Chinese Foreign Direct Investment and Economic Growth of Bangladesh: A VECM Analysis

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Abstract: *The main objective of this study was to find out the impact of Chinese FDI on the economic growth of Bangladesh where yearly time series data is used over a period from 1997 to 2020. To obtain those objectives, this study implies the Johansen Co-integration test and vector error correction model as statistical techniques. This study explores that there is a positive and significant long-run relationship among Chinese FDI, Total FDI, Openness of trade, and economic growth of Bangladesh but those variables have no impact on Bangladesh economic growth in the short run. These results also identify there is a long-term granger causality occurring from Chinese FDI, TFDI, and trade openness to the GDP of Bangladesh. Our estimating error correction results is -.72 which conclude that in the long run, the economy is restored around .72 percent of the previous year's disequilibrium within the model and normalized co-integrating coefficient forecast a one percent increase in CFDI and one percent increase in TFDI elicit 0.04% and 0.17% increase in GDP respectively. So that, for enhancing GDP and economic development of Bangladesh our government should influence to bring out the Chinese FDI in our country and make effective policy that can create a strong long-run relationship between two countries.*

Key words: Chinese FDI, Co-integration, error correction model, Bangladesh economic growth

**JEL Codes:**   C01, C22, C53, E22, E37, F21

1. Introduction

Bangladesh is one of the major fastest economic growth receiving country in the world, the rank of the GDP growth rate is 37th position in this year 2021 (Wikipedia 2021). The GDP growth rate is almost 8.2% in FY 2018-2019 which declined to 5.2% in FY 2019-2020 due to Covid-19 pandemic. However, in view of the post-Covid recovery the growth rate is significantly increasing over 6.8% in FY 2020-2021 (Global Economic Prospects 2020, Asian Development Bank 2020) and the policy maker believed that it will increase continually. In that circumstances it is found that foreign direct investment is the key factor of Bangladesh economic development. The FDI stock of the country almost 16.85 billion last year and the contribution of FDI in economic development of the country takes crucial fact. Though Bangladesh is a country of agrarian economy but it is now successively passing from an agrarian economy to an industrial economy and today is counted as a developing economic country and Bangladesh now proudly stands as an emerging trade and investment destination in the global economy. The entrepreneurs supported by the steady growth of export business,

hard-working manpower and pro-government investment policies are taking Bangladesh on the line of global business qualification. The country's fascinating location for peace and harmony, regional stability, collaboration, economic development by international and regional trade with its trading cooperation and also included the increasing flow of remittance from skilled manpower and Bangladeshis living around the world have helped the country's achieve to sustain an impressive economic situation.

Last three decades, economic policymaking has become a key feature for many countries especially in the developing world to attract foreign direct investment (FDI). FDI can be considered as a key factor of a developing nation as its multidimensional assets. As a result, Most of the studies show that there is a positive relationship between economic growth and foreign direct investment in the global economy. Islam, Fei & Kumar (2020); Shaari, Hong and Shukeri (2012); Kang (2010) show that in their research. As a developing country, like Bangladesh has now become one of the most attractive emerging markets in the world and FDI plays a significant role in economic growth and development of the country. Bangladesh government is trying to establish a conducive environment for investment by introducing economic policies, incentives for investors, promoting privatization and so on. Therefore, the contribution of FDI is very important in the increasing of country's economic growth as well as economic development. Bangladesh has been very successful in attracting FDI inflows (net) since the beginning of economic reform in 1995. In 1996, it became 231.61 million USD which rose significantly in 2008 to 1086 million USD (1.4% of GDP) which declined to 913.32 million USD (1.1% of GDP) in 2010. During the period 2017-18, FDI net inflow of Bangladesh is USD 2.6 billion (0.72 % of GDP) which gradually increase in FY 2018-2019 to USD 3.9 billion (1.29% of GDP) which declined to USD 2.4 billion in FY 2019-2020 (0.94% of GDP) (Sources: Statistics Department of BB). This flow of stocks have helped the country in progression of technology, skill up improvement, employment creation, better infrastructure and advanced management over the years. In below fig.1 show FDI volume of the country:

**Figure 1:** FDI inflow to Bangladesh since from 1996 to 2020
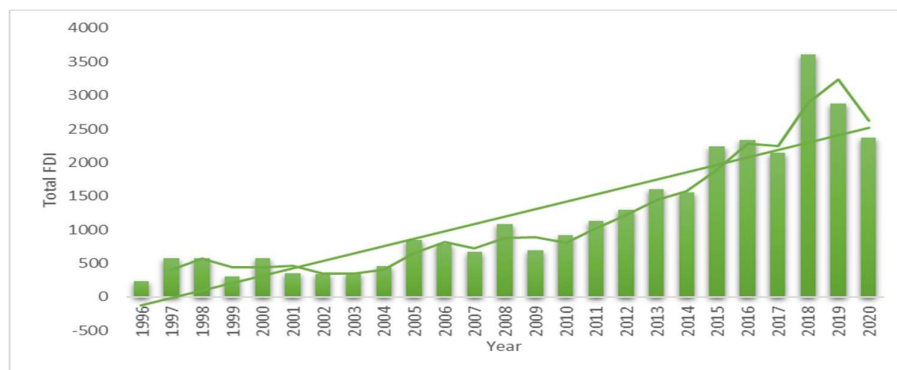
Source: Bangladesh central bank

According to the UNCTAD's World Investment Report 2020, in Bangladesh the main investors were China, South Korea, Egypt, the United Kingdom, India, the United Arab Emirates and Malaysia and so on. As in the previous year, China came out as the largest investor in the country with $1159.42 million FDI in FY 2018-2019 as compared to $506.13 million FDI

in FY 2017-2018, this figure also declined to $80.29 million in FY 2019-2020. China invests the various FDI sectors in Bangladesh like energy and power, textile and Wearing, food, Construction, Leather and Leather Products, Computer Software and IT, trading, Fertilizer, Agriculture and Fishing and a few others which are considered the major FDI recipient sectors in the country. In FY 2019-2020, China invested in those sectors which figures were energy and power ($40.76 million), textile and wearing ($10.76 million), food ($1.11 million), Construction ($3.37 billion), Leather and Leather Products ($2.81 million), Computer Software and IT ($0.20 million), trading ($4.09), Fertilizer ($0.12 million), Agriculture and Fishing ($0.04 million) and a few others ($15.90 million). Now a days, energy and power is the top recipient sector among all, which is progressively helping the economy to increase and the government is receiving more revenue from the FDI financed institutions located inside and outside of the economic zones.

