

Domestic Investment and Foreign Direct Investment are complements or substitute in the Growth Process: A study of selected countries'

MANOJ KUMAR , SONU, SUMIT KUMAR

Abstract: *The aim of the study is to examine the relationship between domestic investment and foreign direct investment (FDI) to find out whether domestic investment and foreign direct investment are substitute or complement to each other in the growth process of five selected economies of USA, China, Russia, India and Pakistan, during the period 1992 to 2019. The series used for GDP and Gross Fixed Capital Formation (GFCF) as proxy for domestic investment and FDI inflow as proxy for foreign investment are second differenced to ensure that none of the series are spurious, structural breaks are detected and controlled for, and Granger causality tests are used to determine the direction of relationships among variables. GDP has an opposite impact on domestic investment and FDI in the case of Pakistan, and an equal effect in the case of Russia, while in the USA, GDP has an equal effect on the two and in China, it has an inverse effect. One should not apply a standard approach to investment policy for FDI and domestic investment; rather, the investment policy should be specific to the complementary or substitutive dynamics of each economy. This study provides a cross-country/ cross-income group analysis that is unique from single-country studies, using a combination of structural-break adjusted regression and Granger causality testing to gain a more comprehensive understanding of the investment-growth relationship.*

Keywords: Domestic Investment, Foreign Investment, Substitution, Complimentary.

JEL Classification: E22, F21, F41

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Introduction

Foreign direct investment has been an important element of international economics. The flows of capital as technology, knowledge and skills across national boundaries create opportunities for host countries. Contradictory is that the growth of a country does not rely on their own resources i.e. technology, knowledge and skill. Foreign investment is taking place in this context. Role of domestic investment has been doubtful for growth of an economy. In contrast, endogenous growth theory holds that economic growth is the result of endogeneity and not external forces. Endogenous theories stipulate that investment in human capital, innovation, and knowledge are significant contributors to an economy. The Impact of FDI and GDI on economic growth may differ among individual countries. Moreover, the policy towards FDI differs from country to country. The role of Domestic investment is also important for growth of an economy, there should be policy frame that support the domestic investment. (Deok, Ki, & Soo, 2003), found that FDI does not crowd out domestic investment. It is meaning that the FDI compliment to domestic investment. (Choe, 2003) said that it not necessary by the result of causality that the high FDI inflows or gross domestic investment (GDI) rates lead to economic growth. The question is that 'Does the foreign direct investment crowd out domestic investment?' This work distinguished between domestic and foreign investment towards the need of growth of an economy.

That's why a comparative study is required to study the role of FDI and domestic investment for the growth of High Income nation¹ (USA), Upper Middle Income (Russia and China) and Lower Middle Income nations (India and Pakistan). This study basically designed to focus on the role of foreign direct investment and domestic investment in growth process. Race to become top destination for FDI may trouble the domestic investors. Does the domestic investors not capable to contribute growth of an economy as endogenous theory explained?

That's why this exploratory comparative research formulated to study the below given objectives are, to study the nature of domestic investment in the presence of FDI in form of substitution or complimentary in given sample areas.to check the effectiveness of FDI and domestic investment in growth process among sample areas, and to analyse the causal relationship of FDI, domestic investment and output for given sample areas.

Numerous empirical studies from different countries have been conducted to investigate. The overall evidence is best characterized as mixed, as the results. None of the article shows any specific role of FDI and domestic investment in the growth of an economy as comparative analysis among high income, middle income and lower middle income nation. Most of the studies are going on the effect of FDI on output, determinants of FDI, FDI and stock market etc. There are some efforts to review, but specific research papers are less which deal with the study. Given questions is framed in objectives, first, How FDI helps in the growth of an

¹ World Bank list of economics as on calendar July, 2020; High Income (USA), Upper Middle Income (Russia, China), Lower Middle Income (India and Pakistan).

economy when domestic investment is available as per endogenous growth theory?, second, Does FDI substitute or compliment domestic investment?

Null Hypothesis are framed to check the statistical significant of relation, FDI does not complement or substitute domestic investment, FDI does not cause domestic investment or vice-versa, and FDI and Domestic investment does not cause growth of an economy.

Model Specification and Methodology

The following aggregate production function in economy is carried out by combining labour and capital.

$$Y=f(L,K) \quad \dots i$$

Here Y is the aggregate Output, L is labour and K is Capital. As per the argument of endogenous growth theory, technical progress comes from the rate of investment, size of capital stock and the stock of human capital. This theory assumed that the knowledge or learning by doing (Arrow, 1962) is the investment of the firm. (Lucas, 1988), argued that the investment in education leads to create the human capital. Productivity is tied directly to faster innovation and investment in human capital. Investment in human capital improve and acquiring the skill. Human capital has the multivariate relation with number of factors that may be time taking process, that also reflect the expenditures, which improve the labour productivity. The investment on labour, improve the human capital to enhance the productivity.

So, $L=f(I_L)$, here I_L is the investment on labour.

$$\text{So that } Y=f(I_L, K) \quad \dots ii$$

But the K (Capital) is the stock, expansion of the stock is the continue phenomena of investment.

$$I_t \text{ or } \Delta K = K_t - K_{t-1} \quad \dots iii$$

, K_t is the current time stock of capital, K_{t-1} , is previous time stock of capital, and Δ is the change. So ΔK is the Investment (I_t) in time t.

$$\text{So that } Y= f(I_L, I_t) \quad \dots iv$$

Ultimately, Output is depend on Investment that may be on (I_L), is the investment on labour, and expansion of stock is depend on Investment in a period (I_t).

$$\text{So that } Y= f(I), (Y) \text{ output is the function of Investment (I)} \quad \dots v$$

As per Hick's concept regarding Investment that is autonomous investment and induced investment. Autonomous investment is income inelastic, and Induced investment is income elastic, induced investment depends on the change of output. Total Investment (I_t) is the aggregate of autonomous investment (I_a) and induced investment (I_i).

$$I_t = I_a + I_i \quad \dots vi$$

Endogenous growth theory supports the innovation and human capital by domestic investment. International economic theories of foreign investment also support human capital development and promoting technological upgrading. Both the theories are based on induced investment which depends on changes in the level of output. So that induced investment is domestic as well as the foreign.

$$I_i = I_d + I_f \quad \dots vii$$

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By the equation (iv) the output is the function of induced investment (I_i) i.e. domestic induced investment (I_d) and foreign induced investment (I_f).

$$Y = f(I_d, I_f) \quad \dots \text{Viii}$$

International economics theories of growth by foreign investment and endogenous growth theories of domestic investment provide the most empirical work on the growth –investment relationship. This empirical work has been studied by explaining mainly four ways i.e. determinant of growth, determinant of domestic or foreign investment, role of firms and direction of causality between the variables. Some endogenous growth theories points out that foreign investment can not only contribute the growth through capital formation and technology transfer but also do so through the augmentation of level of knowledge through labour training and skill acquisition. That's why it is important to evaluate the extent of complement and substitution between domestic investment and foreign investment because a simplistic Schumpeterian view of foreign investment related innovative investment that emphasis creative destruction through substitution may overlook the scope for complementarity between foreign investment and domestic investment. So that as per functional relation of (vii) is written as the equation for the estimation, that is

$$Y = \alpha + \beta_1 I_d + \beta_2 I_f \quad \dots \text{ix}$$

α , β_1 , and β_2 are the parameters of the equation, and three variables namely, Gross Domestic Product (GDP) as the proxy of Y , Gross Fixed Capital Formation (GFCF) as proxy of Domestic Induced Investment (I_d), and Foreign Direct Investment Inflow (FDIINFLOW) as proxy of Foreign Induced Investment (I_f) has been used.

