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Impacts of Foreign Direct Investment on Economic Growth of Nepal: A Johansen Co-integration Analysis

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ABSTRACT

This research study analysed the impacts of FDI on Nepalese economy using data over the period of 1995-2020. The descriptive and analytical research design has been used. To quantify the effects of independent variables on the dependent variable, data are taken from secondary sources of Nepal Rastra Bank and ministry of finance were employed to measure the variables. In order to interpret the data, the acquired data were analysed by using E-views Statistical Package version 10. Augmented Dickey- Fuller Test is run to test stationary condition in the variables. As per the study, result of Johansen Co-integration Test supported the existence of co-integration in the model. The coefficient of VECM was positive and insignificant expresses that there was no evidence of long run relationship. However, there was found short run causality between GFCF and GDP. Granger Causality Test indicated the two way causality between GFCF and GDP, GFCF with FDI and one way causality from GDP to FDI. The finding shows that the overall model was statistically significant. Furthermore, the GDP was significantly associated with GFCF (p-value=0.0334). 78.53 % of the GDP as explained by the GFCF whereas there was no significantly associated with GDP on FDI.

Keywords: Unit root test, time series analysis, co-integration test, VECM, Granger Causality test

1. Introduction

Despite its modest size, Nepal has the potential to become a new FDI destination in South Asia. Nepal offers a number of benefits, including a stable population structure, improving business indices, a strategic geographic position, and improved legal conditions to attract the investors. To begin with, Nepal has a 56 % economically engaged population, which is increasing every year. Investors may be attracted by the availability of a low-cost labour force. Second, remittances have increased disposable income, which has led to the growth of economic activity and a shift in consumption patterns, resulting in new product markets. Third, according to the World Bank's Doing Business Report 2018, Nepal is ranked 105th in the world, second only to Bhutan in South Asia.

Nepal is potentially attractive location for foreign investors. It is located in between to two emerging economies of the world India in the South and China in the North. The varied climate, cheaper human resources, biodiversity, natural resources, and terrain provide greater opportunities to the Nepal. She has great prospect to invest in different sectors such as agriculture, tourism, manufacturing industry, hydropower, education, transportation, and communication etc. But till date many of which are barely being exploited at all. Nepal has been suffering from vicious circle of poverty, unemployment, low level of living standard, low level of human development index, poor technology, low per capita income, increasing inequality between haves and haves not and investment saving gap, low level of economic growth rate etc.

The empirical results reviles that the impact of FDI in GDP growth rate is minimum and insignificant in case of Nepal. There are lot of research works conducted on study of trend, patterns, and composition and some are on problem and prospects of FDI in Nepal, but this paper trying to examine the relationship of GDP with Gross Fixed Capital Formation (GFCF) and Foreign Direct Investment (FDI).

But the economic growth of Nepal cannot be ignored so that this research study attempts to answer the question what relationship and impact can be found between GDP, GFCF and GDP Growth of Nepal. Based on this research question the objective of this study is to assess the contribution of Foreign Direct Investment and Gross Fixed Capital Formation on economic growth of Nepal. Johansen Co-integration Test is applied after Augmented

Dickey- Fuller unit root test. After that VECM and Granger Causality Test are conducted to find out the long run relationship and direction of causality of the variables.

1.2 Literature Review

A number of theories have been proposed by economists to explain FDI, but none of them has been able to adequately explain the true motivations behind the various types of FDI.

1.2.1 Industrial Organization Theory, (Hymer 1960)

Hymer makes the assumption that a company's decision to invest abroad is a move to take advantage of particular characteristics that its rivals in other foreign nations do not possess (monopolistic advantages). This flaw may firstly be found in the goods markets, where it may manifest as collusion in price, brand names, specific marketing techniques, or product differentiation. Second, it might be in the markets for factors like specialized managerial abilities, disparities in access to finance markets, and patent-protected technologies. Thirdly, the availability of internal or external economies of scale can be a sign of market failure. Finally, government policies like taxes, tariffs, interest rates, currency rates, and others can lead to market imperfections (Hood and Young 1979).