Figure 2: Proportion of Chinese FDI
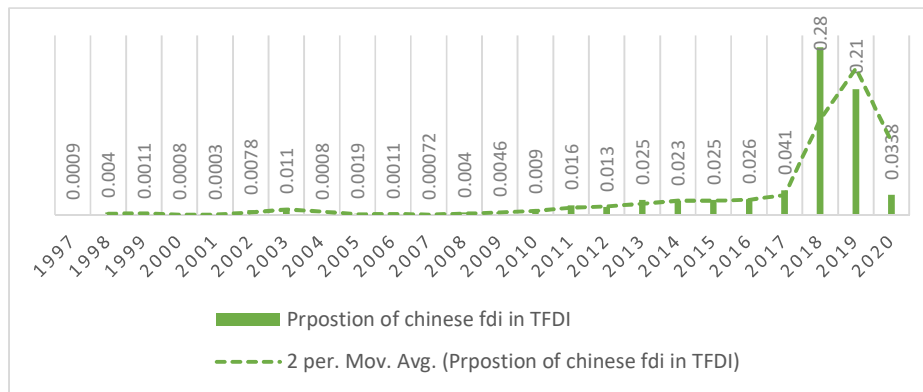
Source: Bangladesh central bank

In recent time, many Chinese companies and authority have created a number of major infrastructure projects in Bangladesh's energy and power, transportation, telecommunications and other fields to contribute positively in economic and social development of the two countries. (The Daily Star, 2020) Ambassador Jiming, in an interview with Global Times in late October in 2020, he said that "the economies of Bangladesh and China were highly complementary to each other and in terms of large scale investment, the undertaking of the Padma Bridge Rail Link project with Chinese funds, costing around USD 3.14 billion, was a mentionable success as since going into service on July 3, 2018 it has created more "than 5,000 direct jobs and tens of thousands of indirect jobs for local residents as well as bringing subcontracting business to more than 100 local companies."

Today China is the largest business and trade partner of Bangladesh and the annual bilateral trade place between two countries was almost over $12.13 billion in the previous year. Bangladesh imported goods from China with value over USD 11.53 billion (25.2 % of total) in FY 2019-2020 as compared to $13.64 billion (26.1% of total) in FY 2018-2019. Besides, China has decreased tariffs for Bangladeshi imported products from July 1, as a part of its Preferential Tariff Program and the result shows that some 97 percent of all Bangladeshi products come out from 60 percent. Now China will provide a lot benefits for the exports business with Bangladesh and duty-free export advantages is among of them. Bangladesh exported an additional 5,161 products to China for the duty-free benefits and the China receiving total

number of products to 8,256 in 2020 where including the items acceptable by the agreement of the Asia Pacific Trade Agreement (APTA). Bangladesh is now exporting a lot of products to China in every year and the major Bangladesh's export items are jute and jute products, plastic products, raw hide and skins, frozen fish and crabs, live eel fish, sesame seeds, cotton waste products and so on. Besides, Bangladeshi exporters are getting benefits to export most of their products to China duty-free since 2010. According to the third round of the APTA negotiation, many Bangladeshi products exported to China by using the duty benefits. Bangladesh also enjoy duty free advantage at several rates for 2,372 products exported to China under the fourth round of the APTA negotiation. However, in spite of the tariff advantage, the volume of exports to China are not increasing. According to the Export Promotion Bureau (EPB), the total volume of exports to China was US$791 million in FY 2014-15 which rose US$808 million in FY16. This figure increased significantly in FY17 to US$949 million compared to as US$695 million in FY18. Besides, Bangladesh exported products to China with worth over US$831 million in FY19 and this figure declined US$557 million in the July to May period of FY20. So, there is no doubt in future china will create more Business environment, investment sector and scope of Business in Bangladesh that will create a long term business relationship between two countries which can be performed prominent impact on Bangladesh economic development. Hence, a modest effort of Chinese foreign direct investment to Bangladesh's economic growth will bring positive results between the two countries and successfully benefiting in the long run. The remaining paper is designed as follows; section 1 is Introduction, section 2 explain the objectives of the study, section 3 discuss theoretical framework, section 4 reviews the literature, section 5 explains the model, data and methodological framework, section 6 presents the test results, section7 represent diagnostic test of the results and section 8 deals with conclusions.

2. Objectives of the Study

The main objective of this study is to ascertain the short and long run impact of Chinese FDI in economic development of Bangladesh
The specific objectives of this study are:

- To evaluate the status of Chinese FDI in Bangladesh
- To analyze the influence of Chinese FDI in Bangladesh economy
- To draw conclusion and give policy recommendation

3. Literature Review

In this section some related literatures will be reviewed about Chinese foreign direct investment and economic growth of Bangladesh and some relevant papers will be also analyzed namely FDI and economic growth, FDI and economic development, sector wise FDI in Bangladesh etc. The authors of reviewed literatures will be Islam, Fei and Kumar (2020), Rahman (2015), Asaduzzaman (2019), Islam, Mahfuz and Khanna (2013), Foysal and Zhen (2019), Razzaque, Rahman & Akib (2020), Hossain, Lopa and Rahman (2018), Hussain and Haque (2016), Ali and Mingque (2018), Quazi and Quddus (2014), Reza and Wang (2018) and so on.

Islam, Fei and Kumar (2020) analyzed the role of Chinese foreign direct investment (FDI) in accelerating the economic growth of Bangladesh during the period from 2004 to 2016 using Multiple Ordinary Least Squared regression model. They shows Bangladesh's economy has

positive impact of Chinese direct investment. Their limitation of work is unit root problem because CFDI data is time series data and it's not a stationary one that's why in the rule of econometrics direct OLS regression of non-stationary data shows vogues regression. Rahman (2015) used Multiple Regression for tracing the FDI impact on the Bangladesh's economic growth. His study has taken time series data over a period of 15 years, from 1999 to 2013. His findings in this research shows a Negative correlation between FDI and GDP. This paper also suffer previous mention unit root problem.