Methodology

Variables, sources, period and sample area

Gross Domestic Product at constant base year 2010 (GDP), Gross Fixed Capital Formation (GFCF) and Foreign Direct Investment Inflow (FDIINFLOW), and GDP as the proxy of Output, GFCF as proxy of domestic investment and FDIINFLOW as the proxy of foreign investment has been used in this study. The data bank of the World Bank is the source of data from 1992 to 2019. The area of present study is as follow, high income (USA), Upper middle income (China and Russia) and lower middle income (India) nation. Secondary data of FDI inflow, domestic investment and output in respective nations will be used as variables.

Augmented Dicky-Fullerⁱ Test and Phillips Parron Test is employed to avoid spurious or non-sense results. After that, regression analysis has been used to analysis the impacted investment. CUSUMSQ test is also plot to identify the stability of regression analysis in the presence of structural break. Granger Causality test is used to investigate the causality among variables.

Empirical Analysis

Estimated OLS Equation and Granger Causality results

This equation is based on second difference of variables to avoid spurious regression. Break points have detected by endogenous detection method, by plot the graph of series as well as to run the Chow test to confirm the break point. The dummy variable is constructed and used in

regressor. Stability test verify by taking the plot of the CUSUMSQ and the plot deviates out of the 5% significance level boundary.

China

Regression with structural break

$$d(\text{GDP}, 2)_t = \alpha_0 + \sum_{i=1}^n \beta_1 d(\text{GFCF}, 2)_t + \sum_{i=1}^n \beta_2 d(\text{FDIINFLOW}, 2)_t + \sum_{i=2007}^n \beta_3 \text{SBd}(\text{GDP}, 2)_t + e_t$$

.....e1

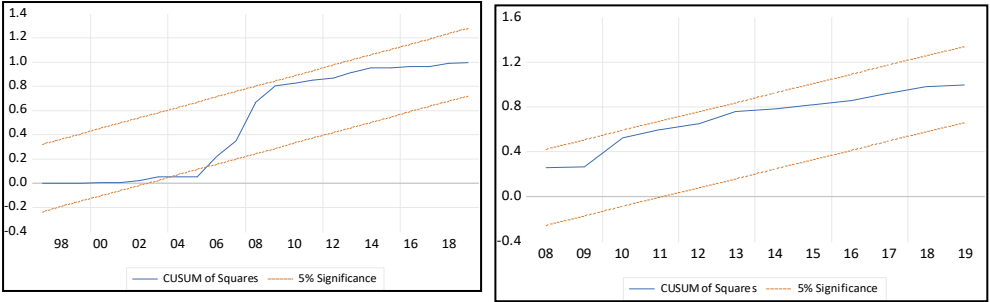
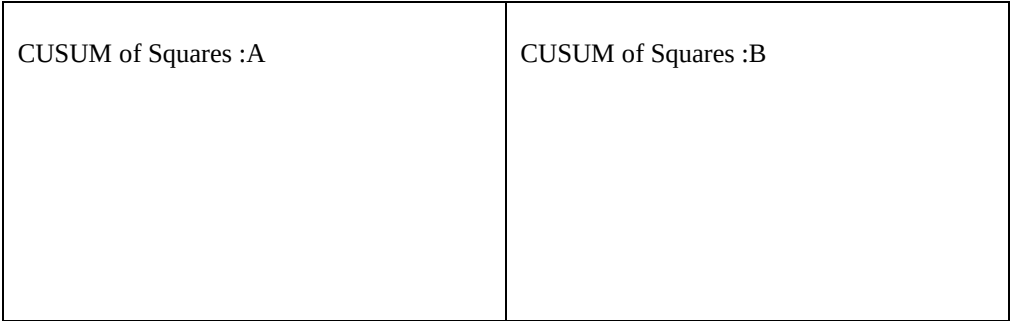
Where , $d(\text{GDP}, 2)_t$ =Second difference of GDP in year t;
 $d(\text{GFCF}, 2)_t$ =Second difference of GFCF in year t;
 $d(\text{FDIINFLOW}, 2)_t$ =Second difference of FDI inflow in year t;
 $\text{SBd}(\text{GDP}, 2)_t$ = Structural break of second difference of GDP in year t;
 α, β_1, β_2 and β_3 are the parameters.

Dependent Variable:	$d(\text{GDP}, 2)$		$\text{SBd}(\text{GDP}, 2)$	
Included observations:	26 after adjustments		)	2007
Variable	Coefficient	Std. Error	t-Statistic	Prob.
$d(\text{GFCF}, 2)$	0.002966	0.061715	0.048053	0.9621
$d(\text{FDIINFLOW}, 2)$	0.0546	0.1003	0.5449	0.5913
$\text{SBd}(\text{GDP}, 2)$	0.9159***	0.1295	7.0734	0.0000
C	12800000000.0	5140000000.0	2.4848	0.0211
R-squared	0.7687			
Adjusted R-squared	0.7372			
F-statistic	24.3756			
Durbin-Watson stat	0.839698			
Prob(F-statistic)	0			

Note:- The lower and upper limits of D-W statistics for 3 explanatory variables are : dL=0.928, dU=1.410. *** significant at 1 % , ** significant at 5% and *significant at 10% level.

Only significant coefficient of the equation (e1) has been interpreted. The estimate of the coefficient of Structural Break ($\text{SBd}(\text{GDP}, 2)$) β_3 is positive and significant. This suggests that the structural break impacts the stability of the model. CUSUM of square model from the year 2007 at 5% significance is confirming the stability of model with the consideration of structural break in GDP in 2007 as shown in figure for CUSUM squares A & B. Without structural break that model was not stables. R-square value is also high; it means the independent variables explain the dependent variables by 76 %. Null hypothesis of non-autocorrelation errors in favour of positive first order autocorrelation is rejected as the calculated value (0.83) is less than the lower bound of tabulated value; means the series are non-auto-correlated of positive first order autocorrelation.

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Regression with lag of independent variables

$$d(GDP, 2)_t = \alpha_0 + \sum_{i=1}^n \beta_1 d(GFCF, 2)_t + \sum_{i=1}^n \beta_2 d(FDIINFLOW, 2)_t + \sum_{i=1}^n \beta_3 d(GFCF, 2)_{t-1} + \sum_{i=1}^n \beta_4 d(FDIINFLOW, 2)_{t-1} + e_t$$

..... e2

Where, $d(GDP, 2)_t$ =Second difference of GDP in year t;
 $d(GFCF, 2)_t$ =Second difference of GFCF in year t;
 $d(FDIINFLOW, 2)_t$ =Second difference of FDI inflow in year t;
 $d(GFCF, 2)_{t-1}$ =Second difference of GFCF in lag year t;
 $d(FDIINFLOW, 2)_{t-1}$ =Second difference of FDI inflow in lag year t;
 $\alpha, \beta_1, \beta_2, \beta_3$ and β_4 are the parameters.