1.2.2 Product Life Cycle Theory, (Vernon 1966)

The Product Life Cycle (PLC) theory attempts to explain why businesses choose to establish operations in another nation by fusing the theory of comparative costs with the timing and location of new product innovation. It also examines how MNEs' location decisions are impacted by the advanced stages of the production life cycle, maturity, and standardization.

1.2.3 Internalization Theory, (Buckley and Casson 1976)

"The solution to an intellectual problem – in this case explaining the international expansion of a firm - is sometimes best achieved not by breaking down the problem into a set of smaller issues, but rather by raising the level of generality and subsuming the problem under a wider issue – in this case, the rationale for the firm itself," (Buckley and Casson 2009).

1.2.4 International Production Theory, (Dunning 1976)

Three requirements must be met, in accordance with the International Production Theory, for businesses to participate in FDI. First, a company must have comparative advantages, or an ownership advantage factor (O), over rival companies. These advantages result from the possession of certain intangible assets, such as patent rights for a specific technology, company size and monopoly power, raw material access, or affordable financing. Second, rather of selling or granting a license to other enterprises, it must be advantageous for the firm to utilize these advantages inside, or internalization factor (I). Thirdly, exporting will be more appropriate until it is more advantageous for the company to combine those benefits with some input components overseas, location factor (L)(Moosa,2002).

1.2.5 Positive Impacts

Pegkas (2015) uses completely modified OLS and dynamic OLS techniques to investigate the influence of foreign direct investment on economic development in Eurozone nations using time series data from 2002 to 2012. The findings reveal a long-term positive link between the stock of foreign direct investment and economic development.

FDI is thought to impact economic growth both directly and indirectly by contributing to gross fixed capital creation and knowledge stock. In the conventional paradigm, FDI is supposed to have a direct impact on economic growth since it is thought to complement domestic investments and serve as a critical supplement to capital and investment shortages. Further research revealed that foreign direct investment has a beneficial influence on economic growth in transition nations due to knowledge spill overs; technical and inventive initiatives are indicated to be an important component underlying growth performance (Silajdzic & Mehic, 2015).

According to Hussain and Haque (2016)'s empirical study of Bangladesh, there is a link between foreign direct investment, trade, and per capita GDP growth rate. The results also revealed that trade and foreign investment factors had a considerable influence on GDP per capita growth rates (Hussain & Haque, 2016). Through positive

spill over effects, FDI inflows to India do actually enhance TFP growth (Choi & Baek, 2017).

Sakyi and Egyir (2017) use the generalized method of moment (GMM) methodology to test the Bhagwati hypothesis for 45 African nations over the period 1990–2014. Their findings reveal that FDI inflows and trade (exports) have a big impact on these countries' economic growth. However, according to Zahonogo (2017), trade openness in Sub-Saharan African nations has a positive and substantial association with economic growth.

The rate at which FDI may promote a country's growth, on the other hand, is largely determined by the social and economic context of the host economy (Osabohien et al., 2020). In a similar way, several empirical research show that FDI increases economic growth (Nuzhat, 2009). According to Nuzhat (2009), foreign investment inflows can have a direct influence on an economy's growth by encouraging domestic capital formation, supporting domestic savings, and facilitating knowledge transfer in the host emerging nations. Using the fully modified ordinary least squares (FMOLS) method, Osabohien et al. (2020) proposed that FDI has a favourable influence on employment and economic growth. The results of Osabohien et al. (2020), using fixed and random effects regression analysis, reveal that governance and ACC issues have had a detrimental impact on FDI inflow and economic growth in Nigeria. Aside from the favourable relationship between foreign capital influx and economic growth, a number of studies have found that foreign capital inflow has an impact on economic growth in emerging countries.

Ingham et al. (2020) recognized the uneven sectorial growth effect of FDI in Egypt to investigate the significance of sectorial makeup of FDI. They discovered that the sectorial destination of FDI has a considerable impact on the economy's development. While FDI in the industrial sector contributed to Egypt's economic growth, FDI in service industries (such as banking, retail, and communications) had a negative influence. Khan and Khan (2011), on the other hand, discovered that the sectorial mix of FDI is also crucial in Pakistan. They discovered that FDI in the primary and service sectors resulted in economic growth, but that FDI in the manufacturing sector played a little contribution.