Asaduzzaman (2019) investigated the empirical relationship between economic growth (GDP) and Foreign Direct Investment (FDI) as well as the Real Effective Exchange Rate (REER) and Trade Openness (TOP) of Bangladesh over the period from 1973 to 2017 by using Johansen Co-integration test and VECM analysis. The empirical result exhibit that there are a Short-run and long-run relationship exists between economic growth and foreign direct Investment in Bangladesh. While the Error Correction Term (ECT) result exhibits that real Effective exchange rate and trade openness are causing economic growth in the long-run. This Study highly suggests that fully utilizing foreign direct investment and trade openness is one of the best chances of Bangladesh to develop its economy. Islam, Mahfuz and Khanna (2013) explore Motives of Chinese Companies investment in Bangladesh and their Outwards FDI by using survey data of a sample of 145 Chinese firms. In their paper they show Patterns of China's Recent Outward FDI in Bangladesh and Ease of Doing Business in Bangladesh. They also traced Sector-wise allocation of China's Outward FDI in Bangladesh like; Textile and Wearing , Banking , Gas & Petroleum, Agriculture and Fishing, Power, Telecommunication, Food, Cement, Computer Software and IT, Chemicals and Pharmaceuticals, NBFI, Trading and Other sector. Foysal and Zhen (2019) discussed about the Collaboration between Bangladesh and Chinese Companies across Various of Bangladesh. They used primary source questionnaires survey techniques for this study, which called the Mono Quantitative Method (MQM). They described about multi-National Companies and Regional Development and FDI and Sector by Sector Collaboration like: Collaboration Significance or Lack thereof between Bangladesh and Chinese. They tested the Statistical Significance of the Level of Readiness of Bangladesh to Collaborate with Chinese Companies in Various Sectors. Razzaque, Rahman & Akib (2020) shows the present status of Bangladesh-China Economic Engagements.. They investigated Current Trade and Economic Cooperation Arrangements and Asia-Pacific Trade Agreement (APTA), APTA concessions and China's DFQF market access for LDCs. They also show Bangladesh–China–India–Myanmar (BCIM) Forum for Regional Cooperation and Bangladesh's Export Potential and Market Prospects in China. They conclude Chinese products in Bangladesh with the revealed comparative advantage. Hossain, Lopa and Rahman (2018) founded out opportunities and challenges of Chinese investment in Bangladesh. They gathered Data from different secondary sources of 2013 to 2017. They find out Low labor rate, labor availability, low government debt, gross national savings etc. are the main cause behind Chinese FDI. Besides, political discomfort, low lead time hampers the flow of Chinese investments. Hussain and Haque (2016) implied that there is a relationship between foreign direct investments, trade, and Growth rate of per capita GDP for Bangladesh by yearly time series data for 1973 to 2014. The Vector Error Correction Model (VECM) shows that there is a long-term relationship exist between these variables. Ali and Mingque (2018) analyze the interrelation between foreign direct investment (FDI) and economic growth and the effect of FDI on economic growth of Sri Lanka, Pakistan, Philippine and Thailand using panel data for the period of 1990–2014. They applied Johansen Co-integration test and vector error correction

model and they proved that there is a Positive, significant and long run relationship among FDI and economic growth. Their results also identify there is a long-term granger causality occurring from FDI, gross capital formation, government consumption, trade openness and labor to gross domestic product. Quazi and Quddus (2014) Analyses recent trends in capital inflows as measured by Foreign Direct Investment (FDI) for selected economies in South Asia namely Bangladesh, India, Pakistan and Sri Lanka by using panel regression model. Furthermore, this Study finds that FDI inflows are negatively correlated with policies that diminish a country's economic freedom (as Measured by the Economic Freedom Index published by the Heritage Foundation. Reza, Fan, Reza and Wang (2018) analyzed that there is a causal relationship between (FDI) and (GDP) by applying yearly secondary data for the year of 1990-2015 of Bangladesh, to identify the relationship between FDI Inflows and Economic Growth in Bangladesh. They used co-integration and (VECM) for exploring of the relationship between FDI and Economic growth in Bangladesh and Find out positive relationship exist from FDI Inflows to GDP in the long-run and short-run. Most of the above studies were done to show the relationship between Total FDI and GDP of Bangladesh. Though Islam, Fei and Kumar (2020) analyzed the short run effect of Chinese foreign direct investment (FDI) in accelerating the economic growth of Bangladesh by OLS model   .So that as our investigation show that there is no study have been done before on the short run and long run effect of Chinese FDI inflow on development process in Bangladesh. That's why this study has been designed to fill up this gap. We claim that our collecting data length of period is short in that reason some results would be shown statically insignificant. We hope in future this limitation will be solved by the use of maximum time periodic data.

4. Theoretical Frame Work

Nowadays, in modern world foreign direct investment is the crucial part of successful economic development for the country especially in developing country like Bangladesh .Therefore in economic research there is many study have been done to show the relationship between FDI and economic development and many economist and business analyst also give number of FDI theories. Now we will discuss about some relevant FDI theories. As earlier by J. Dunning, S. Hymer or R.Vernon state that FDI has a significant impact on economic development; among them in Vernon's Life cycle theory, Vernon (1966) Said that a product would be generally goes through four stage 1.Innovation stage 2. Mature Stage 3.Standradization stage 4.Decline stage. Vernon managed to explain this theory for several US investment in Europe during post world war 2.

The internalization theory developed by Buckley and Casson (1976) is one of the major FDI theory. Internationalization theory try to explain why investors are prefer FDI over international business license and others tactics for entering international market.

Some neoclassical economist also discuss about investment influence on economic growth among them Lord Keynes is one of the pioneer economist moreover Harrod-Domer and Solow expand their development theory with the help of Keynesian investment multiplier theory. In Keynes investment theory he argued that, if we increase one unit of investment expenditure then it raises the total Gross Domestic Product (GDP) by more than the amount of the increase. By the help of Keynes theory harrod-domer try to explained that economic growth can be increased by level of savings and capital investment i.e. more savings create bigger investment and large number of investments create strong capital formation that higher capital stock can

make higher level of economic growth. According to him there is several types of economic growth such as- warranted growth, actual growth and natural rate of growth. Warranted growth is the growth that explain economic growth can't be expand infinitely it has a limitation. Actual growth rate is the augment of country's GDP every year and natural growth is kind of growth that maintain full-employment of the country due to stable gap rate natural growth always hold full employment position.

On the other hand Solow explained another growth model, according to him long-run economic growth can be formed by capital accumulation, labor or population growth, and increases in productivity, commonly referred to as technological progress.