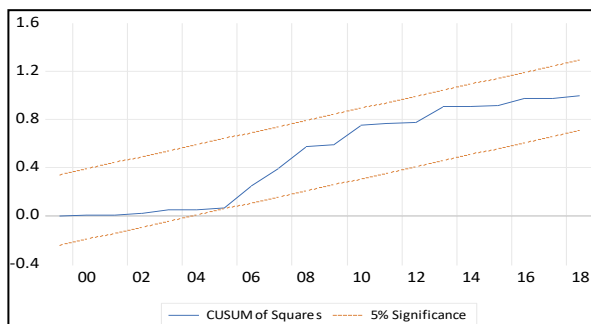
Dependent Variable:	d(GDP,2)			
Included observations:	25	after adjustments		
Variable	Coefficient	Std. Error	t-Statistic	Prob.
d(GFCF,2)	-0.1063	0.1290	-0.8244	0.4194
d(FDIINFLOW,2)	0.5439**	0.1970	2.7610	0.0120
d(GFCF,2)t-1	-0.1788	0.1113	-1.6071	0.1237
d(FDIINFLOW,2)t-				
1	0.2597	0.1838	1.4131	0.1730
C	24300000000.0000	8910000000.0000	2.7292	0.0129

R-squared	0.3681
Adjusted R-squared	0.2418
F-statistic	2.9130
Durbin-Watson stat	1.709115
Prob(F-statistic)	0.0475

Note:- The lower and upper limits of D-W statistics for 4 explanatory variables are : $dL=0.832$, $dU=1.521$. *** significant at 1 % , ** significant at 5% and *significant at 10% level

Only significant coefficient of the equation (e2) has been interpreted. The estimate of the coefficient of second difference of FDI inflow ($d(FDIINFLOW,2)$), β_2 (0.54) positively significant. This suggests that foreign direct investment positively impact the output. One unit of FDI inflow transformed (0.54) unit of output. CUSUM of square model at 5% significance is confirming the stability of model in figure for CUSUM squares C. R-square value means the independent variables explain the dependent variables by 36 %. Null hypothesis of non-autocorrelation errors in favour of positive first order autocorrelation is not rejected as the calculated value (1.709) is greater than the upper bound of tabulated value; means the series is auto-correlated of positive first order autocorrelation.

CUSUM of Squares: C



The second row of table 05 in Appendix A shows that the null hypothesis, $d(GDP,2)$ does not Granger Cause $d(GFCF,2)$, is rejected at 3.9 percent level of significance and therefore, Second different GDP ($d(GDP,2)$)Granger causes second difference of Gross Fixed Capital Formation($d(GFCF,2)$). Unidirectional relation means that the GDP of a country induced the domestic investment.

The fourth row of above table shows that the null hypothesis, $d(GDP,2)$ does not Granger Cause $d(FDIINFLOW,2)$, is rejected at 2.4 percent level of significance and therefore, Second different GDP ($d(GDP,2)$)Granger causes second difference of foreign direct investment inflow ($d(FDIINFLOW,2)$). There is unidirectional relation and means that the GDP of a country induced the foreign direct investment inflow.

The sixth row of above table shows that the null hypothesis, $d(GDP,2)$ does not Granger Cause $d(GFCF,2)t-1$, is rejected at 8.1 percent level of significance and therefore, Second different

of current GDP ($d(GDP,2)$)Granger causes lag value of second difference of Gross Fixed Capital Formation($d(GFCF,2)_{t-1}$) There is unidirectional relation and means that the current GDP of a country induced the lagged domestic investment, or in reverse the current GDP decides the future domestic investment.

The tenth row of above table shows that the null hypothesis, $d(GFCF,2)$ does not Granger Cause $d(FDIINFLOW,2)$, is rejected at 1.4 percent level of significance and therefore, Second different gross fixed capital formation ($d(GFCF,2)$) Granger causes second difference of foreign direct investment inflow ($d(FDIINFLOW,2)$). There is unidirectional relation and means that the domestic investment of a country induced the foreign direct investment inflow, or in reverse the current GDP decides the future foreign direct investment inflow.

The thirteenth row of above table shows that the null hypothesis, $d(GFCF,2)_{t-1}$ does not Granger Cause $d(FDIINFLOW,2)_{t-1}$, is rejected at 0.0 percent level of significance and therefore, Lag of second different of gross fixed capital formation ($d(GFCF,2)_{t-1}$) Granger causes lag of second difference of foreign direct investment inflow ($d(FDIINFLOW,2)_{t-1}$). There is unidirectional relation and means that the lag domestic investment of a country induced the lagged foreign direct investment inflow.

In other words, as per the Granger Causality Tests confirm the unidirectional relations, and the GDP of the China induced the domestic investment as well as the foreign direct investment inflow. Foreign direct investment inflow and domestic investments seems the complimentary of each other to increase the aggregate output of in China.

India

Regression with structural break

$$d(GDP, 2)_t = \alpha_0 + \sum_{i=1}^n \beta_1 d(GFCF, 2)_t + \sum_{i=1}^n \beta_2 d(FDIINFLOW, 2)_t + e_t$$

Where,e3
 $d(GDP,2)_t$ =Second difference of GDP in year t;
 $d(GFCF,2)_t$ =Second difference of GFCF in year t;
 $d(FDIINFLOW,2)_t$ =Second difference of FDI inflow in year t;
 α, β_1 and β_2 are the parameters.

Dependent Variable: $d(GDP,2)$

Included

observations: 26 after adjustments

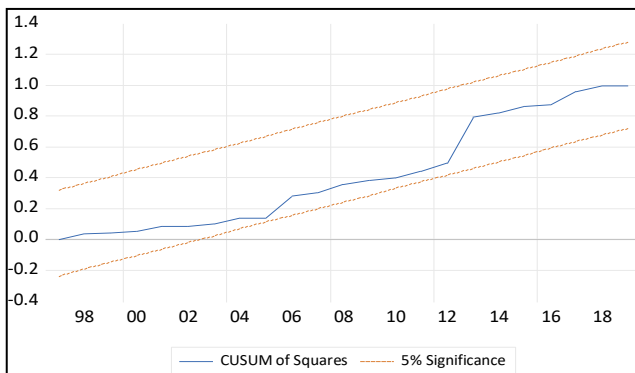
Variable	Coefficient	Std. Error	t-Statistic	Prob.
$d(GFCF,2)$	0.4138***	0.1244	3.3263	0.0029
$d(FDIINFLOW,2)$	-1.2344***	0.4302	-2.8695	0.0087
C	4330000000.0	3950000000.0	1.0969	0.2840

R-squared	0.5157
Adjusted R-squared	0.4736
F-statistic	12.2444
Durbin-Watson stat	1.8273
Prob(F-statistic)	0.0002

Note:- The lower and upper limits of D-W statistics for 2 explanatory variables are : dL=1.000, dU=1.311. *** significant at 1 % , ** significant at 5% and *significant at 10% level.

Only significant coefficient of the equation (e3) has been interpreted. The estimate of the coefficient of second difference of the gross fixed capital formation (d(GFCF,2)) and second difference of FDI inflow (d(FDIINFLOW,2)), β_1 (0.413) is positively significant, and β_2 (-1.234) negatively significant respectively. This suggests that the domestic investment positively impact the output, and foreign direct investment negatively impact the output. One unit of domestic investment transformed in 0.41 unit of output, and one unit of FDI inflow transformed in (-1.23) unit of output. CUSUM of square model at 5% significance is confirming the stability of model in figure for CUSUM squares A. R-square value means the independent variables explain the dependent variables by 51 %. Null hypothesis of non-autocorrelation errors in favour of positive first order autocorrelation is not rejected as the calculated value (1.82) is greater than the upper bound of tabulated value; means the series is auto-correlated of positive first order autocorrelation.