1.2.6 Negative Impacts

Using OLS and GMM approaches, Anyanwu and Yameogo (2015) investigate the influence of FDI on economic growth in a sample dataset of West African nations from 1970 to 2010. FDI and economic growth have a negative connection, according to the study. For the period 1999-2013, Rahman (2015) studies the impact of FDI on Bangladesh's economic progress. The study indicates that FDI has a negative influence on economic development using multiple regression analysis.

Azam and Ahmed (2015) also empirically study the Commonwealth of Independent States-CIS (ten nations) from 1993 to 2011, using time-series panel data. They use Fixed and Random Effects Models to determine the impact of Human Capital and Foreign Direct Investment on economic growth in those nations. Human Capital (life expectancy and gross secondary school enrolment as proxies for health and education) has a considerable impact on economic growth, according to the study. FDI's influence in encouraging growth has also been demonstrated to have a negative impact on economic growth. Many CIS republics were unable to attract the FDI flows that they desired after becoming independence. These economies have also been hampered in the early phases by a lack of capital and the use of cutting-edge technologies in the manufacturing process. According to the findings, policymakers should examine the impact of FDI inflows on host country economic growth and development. The host economies should smooth up the business climate and attract potential investors by improving domestic circumstances and economic policies.

1.2.7 Long-run and Short-run Causality

Sufian and Moise (2010) used data from 36 nations to examine the link between FDI, economic progress, and openness. The findings suggest that some of these characteristics, such as GDP and openness, have a favourable influence on foreign investment flow, while others, such as the corruption index, inflation rate, and government expenditure, have a negative impact.

According to Tiwari (2011), FDI accelerates the economic growth process in Asian countries. He went on to say that capital and labour are equally necessary for economic success. According to Mehic et al. (2013), there is a positive and substantial relationship between foreign direct investment and economic development in seven Southeast European nations. In 13 Middle East and North Africa (MENA) nations, Omri and Kahouli (2014)

found a bi-directional causal relationship between FDI and economic development. According to Pegkas (2015), foreign direct investment (FDI) is a key contributor to economic growth in Eurozone nations. According to Durmaz (2017), FDI has a spill over impact on the Turkish economy.

FDI allows a company in the home nation to purchase the assets of a company in the host country, allowing it to manage the company's production, manufacturing, distribution, and all other operations (Wajid & Zhang, 2017). Recent empirical studies have revealed that the availability of absorption capacities in the receiving nation is a necessary requirement for FDI to assist the achievement of targeted macroeconomic performance. Various studies on the relationship between FDI and economic growth in developing and emerging market nations, as well as industrialized countries, have shown varied conclusions (Abbas et al., 2011).

Sothan (2017) just published a research that demonstrates the link between FDI and economic growth in Cambodia. Using VECM, he looks at these two variables from 1980 to 2014. The empirical findings show substantial (uni-directional) causation between FDI and GDP in the long run, but no connection between FDI and Cambodian economic development in the short term. For the ASEAN5 (Indonesia, Malaysia, the Philippines, Singapore, and Thailand) economies, Ahmad, Draz, and Yang (2018) investigate the causation between FDI, exports, and economic growth. For the 1981–2013 analytic periods, they employ Johansen co-integration and Granger causality. In the long run, FDI and growth are bi-directionally causative, but FDI and exports are uni-directionally causal in the short run, according to the study. In the long and short term, their findings show that there is export-led growth (ELG) and FDI-led growth.

Phuyal and Sunuwar (2018) discovered that FDI in all sectors had a favourable and significant impact on economic growth in Nepal. The research concluded that, in order to stimulate economic growth, the government should prioritize export-oriented FDI above domestic demand-oriented FDI, based on disaggregated sectorial data. Some studies have also concluded that there is no evidence of FDI having a substantial impact on economic growth. Lund (2010) looked at the data for both rich and developing countries and discovered that FDI did not function as a stimulant for developing country growth, as many previous studies have claimed. He also stressed that a certain degree of development is required in order to reap the full benefits of FDI.