Capital arbitrage theory, this theory explain that movement of direct investment occur where country's profitability is high and capital abundant country should export their goods and less capital country should import goods from them.

The electric theory of FDI, The theory tries to discuss a general outlook for finding the extent and shape of both foreign-investment production performed by a country's own enterprises, and that of domestic production owned or managed by foreign firm. Dunning and Lundan(2008).

Lastly all the empirical research and theories failed to unify a significant and clear-cut FDI theories which can be explained only FDI clearly, at this situation our hope is that in future economist and analyst will give clear conceptual FDI theories that will help us to explain FDI more evidently.

5. Data and Methodological Instruction

The purpose of the study is to identify short run and long run relationship between Chinese FDI Inflows and Economic development in Bangladesh, Since Chinese investment in Bangladesh started from 1997, we take time series secondary data in period of 1997 to 2020. All data is gathered from World Bank Development Indicators and Bangladesh bank half yearly data publication catalog. In this paper, following procedures will be maintained. At first we will discuss descriptive statistics of all variables and trend of Chinese FDI in Bangladesh then we will perform unit root test for stationary and non-stationary checking by using Augmented Dickey-Fuller (ADF) test and Phillips–Perron (PP) test. Then we will select perfect lag selection criteria by optimum lag selection criterion of optimum lags. In third phase after selecting optimum lags we need to use johansen (1988) co-integration test to identify the co-integration between dependent and independent variable. In fourth step if we will get co-integration equation which is suggest by johansen test then we have to use Vector error correction model i.e. VECM is for showing short run and long run Relationship among variables. Finally we will perform some robustness test and diagnostics test of the model for looking the strength of the model and verify the results. Though we have small sample restriction, non-stationary regression can be spurious or vogues interpretation, for that reason we will use Johansen-Juselius(1990) co-integration and Vector error correction (sims 1980) model to calculate non-stationary time series regression . Therefore the model and above method will be discussed in details in the section of empirical methodology to this paper.

5.1 The Econometric Model and Empirical Methodology

Our intention is to identify the impact of Chinese FDI on Bangladesh economic development. Our econometric model is set for whether our independent variable cause dependent variable for this reason we follow Islam, Fei, Kumar (2020) and Tabassum & Ahmed (2014) papers to take some crucial supply factor as well as demand factor variable to create our model.

$$GDP_t = \beta_0 + \beta_1 CFDI_t + \beta_2 TFDI_t + \beta_3 OPENESS_t + \varepsilon_t \tag{1}$$

Where,

GDP= National Gross domestic product / national income

CFDI= Volume of Chinese foreign direct investment

TFDI= Total foreign direct investment of the country

Openness= export+import

ε = error term

The main objective of the study is to find out the links between Chinese foreign direct investment and its impact on Bangladesh economy. To find out the short-run and long-run relationship in the models, unit root test (non-stationary), co-integration test and vector error correction method will be used.

We know that a stationary data is an unchanged data over the period of time but non stationary data is changeable   and its can be move upward and downward over the time period of time. As our concern most of the time series economic variables have a non-stationary trend. In case of variables are non-stationary then R-square and the t value and low durbin Watson value can make false regression result, in this situation regression can be spurious and the result will show error forecasting. So that if we find that time series variables has a unit root problem then we have to take variables as 1st difference order , maximum time after transferring into first difference order it change into stationary . The Augmented Dickey-Fuller (ADF) [1984] unit root test is for examine the stationary of the data set. The ADF test is based on following regression:

$$\Delta y_t = \alpha + \beta_{y_{t-1}} + \delta t + \sum_{j=1}^{p} \gamma_j \, \Delta y_{t-j} + \varepsilon_t \tag{2}$$

In this equation α is constant, t is a linear time period trend, β, δ and γj are slope coefficients, εt is the disturbance/stochastic term. The null hypothesis of non-stationary series would be written as: H0: $\beta = 0$(variable is non stationary). Besides, the alternative hypothesis for stationary series would be expressed as: H1: $\beta < 0$ (variable is stationary). After that test statistics can be calculated and it can be compared to the critical value of Dickey-Fuller Test (MacKinnon, 1991).

If the test statistics result is less than the critical value or p value is less than the .05,.01 significant level , then the null hypothesis will be rejected and no unit root is present (stationary). Besides, if the test statistic exceed the critical value or P value is greater than .05, .01 significant level, that unit root is present the series is non stationary. If we convert our stationary variable into non stationary by taking 1st differenced of the variable then it can be

denoted like [i.e., I (1)]. Incase our non-stationary variable couldn't change into stationary by 1ˢᵗ differencing then if we take as second difference then its sign will be looked like [i.e., I (2)] and so on. For our concern Johansen co-integration is used for showing long run relationship between variables, other side Engle and Granger (1987) said that, if only variables take place with same order then it could tested for Co-integration test. Therefore, here we examined both variables for co-integration. The use of johansen co-integration test is used to check the long-run impact of the variables. This test will follow maximum likelihood estimation and K-dimensional Vector Auto regression (VAR) of order p:.

$$y_t = A_1 y_{t-1} + - - - - + A_p y_{t-p} + Bx_t + \varepsilon_t \tag{3}$$

Here yt is a k-vector of non-stationary variables, xt is a d-vector of deterministic variables (like a constant, or a constant and time trend or linear trend etc.) and εt is a vector of stochastic term.

Then we will use Trace eigenvalue statistic and Maximum (L-max) eigenvalue statistic to test the co-integration equation. Trace test find out null-hypothesis that r is less co-integrating vectors on the contrary the alternative hypothesis that more than r vectors. This calculated test can be state as equation.

$$Tr = -t \sum_{i=r+1} ln (1 - \hat{\lambda}_{r+1}) \tag{4}$$

Here, T is the practical observations, and λ1, s are the calculated eigenvalue of the matrix. The maximum eigenvalue test indicate that null hypothesis is exactly r co-integrating vector on the other hand the alternative hypothesis is r+1. The maximum eigenvalue test is the (r+1) eigenvalue and that is present here.

$$L - max = -t \sum_{i=r+1} ln (1 - \lambda_{r+1}) \tag{5}$$

If the trace eigenvalue test and maximum eigenvalue test shows different results, then we need to choose maximum eigenvalue test because the power of maximum eigenvalue is higher than the power of the trace eigenvalue test (Johansen and Juselius 1990). The order of var and the error correction model was selected by minimum Akaike's information criterion. Granger (1988) state that if the variables are integrated at I (1) and it's become co-integrated, there should be at last one way casualty exist. After this producers in case the variables are co-integrated, then VECM model may follow this type of form.

