Int.J.HIT.TRANSC:ECCN.Vol.8: Issue 2A (2022) Page 39-62 ISSN: 0973-6875

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ORIGINAL CONTRIBUTION

DOES FDI IN THE SECONDARY AND TERTIARY SECTORS ACCELERATE ECONOMIC GROWTH IN INDIA? : AN EMPIRICAL ANALYSIS

Mr. Prasenjit Makur * and Arkajyoti Jana†

**Assistant Professor of Commerce, Calcutta Girls' College, 3, Goaltuli Lane, Kolkata-13, West Bengal*

†Assistant Professor of Economics, Calcutta Girls' College, 3, Goaltuli Lane, Kolkata-13, West Bengal, India

ABSTRACT

Purpose of the study: Foreign Direct Investment (FDI) plays an instrumental role in propelling economic growth, particularly evident in the rapid development witnessed by China and other south Asian nations. Its influence on the Indian economy is undeniable, offering a plethora of benefits. This paper attempts to explore the causal relationships between FDI inflows and the select sectoral Gross Value Added (GVA) as proximity to economic growth.

Methodology: This study aims to analyse the growth of major sectors in India that receive the bulk amount of foreign direct investment (FDI) inflows. It will cover the period from 2007-08 to 2019-20, using quarterly data from sectoral statistics published by the Reserve Bank of India (RBI) and other government agencies. The study will employ econometric techniques, like ARDL long run form and bounds test, VEC Granger causality tests, to identify long run cointegration and causal relationships between FDI inflows and sectoral-specific growth. Additionally, variance decomposition test has been performed to investigate the level of exogeneity of the study's variables. Further the study captured impulse response function to provide a numerical estimate of the effects over a number of future time periods.

Originality: This study's findings will help policymakers and regulators to determine the factors that not just attract FDI but also make the process worthwhile in terms of higher growth and development. This study may be unique in terms of determining types and magnitudes of causal relations in this context.

Findings: A long-run association between FDI and the sector -specific GVA under investigation was found to be co-integrating. The findings suggest a unidirectional causal relationship among sector-specific FDI and sector -specific GVA and total GVA. Additionally, the study shows that the tertiary sector FDI Granger causes total GVA but the secondary sector does not Granger cause total GVA.

Paper Type: This is an empirical research paper based on secondary data

.**KEY WORDS:** VECM, Economic Growth, FDI, ARDL, Cointregation

*Corresponding Address: prasenjitmakur06@gmail.com

1. INTRODUCTION

The relationship between Foreign Direct Investment (FDI) and economic growth is a subject of ongoing academic debate, characterized by a degree of ambiguity and complexity. While a substantial body of literature posits a positive correlation between FDI and economic growth, the empirical evidence presents a more nuanced picture. The impact of FDI on economic growth appears to be contingent on a multitude of factors, including the sectoral allocation of FDI, the absorptive capacity of the host economy, and the policy environment, among others. This introduces a level of variability and uncertainty in the relationship, making it challenging to draw definitive conclusions. Furthermore, the mechanisms through which FDI influences economic growth - such as technology transfer, human capital formation, and integration into global markets - are not fully understood, adding another layer of complexity.

One of the oldest ideas in this area, the endogenous growth theory, predicts a positive association between FDI and economic growth, although actual results have not always supported this theoretical assertion. Since the institutional, policy, and regulatory environments that affect FDI and growth are always changing, it is practically impossible to generalize the relationship between the two (Herzer & Klasen, 2008). Notably, development economists from emerging and developed economies have recently started to acknowledge that the sectoral distribution of inward foreign direct investment is another significant factor contributing to the variation in findings among economies. Subsequent research frequently highlights that the impact that FDI would have on the process of economic growth hinges on how sector-wise it is split (Alfaro, 2003; Borensztein, De Gregorio, & Lee, 1998; Hirschman, 1958). These studies suggest that FDI is not likely to have the same economic effects throughout an economy's sectors. This is because—among other things—each of these sectors has a distinct technological foundation, investment absorption capacity, and regulatory framework (Borensztein et al., 1998; Li & Liu, 2005). Hirschman (1958) asserted that not all sectors have the same capacity to take in technology and finance from outside or to establish connections with other segments of the economy. The relationship between the host nation's human capital and technological foundation and the dynamics of foreign direct investment (FDI) and economic growth was once again supported by Borensztein et al. (1998) and Li and Liu (2005). They argue that foreign direct investment (FDI) with a technology gap has a major adverse influence on economic growth in developing nations and that FDI only has a positive effect when combined with human capital. Consequently, it is clear why the impact of foreign direct investment (FDI) can differ depending on sector or even industry specifications (Chakraborty & Nunnenkamp, 2008). It is important to note that economic research on the relationship between total foreign direct investment (FDI) and aggregate growth was predicated on the shaky premise that FDI in various sectors would have an equal impact on economic growth (Wang, 2009) and that these studies were homogeneous.

Therefore, a more thorough examination of this relationship must handle FDI appropriately before connecting it to economic growth.

Based on the most recent data available, the agriculture and allied sector in India only contributes 16.27% of the gross value added (at constant 2011-12 price) of the nation's economy (Source: INDIA KLEMS database 2021). The industry sector, which accounts for 30.16 percent of the nation's total GVA, is represented by the secondary sector of the economy. The largest economic sector in India is the service industry, which generates 53.57 percent of the country's GVA.