CUSUM of Squares :A



Regression with lag of independent variables

$$d(\text{GDP}, 2)_t = \alpha_0 + \sum_{i=1}^n \beta_1 d(\text{GFCF}, 2)_t + \sum_{i=1}^n \beta_2 d(\text{FDIINFLOW}, 2)_t + \sum_{i=1}^n \beta_3 d(\text{GFCF}, 2)_{t-1} + \sum_{i=1}^n \beta_4 d(\text{FDIINFLOW}, 2)_{t-1} + e_t$$

.....e4

Where, $d(\text{GDP}, 2)_t$ = Second difference of GDP in year t;
 $d(\text{GFCF}, 2)_t$ = Second difference of GFCF in year t;

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$d(\text{FDIINFLOW}, 2)_t$ = Second difference of FDI inflow in year t ;

$d(\text{GFCF}, 2)_{t-1}$ = Second difference of GFCF in lag year t ;

$d(\text{FDIINFLOW}, 2)_{t-1}$ = Second difference of FDI inflow in lag year t ;

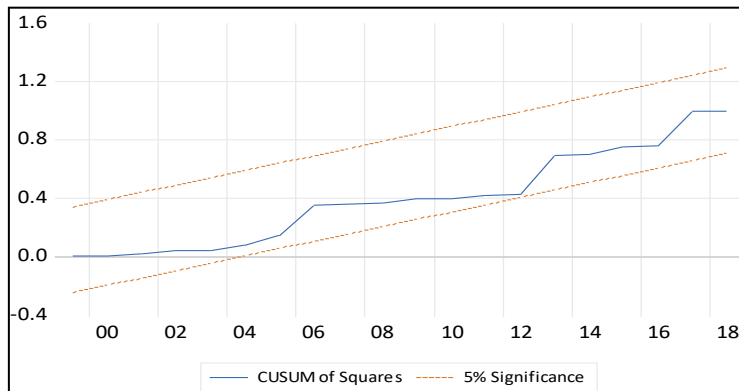
$\alpha, \beta_1, \beta_2, \beta_3$ and β_4 are the parameters.

Dependent Variable:	d(GDP,2)			
Included	25	after		
observations:	adjustments			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
d(GFCF,2)	0.5976***	0.1690	3.5365	0.0021
d(FDIINFLOW,2)	-0.8925**	0.4668	-1.9120	0.0703
d(GFCF,2)t-1	0.3272**	0.1361	2.4033	0.0261
d(FDIINFLOW,2)t-1	0.5809	0.4707	1.2343	0.2314
		3770000000.000		
C	4070000000.0000	0	1.0781	0.2938
R-squared	0.5820			
Adjusted R-squared	0.4984			
F-statistic	6.9626			
Durbin-Watson stat	2.0714			
Prob(F-statistic)	0.0011			

Note:- The lower and upper limits of D-W statistics for 4 explanatory variables are : dL=0.832, dU=1.521. *** significant at 1 % , ** significant at 5% and *significant at 10% level

Only significant coefficient of the equation (e4) has been interpreted. The estimate of the coefficient of second difference of the gross fixed capital formation ($d(\text{GFCF}, 2)$), second difference of FDI inflow ($d(\text{FDIINFLOW}, 2)$), and lag of second difference of the gross fixed capital formation ($d(\text{GFCF}, 2)_{t-1}$), β_1 (0.59) is positively significant, β_2 (-0.89) negatively significant, and β_3 (0.32) is positively significant respectively. This suggests that the domestic investment as well as the lagged value of domestic investment positively impact the output, and foreign direct investment negatively impact the output. One unit of domestic investment transformed in 0.59 unit of output, one unit of lagged domestic investment transformed in 0.32 unit of output, and one unit of FDI inflow transformed in (-0.89) unit of output. CUSUM of square model at 5% significance is confirming the stability of model in figure for CUSUM squares B. R-square value means the independent variables explain the dependent variables by 58 %. Null hypothesis of non-autocorrelation errors in favour of negative first order autocorrelation, therefore not reject the null hypothesis, calculated value (4 -2.071=1.928) is above the upper bound of tabulated value; means the series are auto-correlated of negative first order autocorrelation.

CUSUM of Squares: B



The first and second row of table 06 in Appendix A shows that the null hypothesis, $d(\text{GFCF}, 2)$ does not Granger Cause $d(\text{GDP}, 2)$ is rejected at 1.1 percent level of significance, $d(\text{GDP}, 2)$ does not Granger Cause $d(\text{GFCF}, 2)$, is rejected at 1.2 percent level of significance therefore, Second different GFCF ($d(\text{GFCF}, 2)$) and second difference of Gross Domestic Product ($d(\text{GDP}, 2)$) has bidirectional relationship. It means that the domestic investment and the GDP causing each other.

The fifth and sixth row of above table shows that the null hypothesis, $d(\text{GFCF}, 2)t-1$ does not Granger Cause, $d(\text{GDP}, 2)$ is rejected at 0.05 percent level of significance, and $d(\text{GDP}, 2)$ does not Granger Cause $d(\text{GFCF}, 2)t-1$, is rejected at 8.8 percent level of significance therefore, lag value of second difference of Gross Fixed Capital Formation $d(\text{GFCF}, 2)t-1$ and Gross Domestic Product ($d(\text{GDP}, 2)$) has bidirectional relationship. It means that the lag domestic investment and GDP causing each other.

The seventh row of above table shows that the null hypothesis, $d(\text{FDIINFLOW}, 2)t-1$ does not Granger Cause $d(\text{GDP}, 2)$, is rejected at 9.5 percent level of significance and therefore, Second different of lag FDI inflow ($d(\text{FDIINFLOW}, 2)$) Granger causes the second difference of Gross Domestic Product ($d(\text{GDP}, 2)$). It has unidirectional relation and means that the lag FDI inflow induced the current output.

As per the Granger Causality Tests, domestic investment and GDP has bidirectional relation, Domestic investment and output determinants of each other. Lag value of domestic investment and GDP has also bidirectional relation, it means that previous domestic investment and current output is also determined each other. Lag FDI inflow also causes the current output. It seems that the lagged value of domestic investment and FDI inflow support the current GDP in India.

Pakistan

Regression with structural break

$$d(\text{GDP}, 2)_t = \alpha_0 + \sum_{i=1}^n \beta_1 d(\text{GFCF}, 2)_t + \sum_{i=1}^n \beta_2 d(\text{FDIINFLOW}, 2)_t + \sum_{i=2016}^n \beta_3 \text{SB}d(\text{GDP}, 2)_t + e_t$$

..... e5

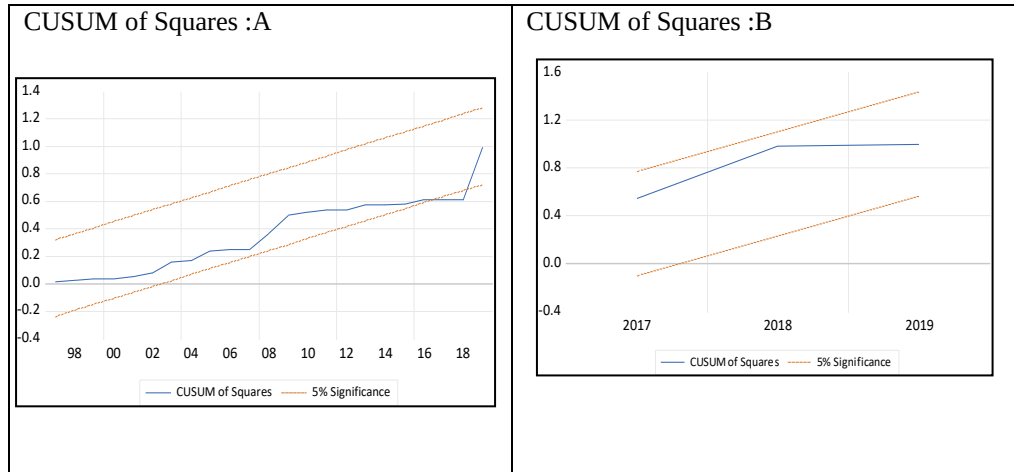
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Where, $d(GDP,2)_t$ =Second difference of GDP in year t;
 $d(GFCF,2)_t$ =Second difference of GFCF in year t;
 $d(FDIINFLOW,2)_t$ =Second difference of FDI inflow in year t;
 $SBd(GDP,2)_t$ = Structural break of second difference of GDP in year t;
 α, β_1, β_2 and β_3 are the parameters.