$$\Delta GDP_t = \alpha + \sum_{i=1}^{p} b_i \Delta GDP_{t-i} + \sum_{i=1}^{q} CFDI_j \Delta CFDI_{t-j} + \sum_{i=1}^{q1} TFDI_j \Delta TFDI_{t-j} + \sum_{i=1}^{q2} Open_j \Delta open_{t-j} + dECT_{t-1} + v_t \tag{6}$$

$$\Delta CFDI_t = \alpha + \sum_{i=1}^{r} \beta_i \Delta CFDI_{t-i} + \sum_{i=1}^{s} GDP_j \Delta GDP_{t-j} + \sum_{i=1}^{s1} TFDI_j \Delta TFDI_{t-j} + \sum_{i=1}^{s2} OPEN_j \Delta open_{t-j} + \delta ECT_{t-1} + u_t \tag{7}$$

$$\Delta TFDI_t = \alpha + \sum_{i=1}^{m} \theta_i \Delta TFDI_{t-i} + \sum_{i=1}^{n} GDP_j \Delta GDP_{t-j} + \sum_{i=1}^{n1} CFDI_j \Delta CFDI_{t-j} + \sum_{i=1}^{n2} open \Delta open_{t-j} + \gamma ECT_{t-1} + u1_t \tag{8}$$

$$\Delta Open_t = \alpha + \sum_{i=1}^{k} \mu_i \Delta open_{t-i} + \sum_{i=1}^{l} GDP_j \Delta GDP_{t-j} + \sum_{i=1}^{l1} CFDI_j \Delta CFDI_{t-j} + \sum_{i=1}^{l2} TFDI_j \Delta TFDI_{t-j} + \rho ECT_{t-1} + v1_t \tag{9}$$

Above equation ECM is the error correction indicators term and the ECMT-1 is the estimated error term of one period lagged value of the co-integrating regression which is obtain by the OLS model application. The main focus of this model is to represent a long-run equilibrium relationship between two economic aspect that we predict to show relationship between them and we assume that in short run it can be showed disequilibrium status. So that the error correction Techniques can solve that problem by showing next period equilibrium status and

the time of adjustment towards to the equilibrium. Hence, error correction mechanism is the process of reconciling short-run and long-run pattern. In this Error correction model $\beta i/bi/\theta i$ /μi & γj /xj/$x1j$/$x2j$ are the short-run dynamic coefficients and $\delta/d/\gamma/\rho$ are the long-run coefficient, $ut, vt, u1, v1t,$ are white-noise residuals and the absolute values $\delta/d/\gamma/\rho$ indicate how quickly the equilibrium is restored and bounce back to the equilibrium position. On the other hand if our variables are not co integrating with each other then we have to implement vector auto regression (VAR) by using first differences order of the variable.

5.2 VECM Model Identification

In this study we used Cholesky approach because it is a unique case of exactly identified of VAR model. The reduced form of recursive VAR covariance matrix can be expressed as follows:

$$
\begin{bmatrix} vt^{gdp} \\ vt^{cfdi} \\ vt^{tfdi} \\ vt^{open} \end{bmatrix} = \begin{vmatrix} 1 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 \\ a_{31} & a32 & 1 & 0 \\ a_{41} & a42 & a_{43} & 1 \end{vmatrix} \begin{bmatrix} u_t^{cfdi} \\ u_t^{tfdi} \\ u_t^{openess} \end{bmatrix} \tag{10}
$$

In equation (8) we assume that first two variables such as GDP growth and TFDI are exogenous to all other variables. If there is co-integration among the variables, then specify the VECM with (p-1) lags. So the equation (7) can be written as;

$$
ECT_{t-1} = gdp_{t-1} + CFDI_{t-1} + TFDI_{t-1} + OPENESS_{t-1} \tag{11}
$$

6. Results & Analysis

Our first test result and analysis is descriptive statistics and trend analysis; below we will discuss following table results.

Table (1a) Descriptive Statistics

	GDP	OPEN	TFDI	CFDI
Mean	131158.5	48630.38	1237.533	87.03417
Median	97054.50	40070.50	879.2900	4.255000
Maximum	353000.0	111224.0	3613.350	1029.900
Minimum	48244.00	12710.00	309.1200	0.110000
Std. Dev.	90199.05	32992.68	912.0039	237.3794
Skewness	1.047328	0.464280	1.031112	3.271227
Kurtosis	2.950666	1.771070	3.126020	12.50850
Jarque-Bera	4.390019	2.372493	4.268648	133.2153
Probability	0.111358	0.305365	0.118325	0.000000
Sum	3147803.	1167129.	29700.79	2088.820
Sum Sq. Dev.	1.87E+11	2.50E+10	19130277	1296026.
Observations	24	24	24	24

In table 1a we look forward to explaining skewness, kurtosis and Jarque-Bera test , since GDP: skewness is 1.04 and kurtosis is 2.95<3 then it is normally skewed and platykurtic similarly kurtosis value for TFDI is 3.12>3 and skewness is 1.03 which is positive skewnes and leptokurtic , (OPEN) kurtosis value is 1.78<3 and skewness is .46 which is different and it is normally skewed and platykurtic (CFDI) kurtosis value is 13.08>3 and skewness is 3.35 which is positively skewed and leptokurtic. Next the probability value of Jarque-Bera test accept null hypothesis at .05 significant level except CFDI so that all the variables is normally distributed except Chinese FDI.