Of the three economic sectors in India, the agriculture and allied sector has the least potential for connection and spillover with the other sectors because of its inadequate technology base, conventional operations, weak infrastructure, low level of output commercialization, lack of activity diversification, and so forth. Unlike the

other two sectors, the agriculture and allied sector's growth is also quite erratic, which is mostly because of its heavy reliance on environmental factors including temperature, rainfall, and natural hazards. Compared to the agriculture and allied sectors, foreign direct investment (FDI) in the industry and, more specifically, the service sectors, has a higher potential to positively influence the expansion of the corresponding sectors because of the clearer connections and potential for spillover.

There has been a lot of research done on the relationship between FDI and economic growth in India (Gupta & Garg, 2015; Kaur, Yadav, & Gautam, 2013; Sahu & Pandey, 2018), but to our knowledge, not much work has been done on a sector-specific study. Furthermore, the Indian economy differs more from most other rising countries in terms of sectoral differences in terms of economic contribution, linkage, and spillover potential, dependent on external variables, and so forth. Also Aykut & Sayek, 2007) advocated that FDI is correlated with economic activity; each sector requires a different approach because of the high cross-sectoral adaptability, heterogeneity in individual characteristics, and variable contribution towards growth.

After considering extended research it is worthwhile to look at the sector-specific FDI-growth relationship in a nation like India, where each sector has unique characteristics and, consequently, varies greatly in its capacity to produce an impact from FDI. At this point, the analysis is a little more focused because it looks at how industry and service sector FDI inflows can impact the growth of the economy separately.

2.Literature Review

Researchers in the field of development economics from both advanced and emerging economies have shown a keen interest in studying the relationship between foreign direct investment (FDI) and a nation's economic growth. Studies on the relationship between FDI and growth that are sector-specific are, however, extremely scarce. A thorough analysis of economic research yields a small number of papers that address the significance of sectors in the relationship between FDI and growth. An overview of the research done to determine how foreign direct investment (FDI) affects the expansion of various economic sectors—or, in certain situations, a single sector—is provided in this section.

Aitken, Hanson, and Harrison (1997) began our review from Bangladesh, one of India's neighbouring countries, and found evidence of positive spillovers from FDI's investment in the nation's economy as well as a positive impact of FDI on the creation of jobs and export promotion from the manufacturing sector through the use of sophisticated technology.

Alfaro (2003) was conducted yet another noteworthy study . The study examines how FDI inflows in various sectors, including agriculture, manufacturing, and services, had varying effects on economic growth across national borders. The empirical analysis showed that because of improved spillover connectivity, FDI inflows only significantly and favourably affect economic growth in the manufacturing sectors. FDI inflows in mining and agriculture had little potential for spillover, which harms growth. The analysis did, however, showed that the impact of FDI inflows in the service sectors was not evident.

In a somewhat similar attempt, Mathiyazhagan & Sahoo (2008) noted how output, export, and labour productivity did not significantly co-integrate with FDI in core sectors such as power and fuels, transportation, chemicals, food processing, and so on. This was observed under a panel co-integration test in the context of the Indian economy.

Using a data set comprising 33 nations, Aykut and Sayek (2007) sought to determine the impact of the sectoral

composition of FDI on the economic growth of the host country.

In consistent with the results of earlier cross-country related study by Alfaro (2003).This analysis showed that when FDI was biased with respect to the manufacturing sector, it had a considerable and beneficial impact on economic growth, which was FDI accelerated economic growth in the manufacturing sector ,in contrast hurts primary or service sectors,. Lastly, the study recommended that nations should consider measures that will aid in optimising benefits through suitable inflow composition in addition to concentrating on attracting larger volumes of FDI.

Simultaneously, Msuya (2007) discovered in the context of the Tanzanian economy that FDI had a positive impact on agricultural growth as a result of small farmers' strong links to integrated production systems.

In a follow-up study, Chakraborty and Nunnenkamp (2008) used an industry-specific analysis to examine the impact of foreign direct investment (FDI) on India's economic growth using the Granger causality test inside a panel co-integration framework. The analysis advocated no causal association between FDI and primary sector output , but it indicated that they were reciprocally buttressing in the manufacturing sector. The study also noted that FDI had a transient impact on India's service sector. Additionally, it was discovered that cross-sector spillover from foreign direct investment in the service sector impacts the manufacturing sector as well.

The Wang (2009) research had also supported the disposition of FDI, particularly in the industrial sector. The study, which was conducted between 1987 and 1997 using 12 Asian economies as sample, argued that while FDI inflows into the manufacturing sectors were crucial for boosting economic growth, other sectors were unable to provide a positive stimulus. This study offered some insight into the various ways that inward FDI at the sector level promoted economic growth.

Yu and Walsh (2010) examined a range of institutional, developmental, and macroeconomic factors that influence foreign direct investment inflows in a sample of 26 developed and developing nations. Based on empirical data, it appeared that there was no significant correlation between macroeconomic stability, institutional quality, and development level and primary sector FDI. An economy seems to attract more secondary FDI when it had a poorly real effective exchange rate, a spare supple labour market, a rooted finance market, and so on. However, because these economies were expanding faster and had superior infrastructure, they also watched bigger inflows of foreign direct investment (FDI) into the service sector. In conclusion, this research finds that macroeconomic factors—such as a stronger currency rate and lower average inflation—were more significant in luring developed nations' increased foreign direct investment into the services sector.

In consistent with the majority of previous studies Srikanth and Kishore (2012) demonstrated bidirectional causality between FDI and India's industrial production as determined by the Index of Industrial Production. Furthermore, Oloyede (2014) provided evidence that FDI influx had a positive influence on Nigeria's agricultural output growth, which was consistent with Msuya's (2007) findings. Still, research by Alam and Mittal (2014), Maheswari (2015), and Sahu and Pandey (2018) supported the similar effect of FDI as proposed by Chakraborty and Nunnenkamp (2008) on the expansion of industrial production in the Indian economy.