2. Material and Methods Used

2.1 Research Design

The descriptive and analytical method was used in this research, which was designed as a quantitative study. To quantify the effects of independent variables on the dependent variable, secondary data were employed to measure the variables. In order to interpret the data, the acquired data were analysed using E-views statistical package version 10.

2.2 Conceptual framework and Variables

The host economy benefits greatly from foreign investment, according to classical economic theory. In other words, according to the classical economic theory, the economy where the investment was made was the only one to profit fully from it. Solow examines the impact of increased saving and investment on long-term economic growth. Higher saving and investment do, in the short run, accelerate the rate of growth of national income and output (Mukherjee, 2013).

$GDP=\beta_0+ \beta_1 t + \beta_2 GFCF+ \beta_3 FDI$

Where FDI=FDI inflow-out flow of Dividend/share of FDI

GFCF=Gross Fixed Capital Formation

GDP= Gross Domestic Product at Producer's Price

In this paper researcher includes two types of variables viz. dependent variable and independent variables. Variable, their description and measurement are as follows:

Table 2.1: Variable, their description and measurement

Variables	Definition	Measurement
GDP	Gross Domestic Product	In Rs.Million
FDI	Amount of Net FDI	In Rs.Million
GFCF	Amount of Gross Fixed Capital Formation	In Rs.Million

Note: As per requirement of analysis measurement unit can be transformed into different forms.

2.3 Nature and Sources of Data

The data used in this analysis are secondary and time series data. Main sources of the data are Different Series of Economic Surveys published by Ministry of Finance, Industrial Statistics published by Department of Industry, Nepal Rastra Bank, Ministry of Commerce and Supply, Central Bureau of Statistics of Nepal and FNCCI.

2.4 Time Period

In order to analyse the relationship between GDP, FDI and GFCF researcher used 26 sets of time series data over the period of 1995-2020.

2.5 Data Processing

In this paper researcher uses secondary data. So, there is no need of that much processing of data as in case of primary data. For the simplification and easy to understand here researcher will use tabulation, Pie-chart, various graphs, bar diagram and charts etc. as per requirement.

2.6 Data Analysis

Major objectives of this paper are to examine the linkage between FDI, GFCF and GDP in Nepal. To fulfil the objectives of researcher time series data is analysed by using e-views**.**

2.7 Econometric Method

In time series method studies, the following procedures are frequently used to test for the impact of FDI on the Nepalese economy overall:

2.7.1 Stationery Test

Since majority of time series econometric techniques are built upon that the time series variables are stationary, when we apply standard estimations and test procedures in the dynamic time series model, as the first step, it is necessary to examine the stationary property of a series.

A crucial concept in time series is a stationary series. Evidently, not every time series we come across is stationary. A stationary series is one whose fundamental characteristics, namely its mean and variance, remain constant over time. The series are considered to be integrated of order one I(1) with evidence of unit roots, suggesting that they need to be modelled in first difference ($\Delta y_t = y_t - y_{t-1}$) to become stationary. The non-stationary data in this study are made stationary.

Steps in E-views: Quick/Series Statistics/Unit Root Test/ Series Name/Augmented Dickey Fuller Test.

2.7.2 Autocorrelation Test

Because it analyses the correlation between a variable's present value and its historical values, autocorrelation is also known as lagged correlation or serial correlation. When autocorrelation is found in the model's residuals, it is likely that the model has been incorrectly specified (i.e., in some sense wrong). One reason could be that a crucial variable or set of variables is absent from the model.

The auto correlation test in this instance uses the Breusch-Godfrey Lagrange multiplier test.

Steps in E-views:"View" / "Residual Diagnostics" /"Serial Correlation LM Test".

2.7.3 Test of Normality

Normality tests are used in statistics to examine whether a data set is well-modeled by a normal distribution and

to calculate the likelihood that a random variable underlying the data set will be normally distributed. The Jarque-Bera test is used to determine whether the data are normal. The Jarque-Bera test measures how well sample data fit a normal distribution in terms of skewness and kurtosis.