Table (1b) Trend analysis
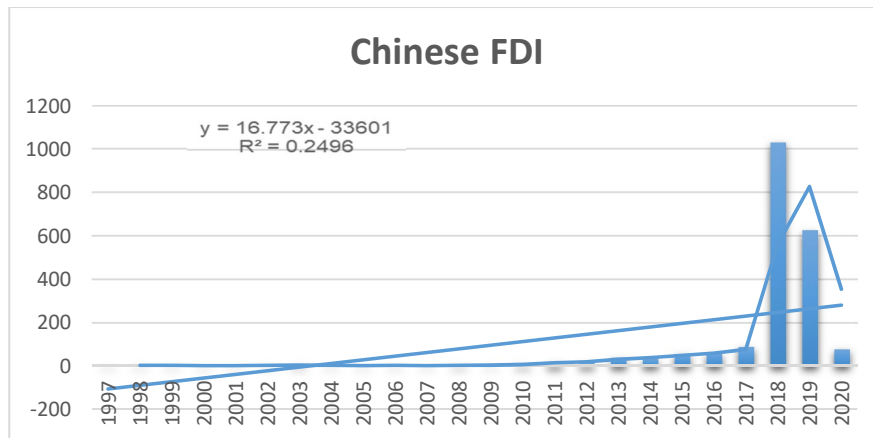
In graph (1b) Chinese FDI bar diagram and linear trend shows that the trend of Chinese FDI in Bangladesh is upward trending. Initially its pace was Slow and steady but in time period 2017 its start to rising and in 2018 it goes to the highest point but in next period 2019 due to covid-19 pandemic and economics crisis in the world Chinese FDI has fallen enormously. Since the trend line is moving upward trend but our estimated line R^2 is very low, the reason behind that the movement of the Chinese FDI during the periods of time is very sluggish and mild. There is another reason we find, in world economy Chinese economics has flourishing recently in that context past decade their foreign investment was comparable to small and slow but recently the economy of china is booming rapidly and their economy is dominating all over the world. So that Looking into this graph we can forecast that after covid exemption in future Chinese investment will rise again and its will hold its upward trend behavior .

Table 2: ADF test & Phillip's perron test Result Variables

Variables	Level			First Difference	
	Constant & Trend		Result	Constant & Trend	Result
GDP	-3.94		I(1)	-3.97	I(0)
Chinese FDI	-4.23		I(1)	-14.15	I(0)
FDI	-3.97		I(1)	-7.25	I(0)
OPENESS	-2.22		I(1)	-4.29	I(0)
variables	Level			First Difference	
	Constant & Trend		Result	Constant & Trend	Result
GDP	-2.14		I(1)	-3.83	I(0)
Chinese FDI	-4.23		I(1)	-5.13	I(0)
FDI	-4.36		I(1)	-6.62	I(0)
OPENESS	-1.32		I(1)	-4.131	I(0)

The result of the unit root test represent in Table 1. Here P-P test is similar to ADF test so that in this test we predict that null hypothesis is that where the variable has a unit root problem. Lag length of our estimation is selected automatically by Schwarz information criterion and maximum lag was 5. Newey-West bandwidth and Barlett-kernal estimation method is automatically selected for P-P test by E-views 10.In table 1. we see that our all variable are non-stationary i,e has unit root problem at the level with 1% significant level, but when we take first differences of the variable it becomes stationary at 5% significant level that means all our variable are stationary at first order's and all of the variables are integrated at same order I(1), hence we can produce Johansen-Juselius procedure to sum up co-integrating relations. Before performing co-integration test, we have to know the maximum lag length. Among the above-mentioned information criterions we have selected Akaike Information Criterion (AIC)

Table 3: VAR Lag Order Selection

Lag	logl	LR	FPE	AIC	SC	HQ
0	30.69289	NA	1.04e-06	-2.426626	-2.228255	-2.379896
1	118.0666	135.0320*	1.63e-09*	-8.915142	-7.923285*	-8.681490*
2	134.7896	19.76363	1.81e-09	-8.980876*	-7.195534	-8.560303

Now we use AIC criterion and indicating lag order for calculating Johansen co-integration and VECM analysis. The selection of optimal lag order is so sensitive issue but the rule of thumb is minimum 2 lag is appropriate otherwise huge lag can affect the test result.

Table 4: Johanson Co-integration Result

Trend assumption: Linear deterministic trend (restricted)				
Lags interval (in first differences): 1 to 2				
Unrestricted Co-integration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.944321	111.9220	63.87610	0.0000
At most 1 *	0.796944	51.27092	42.91525	0.0060
At most 2	0.427776	17.79122	25.87211	0.3581
At most 3	0.250970	6.068497	12.51798	0.4516
Trace test indicates 2 cointe grating eqn(s) at the 0.05 level				
* denotes rejection of the hy pothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Co-integration R ank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.944321	60.65110	32.11832	0.0000
At most 1 *	0.796944	33.47970	25.82321	0.0040
At most 2	0.427776	11.72272	19.38704	0.4414
At most 3	0.250970	6.068497	12.51798	0.4516
Max-eigenvalue test indicates 2 co-integrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

The Johansen co-integration of unrestricted Co-integration Rank Test (Trace) implies that there is a 2 co-integration equation between the variables i,e the trace statistics exceed 2 critical value and they are significant at level 1%. Again the unrestricted Co-integration Rank Test (Maximum Eigenvalue) are also produce 2 co-integration equation exists among the variables. Both results shows co-integrating equations at the 0.01 level of significance value. In Johansen (1988) co-integration rank tests (Trace and Maximum Eigenvalue) verify the long-run equilibrium co-integration among the variables in Table 3 and it indicates that we can use vector error correction model since the test result produce 2 integrating equation. The investigation discloses that in the arrangement, there is a long-run relationship occur consecutively from GDP to CFDI, TDFI and OPENESS.

Table 5: Normalized coefficient Interpretation

Normalized co-integrating coefficients (standard error in parentheses)				
GDP	CFDI	TFDI	OPENESS	@TREND(98)
1.000000	-0.037885	-0.174379	0.121549	-0.035310
	(0.00335)	(0.01367)	(0.02026)	(0.00094)

In normalized co-integrating result the coefficient sign implies reversed result i,e the negative result shows positive long run effect and positive one will show negative impact. Hence our CFDI and TFDI avails that negative sign and Open show positive sign we can say that Increase in CFDI will cause the long run increase in GDP so that in TFDI moreover increase in OPEN economy will lead the GDP decrease.

Long run equation Result = GDP(1) - .037 (CFDI) -.174 (TFDI) + .12(open) - .03 (trend) - 4.58 ©

Table 6: Error Correction Model result

	D(GDP)	**D(CFDI)**	**D(TFDI)**	**D(OPENESS)**
CointEq1	**-0.725**	**-40.19**	**-6.44**	**-2.38**
Standard Error	**(0.119)**	**(12.49)**	**(3.22)**	**(1.166)**
t statistics	**[-6.00]**	**[-3.206]**	**[-1.92]**	**[-1.39]**

The above results of the estimating VECM in Table 5 shows that ECT is negative (-.72) and the probability is 0.0001 % which is significant at 1% level. The VECM result indicate that speed of adjustment within which the model will restore to its equilibrium position following any disturbance .The coefficient of ECT with CFDI, TFDI and Open as dependent variable are negative and its implies there is a convergence from short dynamics towards long run equilibrium in case of disequilibrium situation . Especially we focus on GDP ECT and its coefficient of the Error Correction Term (ECT) is -.72,which indicate that the previous inflexion from long-run equilibrium is fixed in the current period which adjustment speed is almost .72 percent, i.e., the speed of adjustment from disequilibrium to equilibrium is extremely fast. In other words, it can be said that in the long-run, the economy is corrected around .72 of the previous year's disequilibrium within the model.