The data from China and the Indian economy are likewise fairly comparable. Agya & Wunuji (2014) conducted a

sector-specific analysis and came to the conclusion that, in the case of China, economic growth did not a cause in the primary sector FDI , nor does the primary sector FDI cause economic growth. The analysis found a bidirectional causal relationship between economic growth and FDI inflows into the secondary sector. Once more, the study showed a unidirectional causal relationship between FDI inflows to the tertiary sector of the economy and economic growth.

Lee, Kotabe, Heo, Kang, and Yoon (2016) have recently attested to the relationship between outbound foreign direct investment (FDI) and the redaction of South Korean enterprises, highlighting the ways how sector-specific variations and regional factors impact this relationship. The analysis showed that there are significant variations in the capasity of the correlations between FDI and performance in various industries. The manufacturing sector's cumulative stock of direct investment was thought to be more strongly correlated with business performance than the service sector.

Research Gap

A thorough literature analysis of the relatedness between sector-specific FDI and growth yields conflicting results and generally ambiguous conclusions from the viewpoints of several economies and their macroeconomic indicators including India. There is a significant gap in the literature as well. While most research has focused on determining how foreign direct investment (FDI) affects the overall economic growth of developed and emerging economies, more needs to be done to understand how FDI inflow varies by sector while taking sectoral heterogeneity into account. In the current study, we have incorporated the Indian economy's component of secondary and tertiary into our examination of how economic growth influences foreign direct investment. This allows for the modeling of the FDI-growth relationship within a dynamic sectoral specification.

3. Objectives of the Study

In line with the above research gap the study considered following objectives:

i. To investigate the relationship between inward FDI and economic growth in secondary sector

ii. To examine the relationship between inward FDI and economic growth in the tertiary sector.

iii. To explore the relationship between inward FDI in the secondary sector and the pattern of aggregate gross value added.

iv. To inspect the relationship between inward FDI in the tertiary sector and the pattern of aggregate gross value added.

4. Numerical simulations

The study examines the relationship of sectoral FDI influx on the economic growth of select sectors within the context of the Indian economy using quarterly data from 2007 to 2020 from DBIE Database, RBI. Sector- wise GVA are compiled from India's national account statistics published by Ministry of Statistics and Programme Implementation (MOSPI), Government of India. These GVAs are then combined into two separate categories: GVAs from the secondary (includes Mining and Quarrying; Manufacturing; Construction; Electricity ,Gas & Water Supply & Other Utility Services)and tertiary sectors(includes Trade,Hotel,Transport, Communication and Service Related to Broadcasting; Financial,Real Estate & Professional Services; Community ,Public Administration,Defence and Other Services). Foreign direct investment and inflow by sector is gathered from data made available by the Ministry of

Commerce and Industry, the Government of India, and the Indiastat database and compiled accordingly. The FDI inflows in Secondary and Tertiary Sectors are denoted as FDI_SDRY AND FDI_TERY respectively whereas sectoral contribution to Gross Value Added (GVA)for these two sector are denoted as GVA_SDRY and GVA_TERY, respectively.

Based on the earlier discussion and the study's objectives, the following testable hypotheses are formulated for the investigation.

Hypothesis I:

Null hypothesis (H0): There is no relationship between inward FDI and GVA in the Secondary Sector of India.

Hypothesis II:

Null hypothesis (H0): There is no relationship between inward FDI and GVA in the Tertiary Sector of India.

Hypothesis III:

Null hypothesis (H0): There is no relationship between FDI in the Secondary Sector and aggregate GVA of India.

Hypothesis IV:

Null hypothesis (H0): There is no relationship between FDI in the Tertiary Sector and aggregate GVA of India.

The study first computes the descriptive statistics to gain a sense of the nature and fundamental properties of the variables used in the analysis. Then estimates the unit root test to verify the variables' unit root property. This would support cointegration test, ARDL bound test, and vector error correction model (VECM) to establish the long- and short-run dynamic relationship between the variables and the Granger causality test to determine the direction of causality. The variance decomposition test and impulse response analysis are utilised to determine the dynamic relationship between the variables in both the short and long term. The study also uses the cumulative sum (CUSUM) of recursive residuals proposed by Brown, Durbin, and Evans (1975) for the stability, heteroscedasticity, and serial correlation tests to make sure the models are not misspecified.

The stationarity of a data series is a requirement in a time series analysis to examine the long-run equilibrium relationship, to draw meaningful inferences, and to improve the accuracy and dependability of the models built. The paper employs the Augmented Dickey–Fuller (ADF) test, which is the most widely used and well-liked of the several widely used unit root tests.

Furthermore, choosing the right lag duration for the autoregressive model is a crucial and sensitive decision. The method for choosing the delays and variable structure is not widely accepted, yet choosing the right lag length has a significant impact on the estimation's result. The Akaike information criterion (AIC) is used in the study to estimate the ideal lag duration.

The study adopts ARDL long run form and bounds test to estimate the long-run association between the sector-specific GVA and the sector-specific FDI inflows in a bivariate format.

It's possible for the outcomes of a long- and short-term relationship between two or more variables to diverge. The vector error correction mechanism (VECM) can be used to examine the nature of the link between sector-specific FDI inflows and sector-specific GVA growth in the short run. The pace at which it corrects its previous period disequilibrium or the speed of adjustment to restore the long-run equilibrium relationship are implied by the error correction term in the VECM specification. Through a succession of partial short-run changes, the error correction technique thus provides a means of reconciling short-run and long-run behaviour.