At the 5% significance level, a result of 1 indicates that the null hypothesis has been rejected. In other words, a normal distribution is not how the data are distributed. The data are said to be normally distributed if the value is 0.

Steps in E-views:"View/Residual Diagnostics/Histogram-Normality."

2.7.4 Test of Heteroskedasticity

Heteroskedasticity is a situation in which a variable's variability is unevenly distributed throughout the range of values of a second variable that predicts it. The validity of econometric analysis may be affected by this situation of assumption violation for linear regression modelling. Heteroskedasticity is a problem because ordinary least squares (OLS) regression assumes that all residuals are drawn from a population that has a constant variance (homoscedasticity).

Steps in E-views:"View/Residual Diagnostics/Heteroskedasticity Tests."

2.7.5 Co-integration Test

If we regress the non-stationary variables X on the non-stationary variables Y, the "Spurious Regression" may arise, which leads to incorrect estimation of result. However, there exists one exception that is if two or more than two time series variables are non-stationary themselves but a linear combination of them are stationary. In this case the series are said to be co-integrated. This technique examines the correlation between non-stationary time series variables. In practice, many economic time series variables which contains unit roots move together over time and the variable under consideration may drift away from equilibrium for a while, but there exist some forces on the series that make them convergence upon some long run value. Hence, the Co-integration test is conducted to know the nature and degree of long run relationship between the variables. There are various tests regarding co-integration such as Engle-Granger Residual based test and Johansen Co-integration test.

Engle-Granger Residual based test is not appropriate if there are more than two variable under the consideration or the multivariate time series model. Because, there may exist more than one co-integrating relationships in case of multivariate time series model. For such situation, an alternative multivariate technique of co-integration is Johansen Co-integration test. In thus study there are four time series variable so Johansen Co-integration test is carried out.

Steps in E-views: /Quick/Group Statistics/Co-integration test intercept (no trend) in CE and Test.

2.7.6 Vector Error Correction Model

The co-integration test only consider the long-run relationship or long-run linkages between the level series of variables while the Vector Error Correction Model (VECM) is developed to measure any dynamic adjustment between the first differences of the variables. It is conducted to know the nature and degree of temporal causality between the variables. A vector error correction (VEC) model is a restricted VAR designed for use with non-stationary series that are known to be co-integrated.

Steps in E-views: Quick/Estimate VAR/Vector Error Correction/ (write the value-it automatically converts the variables into first difference.) /Proc/Make System/Order by Variable (copy one)/Quick/estimate Equation (Paste)/Ok

2.7.7 Long Run and Short Run Relationship

Since there is long run association between the variables the vector error correction model can be run.

Steps in E-views: Run VECR/ View/Coefficient Diagnostics/Wald Test

2.7.8 Granger Causality Test

The link between the variables is determined using the Pair Wise Granger Causality Test. If previous values of x can be used to predict future values of y given past values of y, then x is said to Granger-cause y. Regressing

y on both its own lagged values and the lagged values of x is a common way to assess Granger causality. The null hypothesis is that the estimated coefficients on the lagged values of x are all jointly zero. Rejecting the null hypothesis is equal to rejecting the null hypothesis that x does not cause y in Granger's model.

2.8 Econometric Results

2.8.1 Unit Root Test

The unit root test is used to determine whether stationary is present in the data. For the test of unit root, which confirms the stationary condition in the variables, the augmented Dickey Fuller Test is used.