Dependent Variable:	$d(GDP,2)$		$SBd(GDP,2)$	2016
Included observations:	26 after adjustments			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
$d(GFCF,2)$	0.1888	0.1823	1.0355	0.3117
$d(FDIINFLOW,2)$	-0.0689	0.3857	-0.1787	0.8598
$SBd(GDP,2)$	0.8680***	0.2210	3.9277	0.0007
C	314000000.0000	395000000.000	0.7942	0.4356
R-squared	0.6252			
Adjusted R-squared	0.5741			
F-statistic	12.2313			
Durbin-Watson stat	2.1854			
Prob(F-statistic)	0.0001			

Note:- The lower and upper limits of D-W statistics for 3 explanatory variables are : $dL=0.928$, $dU=1.410$. *** significant at 1 % , ** significant at 5% and *significant at 10% level.

Only significant coefficient of the equation (e5) has been interpreted. The estimate of the coefficient of Structural Break ($SBd(GDP,2)$) β_3 is positive and significant. This suggests that the structural break impacts the stability of the model. CUSUM of square model from the year 2016 at 5% significance is confirming the stability of model with the consideration of structural break in GDP in 2016 as shown in figure for CUSUM squares A & B. Without structural break that model was not stables. R-square value is also high; it means the independent variables explain the dependent variables by 62 %. Null hypothesis of non-autocorrelation errors in favour of negative first order autocorrelation, therefore not reject the null hypothesis, calculated value ($4 - 2.185=1.814$) is above the upper bound of tabulated value; means the series are auto-correlated of negative first order autocorrelation.



Regression with lag of independent variables

$$d(GDP, 2)_t = \alpha_0 + \sum_{i=1}^n \beta_1 d(GFCF, 2)_t + \sum_{i=1}^n \beta_2 d(FDIINFLOW, 2)_t + \sum_{i=1}^n \beta_3 d(GFCF, 2)_{t-1} + \sum_{i=1}^n \beta_4 d(FDIINFLOW, 2)_{t-1} + e_t$$

..... e6

Where ,

$d(GDP, 2)_t$ = Second difference of GDP in year t;

$d(GFCF, 2)_t$ = Second difference of GFCF in year t;

$d(FDIINFLOW, 2)_t$ = Second difference of FDI inflow in year t;

$d(GFCF, 2)_{t-1}$ = Second difference of GFCF in lag year t;

$d(FDIINFLOW, 2)_{t-1}$ = Second difference of FDI inflow in lag year t;

$\alpha, \beta_1, \beta_2, \beta_3$ and β_4 are the parameters.

Dependent Variable: $d(GDP, 2)$
Included observations: 25 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$d(GFCF, 2)$	0.1813	0.1688	1.0740	0.2956
$d(FDIINFLOW, 2)$	0.1177	0.3401	0.3461	0.7329
$d(GFCF, 2)_{t-1}$	0.2199	0.1299	1.6926	0.1061
$d(FDIINFLOW, 2)_{t-1}$	1.0756***	0.3320	3.2403	0.0041
C	483000000.0000	337000000.0000	1.4341	0.1670

R-squared 0.4124

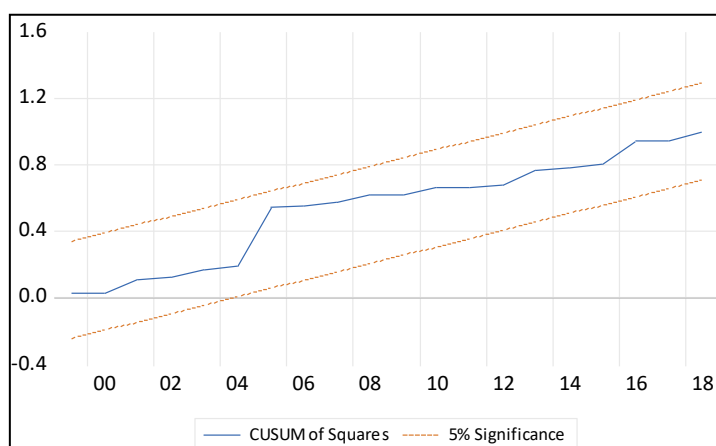
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Adjusted R-squared	0.2949
F-statistic	3.5094
Durbin-Watson stat	2.2728
Prob(F-statistic)	0.0251

Note:- The lower and upper limits of D-W statistics for 4 explanatory variables are : dL=0.832, dU=1.521. *** significant at 1 % , ** significant at 5% and *significant at 10% level

Only significant coefficient of the equation (e6) has been interpreted. The estimate of the coefficient of lag of second difference of FDI inflow ($d(\text{FDIINFLOW}, 2)$), β_4 (1.07) is positively significant. This suggests that the lagged foreign direct investment positively impact the output. One unit of lagged FDI inflow is transformed in (1.07) unit of output. CUSUM of square model at 5% significance is confirming the stability of model in figure for CUSUM squares C. R-square value means the independent variables explain the dependent variables by 41 %. Null hypothesis of non-autocorrelation errors in favour of negative first order autocorrelation, therefore not reject the null hypothesis, calculated value ($4 - 2.272 = 1.727$) is above the upper bound of tabulated value; means the series are auto-correlated of negative first order autocorrelation.

CUSUM of Squares: C



The second row of table 07 in Appendix A shows that the null hypothesis, $d(\text{GDP}, 2)$ does not Granger Cause $d(\text{GFCF}, 2)$, is rejected at 1.3 percent level of significance therefore, second difference of Gross Domestic Product ($d(\text{GDP}, 2)$) and second different GFCF ($d(\text{GFCF}, 2)$) has bidirectional relationship. It means that the GDP causes the domestic investment .

The fourth row of above table shows that the null hypothesis, $d(\text{GDP}, 2)$ does not Granger Cause $d(\text{FDIINFLOW}, 2)$, is rejected at 0.0 percent level of significance and therefore, Second different GDP ($d(\text{GDP}, 2)$)Granger causes second difference of foreign direct investment inflow ($d(\text{FDIINFLOW}, 2)$). It means that unidirectional relation confirms the GDP induced the foreign direct investment inflow.

The fifth row of above table shows that the null hypothesis, $d(\text{GFCF}, 2)_t-1$ does not Granger Cause, $d(\text{GDP}, 2)_t-1$ is rejected at 0.05 percent level of significance, therefore, lag value of second difference of Gross Fixed Capital Formation $d(\text{GFCF}, 2)_t-1$ and Gross Domestic Product ($d(\text{GDP}, 2)_t-1$) has unidirectional relationship. It means that the lag domestic investment induces lagged GDP.

The ninth and tenth row of above table shows that the null hypothesis, $d(\text{GFCF}, 2)$ does not Granger Cause $d(\text{FDIINFLOW}, 2)$, is rejected at 0.0 percent level of significance, and $d(\text{FDIINFLOW}, 2)$ does not Granger Cause $d(\text{GFCF}, 2)$, is rejected at 9.1 percent level of significance, therefore, Second different gross fixed capital formation ($d(\text{GFCF}, 2)$) and second difference of foreign direct investment inflow ($d(\text{FDIINFLOW}, 2)$) has bidirectional relationship. It means that the domestic investment and foreign direct investment inflow are causing each other.