To confirm the existence and kind of the causal relationship between the variables, the Granger causality test is used. Depending on the outcomes of the long-term investigation, it might be ascertained in two different ways. When there is no cointegration among the variables, the Granger test (Granger, 1969) can be used to analyse the short-run causal link. However, the usual Granger test is misspecified when the variables are cointegrated, in which case the error correction approach recommended by Engel and Granger (1987) should be used. The variables are determined to be cointegrated, so the investigation moves forward with a Granger causality test using VECM. For the variables in the model, VECM enables the modelling of both the short- and long-run dynamics. The VEC Granger causality test or the block exogeneity Wald test are used to test for short-run causality among the variables, whereas the error correction term of VECM represents the direction of long-run causality.

The empirical judgements based on the causality tests, while crucial, do not assess the degree of causality or the temporal link between the variables. Furthermore, the degree of exogeneity between the variables outside the sample period cannot be determined by the Granger causality test. Therefore, the degree of exogeneity of the variables utilised in the study is investigated using the variance decomposition test. The findings of the variance decomposition demonstrate how a significant portion of the fluctuation of another variable over time can be explained by one variable. It also shows the percentage of each variable's forecast error that is explained by another variable, allowing us to assess how significant a factor is in producing variations in another. Once again, the Granger causality test empirical findings aid in validating the influence flow, but the impulse response analysis estimates provide a quantitative understanding of the implications throughout multiple future periods. Using an impulse response function analysis, the reactions of sectoral output growth to shocks in the FDI of the corresponding sectors and vice versa are investigated. This will make it easier to comprehend how sector-specific FDI inflows affect sectoral production growth over the short- and long-terms, and vice versa. The impulse response function measures a variable's reaction to a shock to the VAR system over time. How long a shock's influence lasts tells you how soon the system returns to balance. Considering all other variables fixed, the impulse response function will assist in determining the amount, direction, and duration of time that a shock of another variable in the system affects a particular variable.

The fundamental summary statistics for our variables are shown in Table 1. One of the key conclusions we can get from the tables is that the tertiary sector in India contributes more to GVA than the secondary sector with less amount of average foreign contribution. Comparably, we also see that secondary sector has drawn the most amount of foreign direct investment (FDI), with the average FDI in the tertiary sector being significantly lower than that. This means the tertiary sector of Indian economy has the less potential to draw in foreign investment as compare to secondary sector. In addition, foreign affiliates continue to find the secondary sector to be the most alluring investment option. The sector-specific flow of foreign direct investment (FDI) and the sectoral contribution to GVA both exhibit significant changes over the course of the period of study, as is evident when looking at the standard deviation numbers. However, the test for normality indicates the non-stationary nature of most of the variables at level.

Table:1 Descriptive Statistics (in ₹crore)

Variables	**GVA_TL**	**GVA_TERY**	**GVA_SDRY**	**FDI_TERY**	**FDI_SDRY**
Mean	2363892	921830.0	763080.9	8498.500	40968.44
Median	2280596	882367.5	729085.5	6510.500	37589.00
Maximum	3382507	1493270	1060635	23600.00	94049.00
Minimum	1430970	491483	525838.0	1633.000	7718.000
Std. Dev.	575879.5	288041.7	150907.0	5514.679	21538.27
Skewness	0197715	0.277960	0.323900	0.0839143	0.568247
Kurtosis	1.821972	1.858445	1.911706	2.710544	2.587865
Jarque-Bera	3.345579	3.493088	3.475396	6.284258	3.166529
Probability	0.187723	0.174376	0.175925	0.043191	0.205304

Table 2: VAR Lag Order Selection Criteria based on AIC

Lag Length	FDI_SDRY and GVA_SDRY	FDI_TERY and GVA_TERY	FDI_SDRY and GVA_TL	FDI_TERY and GVA_TL
0	47.07562	47.45007	47.82433	45.17710
1	46.85509	45.15648	47.62802	44.77445
2	46.45968	45.29662	46.16329	43.53883
3	45.61619	44.71241	45.87628	43.45695
4	45.00383*	42.44611*	45.64767*	43.10617*

Table:3 Results of Augmented Dickey–Fuller (ADF) Unit Root Test

Variables	Level		First Difference		Result
	Intercept	Trend and Intercept	Intercept	Trend and Intercept	
GVA_TL	-2.531474 (0.1147)	-2.698459 (0.2420)	-20.77961 (0.0001)	-20.55992 (0.0000)	I(1)
GVA_SDRY	-2.358658 (0.1588)	-2.289182 (0.4313)	-25.07552 (0.0001)	-24.82704 (0.0000)	I(1)
GVA_TERY	1.501833 (0.9991)	-2.096048 (0.5345)	-3.122515 (0.0316)	-3.646578 (0.0364)	I(1)
FDI_SDRY	-0.379954 (0.9042)	-7.955457 (0.0000)	-4.922329 (0.0002)	-5.002977 (0.0010)	I(0)
FDI_TERY	-1.1319474 (0.6125)	-2.995845 (0.1440)	-3.832869 (0.0051)	-3.700204 (0.0326)	I(1)

Table: 4 Results of ARDL Long Run Form and Bounds Test at 1% and 5% level of significance

Cointegration Variables	F-Statistics Value	I(0)	I(1)	Remarks
FDI_SDRY and GVA_SDRY	22.46309	3.62	4.16	Long Run Equilibrium Exist
FDI_SDRY and GVA_TL	21.21799	3.62	4.16	Long Run Equilibrium Exist
FDI_TERY and GVA_TERY	25.05629	3.62	4.16	Long Run Equilibrium Exist
FDI_TERY and GVA_TL	25.63920	3.62	4.16	Long Run Equilibrium Exist

