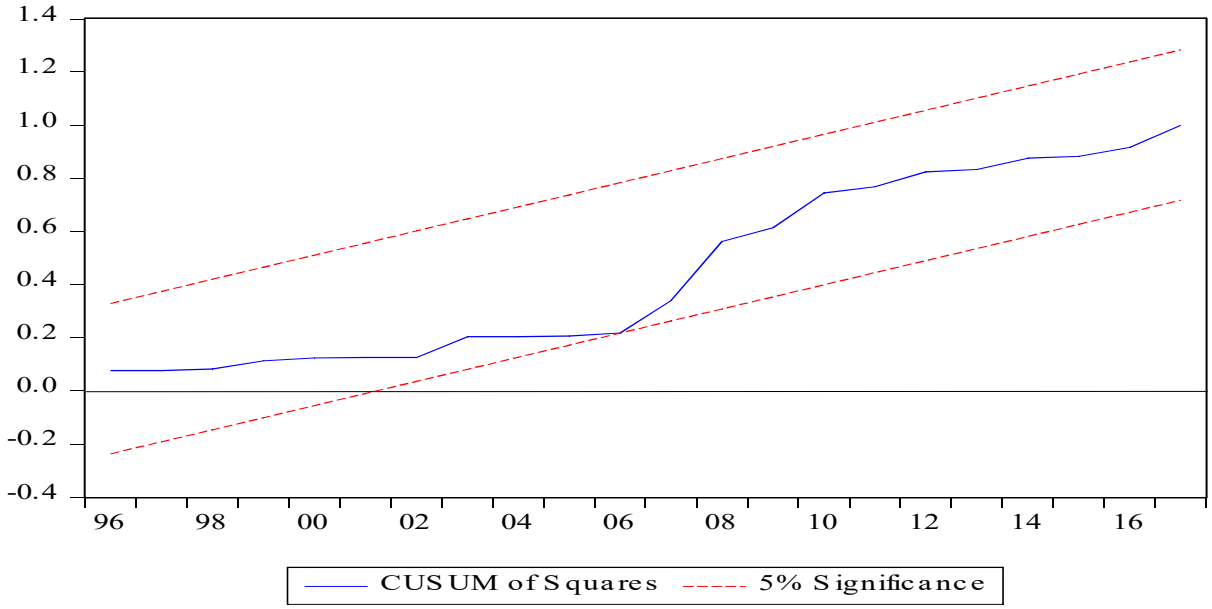
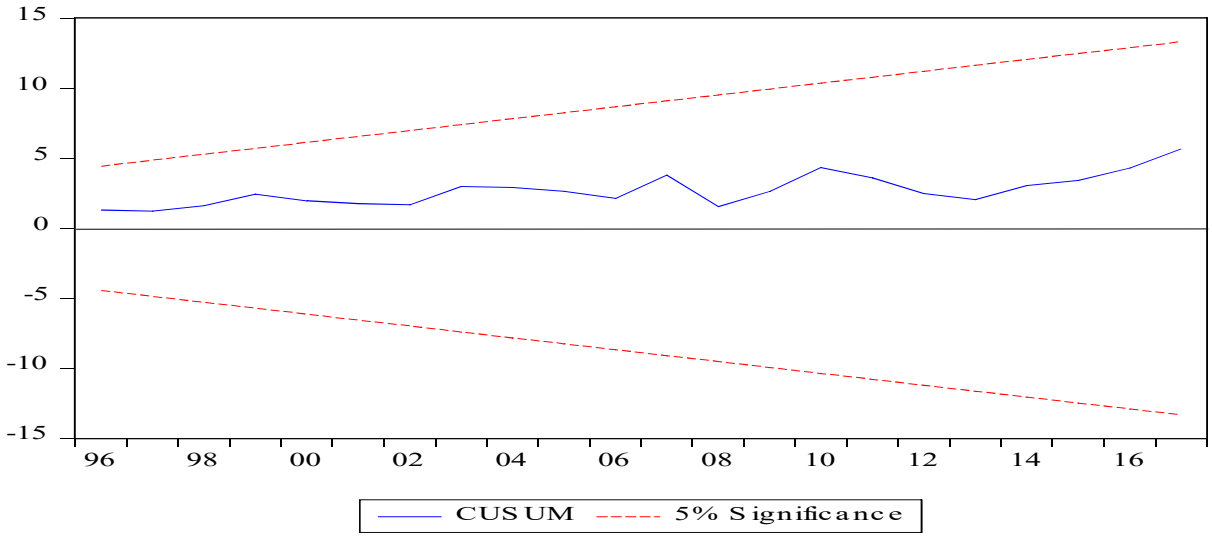