Table 2.2: Result of ADF Test on Level Series

Variables	Intercept	Trend & Intercept	None
FDI	0.048477 (0.9547)	-1.746100 (0.6999)	0.851153 (0.8880)
GDP	4.589304 (1.0000)	-0.319972 (0.9852)	8.757020 (1.0000)
GFCF	2.081474 (0.9998)	-0.998045 (0.9263)	4.175184 (0.9999)

Table 2.3: Result of ADF Test on First Differenced Series

Variables	Intercept	Trend & Intercept	None
ΔFDI	-4.974421* (0.0006)	-5.361314* (0.0012)	-4.742128* (0.0000)
ΔGDP	-2.145053 (0.2301)	-4.214526* (0.0159)	-1.334182 (0.1637)
ΔGFCF	-3.551180* (0.0152)	-4.243018* (0.0150)	-1.345817 (0.1602)

2.8.2 Co-integration Result

If we have more than two variables in the model, then there is possibility of having more than one co-integrating vectors. By this we mean that the variables in the model might form several equilibrium relationships. To find out how many co-integrating relationship exists among K variables requires the use of Johansen's methodology. The Johansen's approach also requires all variables in the system are integrated of the same order.

When two or more than two time series variables are integrated of same order, there is possibility of co-integration between them. Since, FDI, GDP and GFCF are co-integrated conveys that they will retain a reasonable proximity to each other in the long run, i.e. they do have a long-run relationship.

There may be more than one co-integrating relationship among the co-integrated variables. Johansen test provides estimates of all such co-integrating equations and provides a test statistics for the number of co-integrating equations. Following table shows the result of the Johansen co-integration test:

Table 2.4: Result of the Johansen Co-integration Test:

Unrestricted Co-integration Rank Test (Trace)					
Hypothesized **No. of CE(s)**	**Eigenvalue**	**Trace** **Statistic**	**0.05** **Critical Value**	**Prob.****	
None *	0.665536	40.68849	29.79707	0.0019	
At most 1	0.324998	14.40309	15.49471	0.0725	
At most 2 *	0.187053	4.970146	3.841466	0.0258	

Trace test indicates 1 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					
Unrestricted Co-integration Rank Test (Maximum Eigenvalue)					
Hypothesized No. of CE(s)	**Eigen value**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob.****	
None *	0.665536	26.28541	21.13162	0.0086	
At most 1	0.324998	9.432943	14.26460	0.2519	
At most 2 *	0.187053	4.970146	3.841466	0.0258	
Max-eigenvalue test indicates 1 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					

Rank test (Trace) indicates that there is one co-integrating equation at 0. 05level of significance and the maximum Eigen statistics also indicates that there is one co-integrating equation. The following table presents the normalized co-integrating coefficients:

Table 2.5: Co-integrating Coefficients

1 Co-integrating Equation(s):		Log likelihood	-795.0244		
Normalized co-integrating coefficients (standard error in parentheses)					
GDP	**GFCF**	**FDI**			
1.000000	-0.329696	-112.2664			
	(0.44129)	(27.7044)			

2.8.3 Vector Error Correction Model

Since there is long run association between the variables, we can run the vector error correction model. For this level data are used for calculation. The model automatically converts the variables at first difference. The long run relation is thus estimated as:

Table 2.6: Vector Error Correction Model

D(GDP) = C(1)*(GDP(-1) - 0.3297*GFCF(-1) - 112.2664 * FDI(-1) - 701826.708613) + C(2)*D(GDP(-1)) + C(3) *D(GFCF(-1)) + C(4)*D(FDI(-1)) + C(5)				
	Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
C(1)	0.023634	0.035921	0.657944	0.5185
C(2)	0.235876	0.132267	1.783329	0.0905
C(3)	1.424440	0.171413	8.310002	0.0000
C(4)	3.389959	4.181855	0.810635	0.4276
C(5)	45169.90	20399.33	2.214284	0.0392
R-squared	0.878121	Mean dependent var		150341.1
Adjusted R-squared	0.852462	S.D. dependent var		129109.7
S.E. of regression	49591.92	Akaike info criterion		24.64410
Sum squared resid	4.67E+10	Schwarz criterion		24.88952

Log likelihood	-290.7291	Hannan-Quinn criter.		24.70921
F-statistic	34.22299	Durbin-Watson stat		2.408678
Prob(F-statistic)	0.000000			

2.8.4 Long Run Causality

C(1) is the error correction term or speed of adjustment towards equilibrium. Since the C(1) is positive in sign and insignificant, there is no long run causality running from independent variables to dependent variable.