Table 5: Results of ARDL ECM Regression for FDI_SDRY and GVA_SDRY

Variable	Coefficient	t-statistics	Prob.	R-Squared	Durbin-Watson stat
D(FDI_SDRY (-1))	1.124783	4.047295	0.0002	0.891246	1.917071
D(FDI_SDRY (-2))	0.316585	2.303078	0.0268		
D(GVA_SDRY)	0.181624	2.189832	0.0347		
D(GVA_SDRY(-1))	0.383468	4.316396	0.0001		
D(GVA_SDRY(-2))	0.348167	3.871226	0.0004		
D(GVA_SDRY(-3))	0.292727	3.329382	0.0019		
CointEq(-1)*	-3.178042	-8.422356	0.0000		

Table: 6 Results of ARDL ECM Regression for FDI_SDRY and GVA_TL

Variable	Coefficient	t-statistics	Prob.	R-Squared	Durbin-Watson stat
D(FDI_SDRY (-1))	0.999097	3.676726	0.0007	0.866058	2.050109
D(FDI_SDRY (-2))	0.249254	1.835763	0.0733		
CointEq(-1)*	-3.039040	-8.161778	0.0000		

Table: 7 Results of ARDL ECM Regression for FDI_TERY and GVA_TERY

Variable	Coefficient	t-statistics	Prob.	R-Squared	Durbin-Watson stat
D(FDI_TERY (-1))	0.420544	3.168800	0.0028	0.736397	1.674683
CointEq(-1)*	-1.942686	-8.860571	0.0000		

Table: 8 Results of ARDL ECM Regression for FDI_TERY and GVA_TL

Variable	Coefficient	t-statistics	Prob.	R-Squared	Durbin-Watson stat
D(FDI_TERY (-1))	0.426732	3.234138	0.0023	0.740178	1.645533
CointEq(-1)*	-1.966554	-8.963044	0.0000		

Table: 9 Results of Vector Error Correction Model for FDI_SDRY and GVA_SDRY

Independent Variables	Dependent Variables	
	FDI_SDRY	GVA_SDRY
CointEq1	-3.697462 ** [-4.502271]	-1.423001 [-0.98199]
D(FDI_SDRY(-1))	1.642358 * [2.28012]	1.210944 [0.95277]
D(FDI_SDRY(-2))	0.757738 [1.37432]	0.814286 [0.83699]
D(FDI_SDRY(-3))	0.301903 [0.86525]	0.415524 [0.67491]
D(FDI_SDRY(-4))	0.124706 [0.77612]	-0.024072 [-0.08490]
D(GVA_SDRY(-1))	0.183891 [1.53089]	-0.862469** [-4.06911]
D(GVA_SDRY(-2))	0.128554 [1.08107]	-0.897158** [-4.27573]
D(GVA_SDRY(-3))	0.057775 [0.49507]	-0.912430** [-4.43100]
D(GVA_SDRY(-4))	-0.074213 [-0.66415]	0.042837 [-0.21726]
C	1798.875 [0.87005]	-460.0599 [-0.12610]

Table: 10 Results of Vector Error Correction Model for FDI_SDRY and GVA_TL

Independent Variables	Dependent Variables	
	FDI_SDRY	GVA_TL
CointEq1	-3.726777 ** [-4.34284]	0.198408 [0.10322]
D(FDI_SDRY(-1))	1.6177746 [2.11114]	0.237521 [0.13838]
D(FDI_SDRY(-2))	0.753151 [1.27016]	0.5888873 [0.44337]
D(FDI_SDRY(-3))	0.345447 [0.91720]	0.392215 [0.46491]
D(FDI_SDRY(-4))	0.142338 [0.84656]	0.071120 [0.18884]
D(GVA_TL(-1))	-0.071916 [-0.96246]	-0.868967** [-5.19186]
D(GVA_TL(-2))	-0.036573 [-0.50686]	-0.964847** [-5.96962]
D(GVA_TL(-3))	-0.028886 [-0.40784]	-0.867107** [-5.46568]
D(GVA_TL(-4))	-0.045744 [-0.63520]	-0.066791 [-0.41406]
C	1505.191 [0.71529]	609.1508 [0.12923]

Table: 11 Results of Vector Error Correction Model for FDI_TERY and GVA_ TERY

Independent Variables	Dependent Variables	
	FDI_ TERY	GVA_ TERY
CointEq1	-1.644547* [-2.72165]	3.447223 [1.076271]
D(FDI_ TERY (-1))	0.251605 [0.48414]	-2.623993 [-0.95254]
D(FDI_ TERY (-2))	-0.120618 [-0.29438]	-1.744935 [-0.80343]
D(FDI_ TERY (-3))	-0.043887 [-0.16184]	-1.104013 [-0.76806]
D(FDI_ TERY (-4))	-0.105622 [-0.69879]	-0.542886 [-0.67759]
D(GVA_ TERY (-1))	-0.164610 [-1.85733]	-0.676658 [-1.44035]
D(GVA_ TERY (-2))	-0.107794 [-1.56616]	-0.861848* [-2.36232]
D(GVA_ TERY (-3))	-0.042030 [-0.82172]	-1.009225** [-3.72239]
D(GVA_ TERY (-4))	0.019487 [0.53004]	-0.087087 [-0.44688]
C	-841.2239 [-1.23203]	1800.704 [0.49753]