Table 7: VECM short-run representations

Dependent Variable: GDP					
Method: Least Squares (Gauss-Newton / Marquardt steps)					
	Coefficient	Std. Error		t-Statistic	Prob.
C(1)	-0.725662	0.119182		-6.088676	0.0001
C(2)	0.246147	0.142649		1.725538	0.1124
C(3)	0.082240	0.104038		0.790482	0.4460
C(4)	-0.012298	0.003577		-3.437949	0.0055
C(5)	-0.001588	0.002021		-0.785778	0.4486
C(6)	-0.113851	0.024199		-4.704851	0.0006
C(7)	-0.063756	0.016964		-3.758340	0.0032
C(8)	-0.173577	0.037640		-4.611507	0.0008
C(9)	-0.025947	0.065003		-0.399169	0.6974
C(10)	0.044401	0.006265		7.087477	0.0000
R-squared	0.967786	Durbin watson			2.08
Adjusted R-squared	0.941430	S.D. dependent var			0.018565
S.E. of regression	0.004493	Akaike info criterion			-7.666831

Since (c1) is negative and significant which shows long run causality between CFDI, TFDI and Open economy. Our result state that negative as positive effect in the long run i,e the ability of bounce back to equilibrium situation is approximately .72% and C(2) and C(3) are the first and second difference variables of GDP which show .24 and .08 positive effect on GDP which is not significant. Moreover Short run coefficient C4 (CFDI first order difference) = -.01 and the probability is significant, C5 (CFDI second order difference) = -.001 is insignificant which implies negative sign. So we can state that CFDI (-1) and CFDI (-2) a percentage increase in CFDI will lead to decline in GDP about .01 percent in 1st period and .001 in -2nd period. Again C6 (TFDI first order difference) =-.11, C7 (TFDI second order difference) = -.06 which also show negative sign where c (6), c (7) probability value is significant. So we can state that TFDI (-1) and TFDI (-2) a percentage increase in TFDI will lead to decline in GDP about .11 percent in 1st period and .06 in -2nd period. Finally, C8 (Open first order difference) = -.17 is also obtain significant probability value but C9 (Openness second order difference) = -02 has insignificant probability value which indicate negative sign. So we can conclude that open (-1) and open (-2) a percentage increase in CFDI will lead to decline in GDP about .17 percent in 1st period and .02 in -2nd period. Therefore, our congregate equation and ECT result ensure that though there is disequilibrium in short run but all the variable will bounce back to equilibrium in next period with GDP at .72 percent rate.

Table 8: VEC Granger Causality/Block Exogeneity Wald Test

Dependent variable: GDP			
Excluded	Chi-sq.	df	Prob.
CFDI	12.83032	2	0.0016
TFDI	22.94188	2	0.0000
OPEN	26.35965	2	0.0000
All	200.9869	6	0.0000

In this result we just consider GDP as dependent variable there is other endogenous variable we choose but here we just interpret Granger cause of other 3 variable to GDP. Above outcome we see that all the explanatory variable are significant that leads that CFDI,TFDI and open has a granger causality to GDP i.e. CFDI,TFDI and open can be caused of changing GDP and the relationship is significant.

7. Diagnostic Test of the Model

The VECM test outcome show that R^2 is (0.96) and adjusted R^2 is (0.94) of the OLS model throughout. While R^2 revealed greater than 60% then it is considering the model is in best to fit. The F-statistic result is (36.15) and the model is as well as positive and extensive enough where the probability value (0.0001) which is significant at 1% level ,indicating that all the exogenous variables have together influence the endogenous variable GDP. The Durbin-Watson statistic is (2.08) which is lies in the range of 1.5-2.5 implies that, the model is not suffering any autocorrelation problem and the series is stationary. For that reason, now we also carries outs the serial correlation test, the normality Jarque-Bera test of the residuals and the fixity test of the coefficient.

Table 9: Residual diagnostic test resul

Residual diagnostic tests. Test	Hypothesis	Test value	Prob.*	Decision
LM	No serial correlation	LM stat- 11.95	0.82	No serial correlation
White (no cross)	No heteroscedasticity	Chi Sq. – 168.94	0.31	No heteroscedasticity
Jarque-Bera	Residuals are normally distributed	JB 3.59	0.89	Residuals-are normally distributed

Therefore, table 9 shows there is no serial correlation between the variables, and white (no cross) heterocedasticity shows No heteroscedasticity occurs in the series variable. Finally jarque bera test state that all the variable is normally distributed. So we can say that the result is fit and diagnostically it's fine and sound investigation.

All the test is performed by software EVIEWS 10, STATA 16 and SPSS (26)

8. Conclusion and Policy Recommendation

The aim of this research was to find out the causal and short run and long run relationship between Chinese FDI and economic development of the country. We find that there is exist short run, long run relationship between dependent and independent variable and our time series data taken between1997 to 2020. Our empirical methodology VECM show that there is a long run impact on Economic development by CFDI, TFDI and OPEN trade but there is no causal and short relationship occur between these variables in short run. Though. Islam, Fei and Kumar (2020) find out positive relationship between CFDI and economic growth by OLS regression in the meantime our estimate show short run negative impact on GDP and positive long run impact on GDP by CFDI and others independent variables. Moreover we also perform some diagnostic test of the variable and we found sound result that all of our variable are structurally stable and normally distributed. Since our VECM model shows that there is a long-term relationship between Chinese FDI and GDP growth of the Bangladesh, we suggest that Bangladesh government could enhance foreign direct investment-friendly policies, movement of knowledge and trade beneficial policy and maximum utilizing of FDI and CFDI that can be the best instrument of Bangladesh to develop its economy. Increasing facility of transportation, electricity and land area can also help to attract Chinese investment and we know that the sake of geopolitical issue China is very important for our economic development that's why we have to look forward to creating our policy and positive diplomatic approach that we can build strong relationship with china. The limitation of this study is limited samples size. We hope in further study, they will find large number of time series variables. So if we emphasize on this issue and cooperate with china then Chinese investment through our country can enhance country's economic development.