2.8.5 Short run causality

Table 2.7: Wald Test: Null hypothesis: C(2) = 0

Test Statistic	Value	df	Probability
t-statistic	1.783329	19	0.0905
F-statistic	3.180262	(1, 19)	0.0905
Chi-square	3.180262	1	0.0745

Since the probability value of Chi-square is greater than 5 percent, there is no evidence of short run causality running from lag of GDP to GDP.

Table 2.8: Wald Test: Null hypothesis: C(3) = 0

Test Statistic	Value	df	Probability
t-statistic	8.310002	19	0.0000
F-statistic	69.05613	(1, 19)	0.0000
Chi-square	69.05613	1	0.0000

Since the probability value of Chi-square is less than 5 percent, there is short run causality running from GFCF to GDP.

Table 2.9: Wald Test: Null hypothesis: C(4) = 0

Test Statistic	Value	Df	Probability
t-statistic	0.810635	19	0.4276
F-statistic	0.657129	(1, 19)	0.4276
Chi-square	0.657129	1	0.4176

Since the probability value of Chi-square is greater than 5 percent, there is no evidence of short run causality running from FDI to GDP.

2.8.6 Model Diagnosis

2.8.7 F-Test

Since R^2 is 87.81 percent and the p value of F-statistic is less than 1 percent, our model is fitted well. P value of f-statistic is significant in 1 percent.

2.8.8 Normality Test

The Jarque-Bera test is used to determine whether the distribution of the model's variables meets the requirement for normality. This test's significance indicates that the variables are distributed normally. Below is a presentation of the test's results.

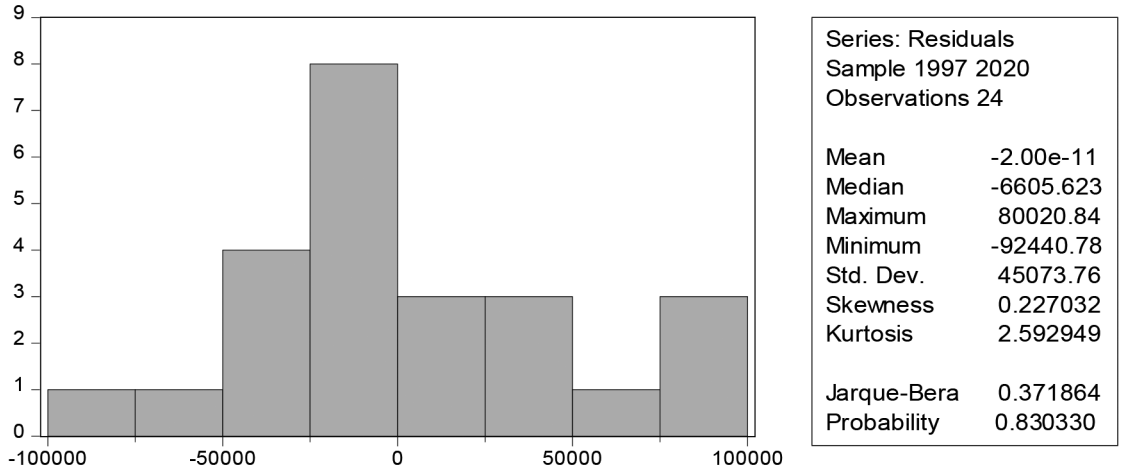

Figure 2.1: Jarque-Bera Normality Test

The result of the Jarque-Bera test indicates that the null hypothesis is accepted because the test's probability is larger than 5% level of significance. Since the probability value of Jarque-Bera(0.830330) is greater than 5 percent, the residual of the model follow the normal distribution.

2.8.9 Heteroskedasticity test

Bruesch-Pagan-Godfrey The test is designed to identify heteroskedasticity, a challenge in econometric regression analysis. The test's outcome is provided in the table below.