Table: 12 Results of Vector Error Correction Model for FDI_TERY and GVA_ TL

Independent Variables	Dependent Variables	
	FDI_ TERY	GVA_ TL
CointEq1	-1.868458** [-3.25771]	2.745928 [0.64898]
D(FDI_ TERY (-1))	0.446483 [0.89610]	-1.275321 [-0.34696]
D(FDI_ TERY (-2))	0.067794 [0.16835]	-0.193951 [-0.06529]
D(FDI_ TERY (-3))	0.097097 [0.35357]	-0.105415 [-0.05203]
D(FDI_ TERY (-4))	-0.035084 [-0.23019]	-0.425276 [-0.37822]
D(GVA_ TL (-1))	-0.086033 [-2.12872]	-0.709801* [-2.38070]
D(GVA_ TL (-2))	-0.050455 [-1.51604]	-0.851503** [-3.46822]
D(GVA_ TL (-3))	-0.026786 [-0.999921]	-0.776781** [-3.93076]
D(GVA_ TL (-4))	-0.002411 [-0.10548]	-0.021111 [-0.12519]
C	-131.8374 [-0.20870]	-564.0065 [0.12103]

Given the dependence of autoregressive models on accurate lag length selection, this study utilizes the widely employed Akaike Information Criterion (AIC) to determine the optimal lag lengths prior to embarking on a Johansen cointegration analysis. As presented in Table 2, the lag order selection process reveals that for all the variables under study, a lag length of 4 minimizes the AIC value, indicating its suitability for further analysis. One explanation of this result may be the fact that the investors are keen on looking at the last few year's performance for making decisions.

The results of Augmented Dickey–Fuller (ADF) Unit Root Test presented in Table 3 showed that all the GVA series (secondary, tertiary and total) are non-stationary at level, but they become stationary after first differencing. Furthermore, the tertiary sector FDI series is more likely to follow the same pattern than not. Only secondary sector FDI series is stationary at level. This varying nature of stationarity of these variables indicate that we can ignore the Johansen Cointegration Test and go straight to the Autoregressive Distributed Lag (ARDL) Long-run Form and Bound Test as the bounds test is used to test for cointegration in the first place. It examines whether there's a long-run relationship between the variables, even if some are integrated of different orders (I(0) or I(1)).

***p-value incompatible with t-Bound Distribution**

Results of the ARDL Long-run Form and bound test enable us to investigate the relationship among the variables further. We do this by running ARDL Error Correction Model Regression. The relevant results for FDI into the secondary sector and GVA of the same sector are presented in Table 5. To start with, we can observe from the table that the lagged values of Secondary sector FDI have significant positive coefficients, indicating strong persistence in FDI_SDRY. Its previous values heavily influence its current level. A one-unit increase in FDI_SDRY in the previous period leads to a 1.1248-unit increase in the current period, holding other factors constant. The effect of FDI_SDRY

two periods ago is smaller but still significant. These results show that there is strong inertia in the trend of inward FDI in industries in India. Furthermore, we can also infer that current and lagged values of secondary sector GVA have significant positive coefficients, suggesting that it positively impacts inward FDI in the same sector in the short run. Growth in GVA_SDRY leads to increased FDI_SDRY, with effects lasting up to three periods. This suggests a positive feedback loop between FDI_SDRY and GVA_SDRY in the short run. Increased FDI_SDRY likely contributes to higher GVA_SDRY, which in turn attracts more FDI.

Moreover, the highly significant negative coefficient of CointEq(-1) (-3.1780) confirms a strong error correction mechanism. Any short-run deviations from the long-run equilibrium relationship between FDI_SDRY and GVA_SDRY are corrected at a rate of about 318% per period. The error correction mechanism ensures that FDI_SDRY and GVA_SDRY move together in the long run, maintaining a stable equilibrium relationship. As the R2 is less than DW value then the model is free from spurious relationship.

***p-value incompatible with t-Bound Distribution**

The lagged value of FDI_SDRY (D(FDI_SDRY(-1))), as can be seen in table 6, has a significant positive coefficient (0.9991), indicating strong persistence in FDI_SDRY. Its level in the previous period significantly influences its current level. Additionally, the lagged value of FDI_SDRY two periods ago (D(FDI_SDRY(-2))) has a smaller but marginally significant positive coefficient (0.2493), suggesting some additional persistence. The highly significant negative coefficient of CointEq(-1) (-3.0390) confirms a strong error correction mechanism.

Any short-run deviations from the long-run equilibrium relationship between FDI_SDRY and other variables are corrected at a rate of about 304% per period. The R-squared and Durbin-Watson statistic confirm a high degree of model fit and absence of significant serial correlation in the residuals.

***p-value incompatible with t-Bound Distribution**

Table 7 shows that The lagged value of FDI into the services sector, (D(FDI_TERY(-1))) has a significant positive coefficient (0.4205), indicating that past levels of FDI_TERY have a positive influence on its current level. Besides, the highly significant negative coefficient of CointEq(-1) (-1.942686) confirms a strong error correction mechanism suggesting strong tendency to return to long-run equilibrium.

***p-value incompatible with t-Bound Distribution**

Similar pattern of association can be observed between FDI in the tertiary sector and total GVA.

The VECM results for short-run dynamics between FDI and GVA in the industrial sector, as presented in Table 9, show that the t-values associated with lag values of each other are not significant. This implies that FDI into and GVA of the secondary sector do not affect each other. However, the table also shows that these two variables are affected by their own past values. The VECM result also indicates that the values of FDI_SDRY adjust the disturbances to restore long-run equilibrium significantly, and the speed of adjustment is about 370 per cent per period.