The fourteenth row of above table shows that the null hypothesis, $d(\text{FDIINFLOW}, 2)$ does not Granger Cause $d(\text{GFCF}, 2)_t-1$, is rejected at 1.8 percent level of significance, therefore, second difference of foreign direct investment inflow ($d(\text{FDIINFLOW}, 2)$) and lag of second different gross fixed capital formation ($d(\text{GFCF}, 2)_t-1$) and has unidirectional relationship.

The fifteenth and sixteenth row of above table shows that the null hypothesis, $d(\text{FDIINFLOW}, 2)_t-1$ does not Granger Cause $d(\text{GFCF}, 2)_t-1$, is rejected at 0.0 percent level of significance, and $d(\text{GFCF}, 2)_t-1$ does not Granger Cause $d(\text{FDIINFLOW}, 2)_t-1$, is rejected at 9.1 percent level of significance, therefore, Lag of second different gross fixed capital formation ($d(\text{GFCF}, 2)_t-1$) and lag of second difference of foreign direct investment inflow ($d(\text{FDIINFLOW}, 2)_t-1$) has bidirectional relationship. It means that the lag of domestic investment and lag of foreign direct investment inflow are causing each other.

As per the Granger Causality Tests, GDP and domestic investment has bidirectional relation, output determines the domestic investment. GDP and FDI inflow also has bidirectional relationship, GDP determine the FDI inflow. Lag of domestic investment determines the current GDP. Current and lag, FDI inflow and domestic investment are causing each other.

Russia

Regression with structural break

$$d(\text{GDP}, 2)_t = \alpha_0 + \sum_{i=1}^n \beta_1 d(\text{GFCF}, 2)_t + \sum_{i=1}^n \beta_2 d(\text{FDIINFLOW}, 2)_t + \sum_{i=2009}^n \beta_3 \text{SB}d(\text{GDP}, 2)_t + e_t$$

Where , e_t
 $d(\text{GDP}, 2)_t$ =Second difference of GDP in year t;
 $d(\text{GFCF}, 2)_t$ =Second difference of GFCF in year t;

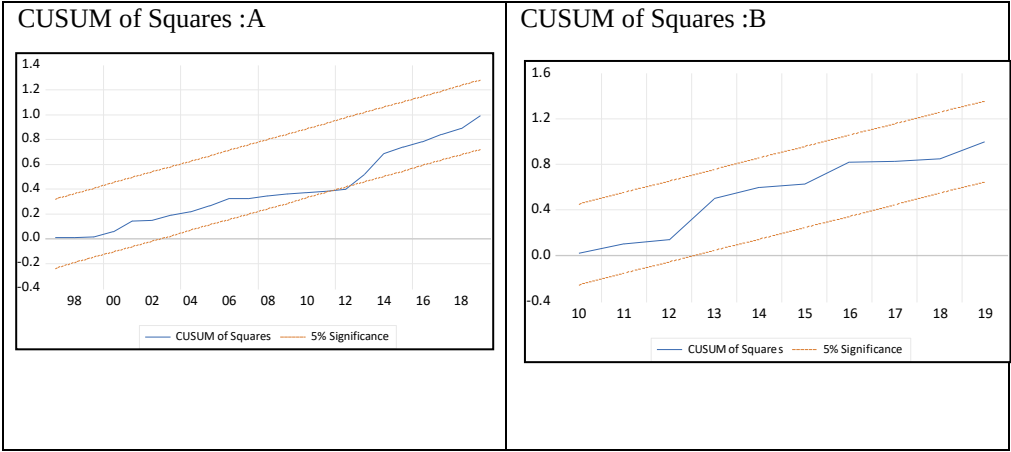
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$d(\text{FDIINFLOW}, 2)_t$ = Second difference of FDI inflow in year t ;
 $\text{SBd}(\text{GDP}, 2)_t$ = Structural break of second difference of GDP in year t ;
 α, β_1, β_2 and β_3 are the parameters.

Dependent Variable:	$d(\text{GDP}, 2)$		$\text{SBd}(\text{GDP}, 2)$	2009
Included observations:	26 after adjustments			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
$d(\text{GFCF}, 2)$	0.4424	0.3562	1.2419	0.2274
$d(\text{FDIINFLOW}, 2)$	-0.1061	0.3541	-0.2997	0.7672
$\text{SBd}(\text{GDP}, 2)$	0.9051***	0.1555	5.8221	0.0000
C	5420000000.0	7030000000.0	0.7708	0.4491
R-squared	0.7563			
Adjusted R-squared	0.7231			
F-statistic	22.7567			
Durbin-Watson stat	2.724594			
Prob(F-statistic)	0.000001			

Note:- The lower and upper limits of D-W statistics for 3 explanatory variables are : $dL=0.928$, $dU=1.410$. *** significant at 1 % , ** significant at 5% and *significant at 10% level.

Only significant coefficient of the equation (e7) has been interpreted. The estimate of the coefficient of Structural Break ($\text{SBd}(\text{GDP}, 2)$) β_3 is positive and significant. This suggests that the structural break impacts the stability of the model. CUSUM of square model from the year 2009 at 5% significance is confirming the stability of model with the consideration of structural break in GDP in 2009 as shown in figure for CUSUM squares A & B. Without structural break that model was not stables. R-square value is also high; it means the independent variables explain the dependent variables by 75 %. Null hypothesis of non-autocorrelation errors in favour of negative first order autocorrelation and inconclusive or as per conservatism, not reject the null hypothesis, calculated value ($4 - 2.724 = 1.275$) is lied in between the lower and upper bound of tabulated value; means the series are auto-correlated of negative first order autocorrelation.



Regression with lag of independent variables

$$\begin{aligned} d(\text{GDP}, 2)_t = & \alpha_0 + \sum_{i=1}^n \beta_1 d(\text{GFCF}, 2)_t + \sum_{i=1}^n \beta_2 d(\text{FDIINFLOW}, 2)_t \\ & + \sum_{i=1}^n \beta_3 d(\text{GFCF}, 2)_{t-1} + \sum_{i=1}^n \beta_4 d(\text{FDIINFLOW}, 2)_{t-1} + e_t \end{aligned}$$

.....e8

Where, $d(\text{GDP}, 2)_t$ =Second difference of GDP in year t;
 $d(\text{GFCF}, 2)_t$ =Second difference of GFCF in year t;
 $d(\text{FDIINFLOW}, 2)_t$ =Second difference of FDI inflow in year t;
 $d(\text{GFCF}, 2)_{t-1}$ =Second difference of GFCF in lag year t;
 $d(\text{FDIINFLOW}, 2)_{t-1}$ =Second difference of FDI inflow in lag year t;
 $\alpha, \beta_1, \beta_2, \beta_3$ and β_4 are the parameters.