**Figure 1. CUSUM of Squares**




***Plot of CUSUM and CUSUMSQ***

**Figure 2. CUSUM**

**Table 10. Granger causality results**

| Particulars | India | | | China | | |
|---|---|---|---|---|---|---|
| | F-value | p-value | Conclusion (Cause) | F-value | p-value | Conclusion (Cause) |
| FDIs do not Granger Cause GDPPC | 0.27379 | 0.7633 | Uni-directional | 1.36129 | 0.2699 | Uni-directional |
| GDPPC does not Granger Cause FDIs | 14.3416 | 0.0001*** | | 2.98343 | 0.0575* | |
| FDIf does not Granger Cause GDPPC | 2.68653 | 0.0926* | Uni-directional | 2.98134 | 0.0521* | Uni-directional |
| GDPPC does not Granger Cause FDIf | 2.9810 | 0.0541** | | 0.07764 | 0.9255 | |
| GFCF does not Granger Cause GDPPC | 1.30429 | 0.2935 | Uni-directional | 2.14097 | 0.156 | Uni-directional |
| GDPPC does not Granger Cause GFCF | 6.42515 | 0.0070*** | | 11.445 | 0.0002*** | |
| TO does not Granger Cause GDPPC | 3.52035 | 0.0408** | Uni-directional | 7.43266 | 2.1069 | Uni-directional |
| GDPPC does not Granger Cause TO | 0.04055 | 0.9603 | | 4.40756 | 0.0199** | |
| FDIs do not Granger Cause GFCF | 2.85117 | 0.0466** | Uni-directional | 4.01637 | 0.0272** | Uni-directional |
| GFCF does not Granger Cause FDIs | 0.53885 | 0.5883 | | 0.17554 | 0.8398 | |
| FDIf does not Granger Cause GFCF | 2.9966 | 0.0597* | Uni-directional | 1.7839 | 0.2759* | Uni-directional |
| GFCF does not Granger Cause FDIf | 0.28003 | 0.7575 | | 3.1456 | 0.0558 | |
| TO does not Granger Cause GFCF | 1.20681 | 0.3116 | Uni-directional | 2.05012 | 0.1443 | Uni-directional |
| GFCF does not Granger Cause TO | 5.93253 | 0.0062** | | 3.22344 | 0.0418** | |
| FDIf does not Granger Cause FDIs | 2.3978 | 0.0948* | Uni-directional | 0.09583 | 0.9089 | Uni-directional |
| FDIs do not Granger Cause FDIf | 4.83113 | 0.0142*** | | 2.998 | 0.0561* | |
| TO does not Granger Cause FDIs | 2.58153 | 0.0904* | Uni-directional | 0.07984 | 0.9234 | Uni-directional |
| FDIs does not Granger Cause TO | 2.99768 | 0.058* | | 4.82728 | 0.0258** | |
| TO does not Granger Cause FDIf | 2.5006 | 0.097* | Uni-directional | 0.71858 | 0.4947 | Uni-directional |
| FDIf does not Granger Cause TO | 3.8088 | 0.0322** | | 3.10584 | 0.0509** | |

***Source: Author's calculation.***
******, ** and * Significant at one, five and ten per cent levels.***

economic growth. However, this study offered a detailed analysis of foreign investments in terms of flow and stock along with gross fixed capital formation that positively accounted for the economic growth of these sample economies, which is an extension of the previous works.

## CONCLUSIONS

The impact of GFCF, FDI (flow and stock) and TO on the economic growth of India and China was studied. ARDL model was utilised, and the empirical results revealed that after integrating with the world market,

India and China had significantly increased their economic growth. The impact of FDI (stock and flow) and GFCF remained positive in the short and long-run for the sample economies. However, trade openness negatively impacted India in both the short and long-run, while it remained negative for China in the long-run only. The most important determinant for China remained FDI flow in both the short and long-run, while for India, it was FDI stock in the long run and GFCF in the short run. Focusing on GFCF and absorbing more FDI through joint ventures could appallingly profit the economies in question.

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