Table 10 presents VECM results for FDI in the secondary sector and total GVA of the Indian Economy. The results show that FDI_SDRY depends neither on its own nor on GVA_TL's lag values in the short-run. However, GVA_TL clearly has strong dependence on its own lag values. Analysis of the VECM results also reveals that, in the short term, there is no statistically significant relationship between inflows of FDI into the secondary sector and the total GVA of the economy. This suggests that short-term fluctuations in one domain do not immediately impact the other. However, the error

correction terms in the VECM indicate a strong long-run equilibrium relationship between the variables when FDI_SDRY is the dependent variable. The term is statistically significant at the 1% level, implying a robust self-correcting mechanism. The coefficient -3.726777 suggests that deviations from the long-run equilibrium are adjusted towards balance at a rate of approximately 373% per period.

The VECM analysis in Table 11, focusing on tertiary sector variables (GVA_TERY and FDI_TERY), reveals statistically significant t-values associated only with the coefficients of second and third lagged values of GVA_TERY when it is used as the dependent variable. All other relationships are not statistically significant. Furthermore, the VECM confirms the presence of a long-run equilibrium relationship between these variables with 5% level of significance when FDI into the tertiary sector is the dependent variable. The coefficient suggests that deviations are corrected at a rate of approximately 164% per period.

The VECM results for FDI into the tertiary sector and overall GVA in Table 12 reveals that there is no significant short-run relationship between these variables. Only lag values of overall GVA have a statistically significant effect on itself. The VECM analysis further reveals the presence of a robust long-run equilibrium relationship between the variables when FDI_TERY is the dependent variable. This is evidenced by the highly significant error correction term ($p < 0.01$), indicative of a powerful self-correcting mechanism that drives deviations from equilibrium back towards balance. The coefficient of -1.868458 signifies an adjustment rate of approximately 187% per period, underscoring the significant speed at which imbalances are rectified in the long run.

Table 13. VEC Granger Causality/Block Exogeneity Wald Test Results

Dependent Variables	Independent Variables	Chi-square Value	Probability Value	Implication
FDI_SDRY	GVA_SDRY	22.01823	0.0002	Causality Exists
GVA_SDRY	FDI_SDRY	2.879214	0.5782	No Causality
FDI_SDRY	GVA_TL	3.392853	0.4944	No Causality
GVA_TL	FDI_SDRY	2.597578	0.6273	No Causality
FDI_TERY	GVA_TERY	10.89897	0.0277	Causality Exist
GVA_TERY	FDI_TERY	1.291215	0.8629	No Causality
FDI_TERY	GVA_TL	11.11352	0.0253	Causality Exist
GVA_TL	FDI_TERY	1.757753	0.7802	No Causality

Findings from Causality Test

Since the study finds that the variables are cointegrated it uses the Engle and Granger (1987) error correction approach to determine the long- and short-run causal relationships between the variables of each pair . The next sections provide the findings from the long- and short-run causality tests conducted using the VECM framework.

Long-run Causality

In Table 9-12, the t-values corresponding to the VECM error correction factors between the GVA contribution and FDI inflows are displayed. The findings suggest a strong long-term unidirectional causal relationship from GVA_SDRY to FDI_SDRY and GVA_TL to FDI _SDRY. It suggests that, over time, changes in the GVA of the secondary sector as well as aggregate Indian GVA will inevitably result in changes to the FDI in the secondary sector. On the other hand, the research discovers the

same result of long-term unidirectional causality from GVA_TERY to FDI_TERY and from GVA_TL to FDI_TERY. It implies that fluctuations in the tertiary sector's GVA as well as the overall GVA of India will eventually cause fluctuations in FDI in the tertiary sector.

Short-run Causality

Table 13 presents the findings of a short-run causality test using VEC Granger causality tests to examine the relationship between sector-specific FDI inflows and the associated sector's as well as aggregate GVA contribution .The short-run causality test result validates the unidirectional short-run causality flowing from GVA_SDRY to FDI_SDRY , GVA_TERY to FDI_TERY, and GVA_TL to FDI_TERY.

Table:14 Result of Diagnostic Tests

VEC Residual	Serial Correlation(A)	Normality(B)	Heteroscedasticity
FDI_SDRY and GVA_SDRY	4.487292 (0.3441)	1.281722 (0.526839)	5.122682 (0.7444)
FDI_TERY and GVA_TERY	3.865620 (0.4245)	6.181625 (0.045465)	1.954192 (0.5820)
FDI_SDRY and GVA_TL	4.083432 (0.3948)	2.399968 (0.301199)	5.130036 (0.2742)
FDI_TERY and GVA_TL	5.138148 (0.2734)	7.478446 (0.023773)	1.119447 (0.7724)

Notes: (A) Based on Lagrange multiplier test of residual serial correlation. (Breusch-Godfrey Serial Correlation LM Test)

(B) Based on a test of skewness and kurtosis of residuals (Jarque– Bera test of normality).

(C) Based on the white heteroscedasticity test with no cross terms yields. (Breusch-Pagan-Godfrey Test)

Respective probability values are presented in parentheses.

To ensure the validity and robustness of the VECM results, the study employed a battery of diagnostic tests, including serial correlation tests (Lagrange multiplier test of residuals), normality tests (Jarque–Bera test), and heteroscedasticity tests. Table 14 presents the findings.

The serial correlation tests revealed no evidence of serial dependence in the residuals of any of the four VECM models: FDI_SDRY & GVA_SDRY, FDI_TERY & GVA_TERY, FDI_SDRY & GVA_TL and FDI_TERY & GVA_TL. The null hypothesis of "no serial correlation" could not be rejected, indicating uncorrelated error terms. Similarly, the heteroscedasticity tests provided no indication of heteroscedastic variance in any of the models. Furthermore, the Jarque–Bera normality tests indicated normality in the residuals of all the variable pairs mentioned above.