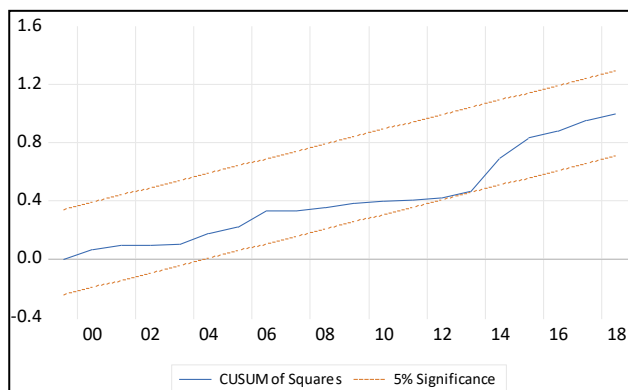
Dependent Variable:	d(GDP,2)			
Included observations:	25 after adjustments			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
d(GFCF,2)	1.2867**	0.5344	2.4078	0.0258
d(FDIINFLOW,2)	0.7409	0.6806	1.0886	0.2893
d(GFCF,2)t-1	-0.1909	0.6438	-0.2966	0.7699
d(FDIINFLOW,2)t-1	0.3309	0.6980	0.4741	0.6406
C	4040000000.0000	11200000000.0000	0.3610	0.7219
R-squared	0.4516			
Adjusted R-squared	0.3419			
F-statistic	4.1171			
Durbin-Watson stat	2.5234			

Prob(F-statistic) 0.0136

Note:- The lower and upper limits of D-W statistics for 4 explanatory variables are : dL=0.832, dU=1.521. *** significant at 1 % , ** significant at 5% and *significant at 10% level

Only significant coefficient of equation (e8) has been interpreted. The estimate of the coefficient of second difference of the gross fixed capital formation ($d(GFCF,2)$), β_1 is (1.28) positive and significant. This suggests that the domestic investment impacts the GDP of China. One unit of domestic investment transformed into 1.28 units of output. CUSUM of square model 5% significance is confirming the stability, as shown in figure for CUSUM squares C. R-square value means that the independent variables explain the dependent variables by 45 %. Null hypothesis of non-autocorrelation errors in favour of negative first order autocorrelation and inconclusive or as per conservatism, not reject the null hypothesis, calculated value ($4 - 2.523=1.477$) is lied in between the lower and upper bound of tabulated value; means the series are auto-correlated of negative first order autocorrelation.

CUSUM of Squares: C



The fifth and sixth row of table 08 in Appendix A shows that the null hypothesis, $d(GFCF,2)t-1$ does not Granger Cause $d(GDP,2)$ is rejected at 0.00 percent level of significance, and $d(GDP,2)$ does not Granger Cause $d(GFCF,2)t-1$, is rejected at 8.5 percent level of significance therefore, lag value of second difference of Gross Fixed Capital Formation $d(GFCF,2)t-1$ and Gross Domestic Product ($d(GDP,2)$) has bidirectional relationship. It means that the lag domestic investment and GDP causing each other

The seventh row of above table shows that the null hypothesis, $d(FDIINLFLOW,2)t-1$ does not Granger Cause $d(GDF,2)$, is rejected at 6.1 percent level of significance and therefore, Second different of lag FDI inflow ($d(FDIINFLOW,2)$) Granger causes the second difference of Gross Domestic Product($d(GDP,2)$). It has unidirectional relation and means that the lag FDI inflow induced the current output.

The eleventh row of above table shows that the null hypothesis, $d(FDIINFLOW,2)t-1$ does not Granger Cause $d(GFCF,2)$, is rejected at 1.4 percent level of significance, therefore, Lag of second difference of foreign direct investment inflow ($d(FDIINFLOW,2)$) and second different gross fixed capital formation ($d(GFCF,2)$) has unidirectional relationship. It means that the

Lag of foreign direct investment inflow causes domestic investment. Domestic investment is made as per the future scope of FDI inflow.

The thirteenth row of above table shows that the null hypothesis, $d(\text{GFCF}, 2)_{t-1}$ does not Granger Cause $d(\text{FDIINFLOW}, 2)$, is rejected at 0.0 percent level of significance. Therefore, there is unidirectional relation and means that the lag domestic investment of a country induced the foreign direct investment inflow. Present FDI inflow is based on lagged domestic investment.

As per the Granger Causality test the lag domestic investment and FDI inflow impacts the current output. FDI inflow creates the scope of needed domestic investment. It means that the FDI inflow and domestic investment is complimentary for each other to increase the output in Russia.

USA

Regression with structural break

$$d(\text{GDP}, 2)_t = \alpha_0 + \sum_{i=1}^n \beta_1 d(\text{GFCF}, 2)_t + \sum_{i=1}^n \beta_2 d(\text{FDIINFLOW}, 2)_t + e_t$$

..... e9

Where , $d(\text{GDP}, 2)_t$ =Second difference of GDP in year t;
 $d(\text{GFCF}, 2)_t$ =Second difference of GFCF in year t;
 $d(\text{FDIINFLOW}, 2)_t$ =Second difference of FDI inflow in year t;
 α, β_1 and β_2 are the parameters.

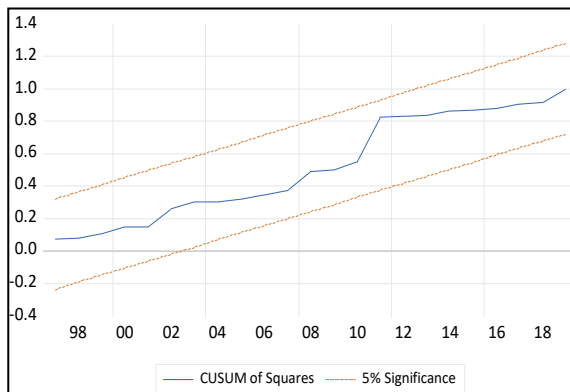
Dependent Variable:	d(GDP,2)			
Included observations:	26 after adjustments			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
d(GFCF,2)	1.2450***	0.1369	9.0935	0.0000
d(FDIINFLOW,2)	0.4185***	0.1299	3.2204	0.0038
C	3750000000.0000	0	0.2206	0.8274
R-squared	0.8558			
Adjusted R-squared	0.8433			
F-statistic	68.2596			
Durbin-Watson stat	2.6978			
Prob(F-statistic)	0.0000			

Note:- The lower and upper limits of D-W statistics for 2 explanatory variables are : dL=1.000, dU=1.311. *** significant at 1 % , ** significant at 5% and *significant at 10% level.

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Only significant coefficient of the equation (e9) has been interpreted. The estimate of the coefficient of second difference of the gross fixed capital formation (d(GFCF,2)) and second difference of FDI inflow (d(FDIINFLOW,2)), β_1 (1.245) is positively significant, and β_2 (0.4185) also positively significant respectively. This suggests that the domestic investment positively impact the output, and foreign direct investment also positively impact the output. One unit of domestic investment transformed in 1.24 unit of output, and one unit of FDI inflow transformed in 0.41 unit of output. CUSUM of square model at 5% significance is confirming the stability of model in figure for CUSUM squares A. R-square value means the independent variables explain the dependent variables by 85 %. Null hypothesis of non-autocorrelation errors in favour of negative first order autocorrelation and inconclusive or as per conservatism, not reject the null hypothesis, calculated value (4 -2.697=1.302) is lied in between the lower and upper bound of tabulated value; means the series are auto-correlated of negative first order autocorrelation.

CUSUM of Squares :A



Regression with lag of independent variables

$$d(GDP, 2)_t = \alpha_0 + \sum_{i=1}^n \beta_1 d(GFCF, 2)_t + \sum_{i=1}^n \beta_2 d(FDIINFLOW, 2)_t + \sum_{i=1}^n \beta_3 d(GFCF, 2)_{t-1} + \sum_{i=1}^n \beta_4 d(FDIINFLOW, 2)_{t-1} + e_t$$

.....e10

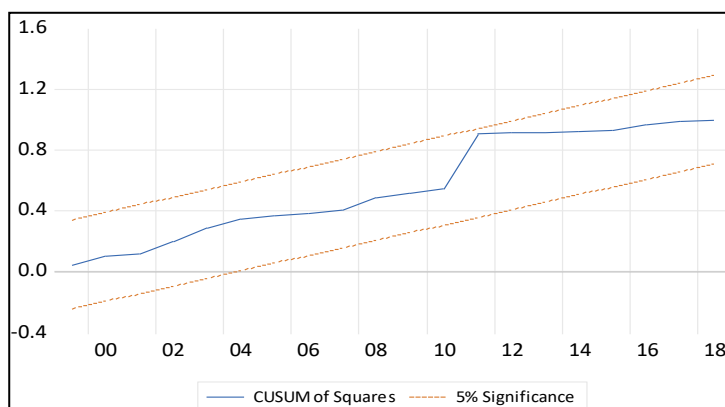
Where,
 $d(GDP, 2)_t$ = Second difference of GDP in year t;
 $d(GFCF, 2)_t$ = Second difference of GFCF in year t;
 $d(FDIINFLOW, 2)_t$ = Second difference of FDI inflow in year t;
 $d(GFCF, 2)_{t-1}$ = Second difference of GFCF in lag year t;
 $d(FDIINFLOW, 2)_{t-1}$ = Second difference of FDI inflow in lag year t;
 $\alpha, \beta_1, \beta_2, \beta_3$ and β_4 are the parameters.