Table 2.10: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	2.959047	Prob. F(6,17)	0.0364
Obs*R-squared	12.26044	Prob. Chi-Square(6)	0.0564
Scaled explained SS	6.120158	Prob. Chi-Square(6)	0.4099

Table 2.10 displays the outcomes of the Breusch-Pagan-Godfrey heteroskedasticity test. The finding that the null hypothesis of homoscedasticity is not rejected at a level of significance of 5% denotes the model's lack of heteroskedasticity i.e. the p value of observed R-squared is greater than 5 percent, the data is homoscedastic.

2.8.10 Serial Correlation Test

To determine the serial correlation in the model, the Breusch-Godfrey LM test is run, and the test's outcome is provided as follows:

Table 2.11: Breusch-Godfrey Serial Correlation LM Test

F-statistic	1.347037	Prob. F(1,18)	0.2610
Obs*R-squared	1.670999	Prob. Chi-Square(1)	0.1961

The Breusch-Godfrey Serial Correlation LM Test result, which affirms the presence of autocorrelation in the model, is shown in table 2.11. As a result, the null hypothesis that there is no serial correlation is accepted because Fstatistic and Obs R-squared probability are both more than 5% level.

2.8.11 Granger Causality Test

The Granger Causality test is utilized determine if the relationship between the independent and dependent variables is causal. The test is run in order to identify the source of influences, which is crucial for influencing policy. The result of Granger Causality test is shown in the following table:

Table 2.12: Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
GFCF does not Granger Cause GDP	24	40.0362	2.E-07
GDP does not Granger Cause GFCF		4.18207	0.0313
FDI does not Granger Cause GDP	24	0.16660	0.8478
GDP does not Granger Cause FDI		11.1223	0.0006
FDI does not Granger Cause GFCF	24	3.92639	0.0374
GFCF does not Granger Cause FDI		10.1535	0.0010

Table 2.12 represents the pairwise granger causality between dependent and independent variables in the model.

i. GFCF Granger causes GDP and GDP Granger causes GFCF. This means there exist bidirectional relationship between GDP and GFCF.

ii. GDP Granger Cause FDI. This means there exist unidirectional relationship between GDP and FDI.

iii. FDI Granger Cause GFCF and GFCF Granger Cause FDI This means there exist bidirectional relationship between GFCF and FDI.

This result is inconsistent to the theory. Because, according to the theory there should be positive relationship between FDI and gross domestic product.

3. Conclusion and Discussion

GFCF Granger causes GDP and GDP Granger causes GFCF. This means there exist bidirectional relationship between GDP and GFCF. GDP Granger Cause FDI. This means there exist unidirectional relationship between GDP and FDI. FDI Granger Cause GFCF and GFCF Granger Cause FDI This means there exist bidirectional relationship between GFCF and FDI. This result is inconsistent to the theory. Because, according to the theory there should be positive relationship between FDI and gross domestic product.

The inflow of FDI signifies boosting role of macroeconomic variables such employment, economic growth, GDP, foreign trade and as well as money supply. In the context of Nepal, the volume of FDI and GFCF have not found sufficient and investors do not fill comfort investing their capital due to policies hurdles and political instability. There needs investment friendly policy and environment for attracting FDI and GFCF.

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Appendix

Research Variables *(Rupees in Million)*

FY	GDP	GFCF	FDI
1995	248913	56081	388
1996	280513	60794	1621
1997	300845	65375	685
1998	342036	65269	578
1999	379488	73324	232.6
2000	441519	89889	-33
2001	459442.8	98073	-282.3
2002	492231.3	109181	961.4
2003	536749	117539	0
2004	589412	135532	136
2005	654084	153337	-469.7
2006	727827	178446	362.3
2007	815663	211039	293.9
2008	988272	264890	1829.2
2009	1192774	292730	2852
2010	1366954	373940	6437.1
2011	1527344	421840	9195.4
2012	1758380	482070	9081.9
2013	1949290	563760	3194.6
2014	2232530	667800	4383.6
2015	2423640	748690	5920.9
2016	2608180	940850	13503.9
2017	3077140	1120860	17504.6
2018	3455950	1304900	13065.2
2019	3858930	1184860	19478.7
2020	3888700	1276860	19513

Source: MOF, Economic Survey (2010/11 and 2021/22) and NRB, QEB (2022).