References

Asaduzzaman, M. (2019). FDI as an Opportunity for Economic growth of Bangladesh: A
VECM analysis. *https://www.researchgate.net/publication/338207926*. Retrieved
from https://www.researchgate.net/publication/338207926

Bangladesh, G. r. (2021, April). *Economy of Bangladesh*. Retrieved from
https://en.wikipedia.org: https://en.wikipedia.org/Economy_of_Bangladeshwiki/

Database, World . Economic ourlook(2021, April 6). *International Monetary Fund.
Retrieved 6 April 2021.* Retrieved from https://www.imf.org.

Dornbusch, R., S. Fischer and C. Kearney (1996) Macroeconomics. Sydney: The Mc-Graw-
Hill
      Companies, Inc.

External,Debt & FDI. (2021, april). *Publication of Bangladesh Bank,Half yearly*. Retrieved
from https://bb.org.bd: https://bb.org.bd/pub/publictn.php

Enders, W. (2004) *Applied Econometric Time Series*, 2nd ed., John Wiley & Sons, Inc.

Engle, R. F. and Granger, C. W. J. (1987) 'Co-integration and Error Correction:
Representation,
      Estimation, and Testing'. *Econometrica,* 55, 251 – 276.

Johansen, S. (1988) 'Statistical Analysis of Cointegrating Vectors'. *Journal of Economic
Dynamics
      and Control*, 12, 231-54.

Johansen, S. (1991) 'Estimation and Hypothesis Testing of Cointegration Vectors in
Gaussian Vector
      Autoregressive Models'. *Econometrica*, 59(6) 1551–1580.

Johansen, S. and Juselius, K. (1990) 'Maximum Likelihood Estimation and Inferences on
      Cointegration – With applications to the demand for money'. *Oxford Bulletin of
Economics
      and Statistics*, 52, 169 – 210.

Keynes, John Maynard (1936) *The General Theory of Employment, Interest and Money.*
London:
      Macmillan (reprinted 2007).

Md Saraful Islam, Xiao Yuan Fei, Raj Kumar. (2020). The Role of Chinese Foreign Direct Investment (FDI) in accelerating the Economic Growth of Bangladesh. *IOSR Journal of Business and Management (IOSR-JBM)*, PP 17-25. doi:DOI: 10.9790/487X-2201051725

Mehedi Mohammad Foysal,Tang Zhen. (n.d.). An assessment of bangladesh collaboration with chinese companies across various sectors. *International Journal of Economics, Commerce and Management ISSN 2348 0386 Vol. VII, Issue 5, May 2019*. Retrieved from http://ijecm.co.uk/

Mir Sohrab Hossain, Nusrat Zahan Lopa and Md. Saidur Rahman. (2018). Chinese Investment in Bangladeshi RMG Sector:Challenges and Opportunities. *African Journal of Business Management*, Vol. 12(16), pp. 518-526, 28 August, 2018. doi:DOI: 10.5897/AJBM2018.8605

Mohammad Abdur Razzaque, Jillur Rahman , Hamim Akib. (n.d.). Bangladesh-China Trade and Economic Cooperation: Issues and Perspectives. *https://www.researchgate.net/publication/346483597*. Retrieved from https://www.researchgate.net/publication/346483597

Mohammad Rafiqul Islam, Mohammad Abdullah Mahfuz, Liza khanam. (2013). Motives for Investing Chinese Companies in Bangladesh and their Outwards FDI. *International Journal of Scientific and Research Publications, Volume 3, Issue 12, December 2013*. Retrieved from www.ijsrp.org

Mohammed Ershad Hussain , and Mahfuzul Haque. (2016). Foreign Direct Investment, Trade, and Economic Growth: An Empirical Analysis of Bangladesh. *www.mdpi.com/journal/economies*. doi:Economies 2016, 4, 7; doi:10.3390/economies4020007

Nafeesa Tabassum & Samiul Parvez Ahmed. (2014). Foreign Direct Investment and Economic Growth: Evidence from. *International Journal of Economics and Finance; Vol. 6, No. 9; 2014*. doi:doi.org/10.5539/ijef.v6n9p117

Najaf Ali, Ye Mingque. (2018). An Application of Vector Error Correction Model Approach in Explaining the Impact of Foreign Direct Investment on Economic Growth of Asian Developing Countries. *International Journal of Economics and Financial*. Retrieved from www.econjournals.com

Rahim Quazi,Munir Quddus. (2014). Foreign Direct Investment and Investment Climate:Comparing Bangladesh with Selected Countries in South Asia. *https://www.researchgate.net/publication/265004311*. Retrieved from at: https://www.researchgate.net/publication/265004311

Rahman, A. (2015). Impact of Foreign Direct Investment on Economic Growth: Empirical. *International Journal of Economics and Finance; Vol. 7, No. 2; 2015*. Retrieved from URL: http://dx.doi.org/10.5539/ijef.v7n2p178

Star, The daily. (2020). *www.thedailystart.net*. Retrieved from www.thedailystart.net

Sultanuzzaman Md Reza,Tunviruzzaman Reza,Banban Wang,Hongzhong Fan. (n.d.). The
impact of foreign direct investment inflows on economic growth: evidence from
Bangladesh. *Journal of Business and Retail Management Research (JBRMR), Vol. 12
Issue 2*, 2018. Retrieved from https://www.researchgate.net/publication/322751236

US$), GDP. (. (2021, April). *World Bank national accounts data, and OECD National
Accounts data files* Retrieved from https://data.worldbank.org:
https://data.worldbank.org/indicator/NY.GDP.MKTP.CD

UKEssays. (November 2018). Theories of Foreign Direct Investment (FDI). Retrieved from
https://www.ukessays.com/essays/economics/various-theories-concerning-foreign-
direct-
investment-economics-essay.php?vref=1
Vernon R. (1966), "International investment and international trade in the product cycle".
Quarterly
Journal of Economics 80, pp. 190-207.

Declarations,

Abbreviations: FDI= Foreign direct investment, CFDI= Chinese foreign direct investment.

GDP= gross domestic product, VECM= Vector error correction model.

TFDI= Total volume of foreign direct investment.

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