Dependent Variable:	d(GDP,2)			
Included observations:	25	after adjustments		
Variable	Coefficient	Std. Error	t-Statistic	Prob.
d(GFCF,2)	1.1739***	0.1433	8.1921	0.0000
d(FDIINFLOW,2)	0.5487***	0.1588	3.4545	0.0025
d(GFCF,2)t-1	0.0721	0.1380	0.5228	0.6068
d(FDIINFLOW,2)t-1	0.1041	0.1490	0.6986	0.4928
C	8720000000.0000	17300000000.0000	0.5050	0.6191
R-squared	0.8738			
Adjusted R-squared	0.8486			
F-statistic	34.6226			
Durbin-Watson stat	2.7447			
Prob(F-statistic)	0.0000			

Note:- The lower and upper limits of D-W statistics for 4 explanatory variables are : dL=0.832, dU=1.521. *** significant at 1 % , ** significant at 5% and *significant at 10% level.

Only significant coefficient of the equation (e10) has been interpreted. The estimate of the coefficient of second difference of the gross fixed capital formation (d(GFCF,2)) and second difference of FDI inflow (d(FDIINFLOW,2)), β_1 (1.17) is positively significant, and β_2 (0.54) also positively significant respectively. This suggests that the domestic investment positively impact the output, and foreign direct investment also positively impact the output. One unit of domestic investment transformed in 1.17 unit of output, and one unit of FDI inflow transformed in 0.54 unit of output. CUSUM of square model at 5% significance is confirming the stability of model in figure for CUSUM squares A. R-square value means the independent variables explain the dependent variables by 87 %. Null hypothesis of non-autocorrelation errors in favour of negative first order autocorrelation and inconclusive or as per conservatism, not reject the null hypothesis, calculated value (4 -2.744=1.255) is lied in between the lower and upper bound of tabulated value; means the series are auto-correlated of negative first order autocorrelation.

CUSUM of Squares :B



The fifth and sixth row of table 09 in Appendix A shows that the null hypothesis, $d(\text{GFCF},2)t-1$ does not Granger Cause, $d(\text{GDP},2)$ is rejected at 0.00 percent level of significance, therefore, lag value of second difference of Gross Fixed Capital Formation $d(\text{GFCF},2)t-1$ and Gross Domestic Product ($d(\text{GDP},2)$) has unidirectional relationship. It means that the lag domestic investment causes current GDP.

The seventh row of above table shows that the null hypothesis, $d(\text{FDIINFLOW},2)t-1$ does not Granger Cause $d(\text{GDP},2)$, is rejected at 0.0 percent level of significance and therefore, Second different of lag FDI inflow ($d(\text{FDIINFLOW},2)$) Granger causes the second difference of Gross Domestic Product($d(\text{GDP},2)$). It has unidirectional relation and means that the lag FDI inflow induced the current GDP.

The thirteenth row of above table shows that the null hypothesis, $d(\text{GFCF},2)t-1$ does not Granger Cause $d(\text{FDIINFLOW},2)$, is rejected at 7.0 percent level of significance. Therefore, there is unidirectional relation and means that the lag domestic investment of a country induced the foreign direct investment inflow. Present FDI inflow is based on lagged domestic investment.

As per Granger causality test that lag of domestic investment and FDI inflow causes the current output of USA. It means that the domestic investment and FDI inflow is complementary for output growth in USA.

Conclusion, relevance and scope of the study

This study answers the questions in the nature of comparative. As per the objectives the first null hypothesis is, FDI does not complement or substitute domestic investment, second, FDI does not cause domestic investment and vice-versa, and third, FDI and domestic investment does not cause growth of an economy, has been analysed by regression analysis and granger causality test.

First hypothesis can't accept and significantly concluded that as per Granger Causality Tests, foreign direct investment inflow and domestic investments seems the complimentary of each other to increase the aggregate output which is supported by (Tang, Selvanathan, & Selvanathan, 2008) in China. The regression analysis with structural break did not support any result of Granger causality test, but the regression analysis with lag variables rejects the third hypothesis and confirm the cause of current FDI to output in China. Second null hypothesis is rejected, and domestic investment causes the FDI inflow which is supported by (Paolino, 2009) in China. That why there are the contradictory to say that the domestic investments and foreign investment complimentary or substitute each other in the expansion of GDP, but GDP causes domestic investment as well as foreign direct investment in China.

Regression and Granger Causality test confirm that the current as well as lag of domestic investment impacts the GDP that is also argued by (Teli, 2014). Lagged FDI impacts the current GDP. Here third hypothesis rejects, and the lagged domestic investment and foreign direct investment cause the current GDP. First hypothesis is rejected, and domestic investment and foreign direct investment complementary for each other in previous period and supported by (Haq & Zhu, 2016), and but substitute the current need of investment in India.

As per the regression with structural break, structural break significantly impacts the economy. Third null hypothesis rejects, and regression with lag variables confirms the lag of FDI inflow impact the current GDP in Pakistan. Regression and Granger Causality test gives the contradictory result that did not confirm any complimentary or substitution between FDI inflow and domestic investment in expansion of GDP in Pakistan. Second null hypothesis is also rejected, and FDI inflow and domestic investment causes each other, supported by (Ullah, Shah & Khan, 2014), and as per (Haq & Zhu, 2016) FDI inflow substitute domestic investment in Pakistan.

Regression with structural break, structural break significantly impacts the economy. Third null hypothesis also rejects, and regression with lag variables confirms the lag of domestic investment causes the current GDP in Russia. It seems that regression and Granger Causality test gives the confirmation that the domestic investment is important in expansion of GDP. Second null hypothesis is also rejected, and FDI inflow causes the domestic investment, it is also confirm by (IPEK & KIZILGOL, 2015) in Russia. FDI inflow doesn't have any significant roles in economy, the contradiction made by (Taganov, 2014) in Russia.

As per the regression with structural break and lag variables the third null hypothesis is rejected, current and lag of domestic investment impact the current GDP. First null hypothesis is also rejected, and Domestic investment and FDI inflow is complementary which is also supported by (Desai, Foley, & Hines Jr, 2005) in USA.

Relevance and Scope of research

The role of domestic investment and FDI inflow in growth process has been differently played. USA a high-income economy has been effectively coordinating the domestic investment with FDI inflow and achieving desired output. Upper middle-income economies like China and Russia are relay on domestic investment that causes the GDP. FDI inflow also works to enhance

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the production capacity. But GDP is the determinant of FDI in such economies. In lower middle income nation such as India getting the benefit of the previous domestic investment and FDI inflow, but in current year data FDI inflow substitute the domestic investment. A second lower middle-income nation, Pakistan rely on FDI inflow, and FDI inflow and domestic investment are interdependent. It means to say, 'You cannot put the same shoe on every foot.'

Further, how countries deal with domestic or foreign investment for anticipated growth? This question is the very relevant scope for further analysis with different sample area and size with same models.

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