The stability of the estimated coefficients plays a crucial role in ensuring the reliability of the estimated model and, consequently, the validity of the results. Therefore, this study employed the Cumulative Sum of Squares (CUSUM) test of recursive residuals to assess the parameter stability of all three VECM models. Figures 1 to 4 depict the CUSUM test results for each model.

The CUSUM graphs, analyzed at a 5% significance level, offer reassuring evidence of parameter stability throughout the sample period. None of the CUSUM plots cross their respective critical boundaries, indicating no significant shifts or instability in the model parameters. This finding strengthens the credibility of the estimated models and bolsters the confidence in the robustness of the derived results.

Table 15. Variance Decomposition of FDI_SDRY and GVA_SDRY

Variance Decompositions	Period	Forecast Error Percentage Innovation Explains Variance	
		FDI_SDRY	GVA_SDRY
FDI_SDRY	1	100.0000	0.000000
	2	98.84060	1.159403
	3	98.64717	1.352830
	4	98.55921	1.440794
	5	97.56491	2.435090
GVA_SDRY	1	10.94384	89.05616
	2	12.00858	87.99142
	3	12.96990	87.03010
	4	12.98348	87.01652
	5	9.679916	90.32008

Table 16. Variance Decomposition of FDI_TERY and GVA_TERY

Variance Decompositions	Period	Forecast Error Percentage Innovation Explains Variance	
		FDI_TERY	GVA_TERY
FDI_TERY	1	100.0000	0.000000
	2	85.52630	14.47370
	3	85.62992	14.37008
	4	86.69666	13.30334
	5	84.15275	15.84725
GVA_TERY	1	3.152330	96.84767
	2	4.383388	95.61661
	3	4.687989	95.31201
	4	4.703731	95.29627
	5	4.956002	95.04400

Table 17. Variance Decomposition of FDI_SDRY and GVA_TL

Variance Decompositions	Period	Forecast Error Percentage Innovation Explains Variance	
		FDI_SDRY	GVA_TL
FDI_SDRY	1	100.0000	0.000000
	2	99.71715	0.282853
	3	98.70203	1.297968
	4	98.51729	1.482712
	5	98.32555	1.674448
GVA_TL	1	0.075113	99.92489
	2	3.789708	96.21029
	3	3.877726	96.12227
	4	7.785174	92.21483
	5	4.923753	95.07625

Table 18. Variance Decomposition of FDI_TERY and GVA_TL

Variance Decompositions	Period	Forecast Error Percentage Innovation Explains Variance	
		FDI_TERY	GVA_TL
FDI_TERY	1	100.0000	0.000000
	2	96.46298	3.537018
	3	93.55011	6.449895
	4	93.99617	6.003831
	5	93.16600	6.833997
GVA_TL	1	0.050799	99.94920
	2	3.716458	96.28354
	3	4.401007	95.59899
	4	5.252919	94.74708
	5	3.294036	96.70596

Outcomes of Variance Decompositions Test and Impulse Response Function Analysis

Tables 15–18 shows that there is a greater endogenous difference among different sectors' FDI inflows that sectoral as well as aggregate output . This is because, during the study period, sectoral FDI influx values are more reliant on internal factors than on gross value added into the corresponding sector .Secondary sector production exhibits a larger endogeneity than the other sectors. This is because innovation to FDI_SDRY explains 97.56% of the fluctuation in the sector, meaning that the sectoral output itself is still the primary driver of its movement. However, a significant portion ,that is 15.85 per cent of the forecast error variance of the tertiary sector output , is explained by the FDI influx in the respective sector.

The impulse response measures the long-term effects of structural shocks on the dependent variables when shock is applied to the error terms (one of these endogenous variables) over several future periods, the impulse response analysis provides a quantitative understanding about the responsiveness

of the endogenous variables in the VAR system. The consequences of a particular unit shock on one of the endogenous variables at impact t period, t + 1 period, and so on are explained in each response.
Figure 5 displays the findings of the impulse response analysis to a one standard deviation shock in secondary sector output and FDI inflow over a five-quarter time horizon. For the first quarter, there is significant response from a positive shock of secondary sector output to FDI influx; the following quarter an inconsistent responses. In contrast, responses from positive shock of FDI_SDRY to GVA_SDRY are found inconsistent.. However, own reactions to an initially positive shock of FDI_SDRY but declining to be negative till the third period after that increase at an accelerating rate up to the fourth after that decreasing , whereas own responses from positive shock of GVA_SDRY remain positive .
Figure 6 depicts the responses generated from a positive shock of GVA_TERY to FDI_TERY are found to be consistently positive .On the other hand a positive shock of FDI_TERY to GVA_TERY generates highly positive responses with high fluctuation. Nevertheless , own responses from a positive shock of FDI_TERY remain positive with inconsistency but positive shock to GVA_TERY generates inconsistent responses.
In Figure 7, the responses generated from a positive shock of FDI_SDRY to GVA_TL and GVA_TL to FDI_SDRY are found to be inconsistent throughout the assessing period. On the other hand a positive shock of FDI_TERY to GVA_TERY generates highly positive responses with high fluctuation. Nevertheless,own responses from a positive shock of GVA_TL remain positive in most of the assessing period but positive shock to FDI_SDRY generates inconsistent responses.
In Figure 8, the responses generated from a positive shock of GVA_TL to FDI_TERY and own response from FDI_TERY are found to be inconsistent throughout the assessing period. .On the other hand, a positive shock of FDI_TERY to GVA_TL generates highly positive responses with medium fluctuation. Again the own responses generated from a positive shock of GVA_TL are positive for most of the time period under assessment.

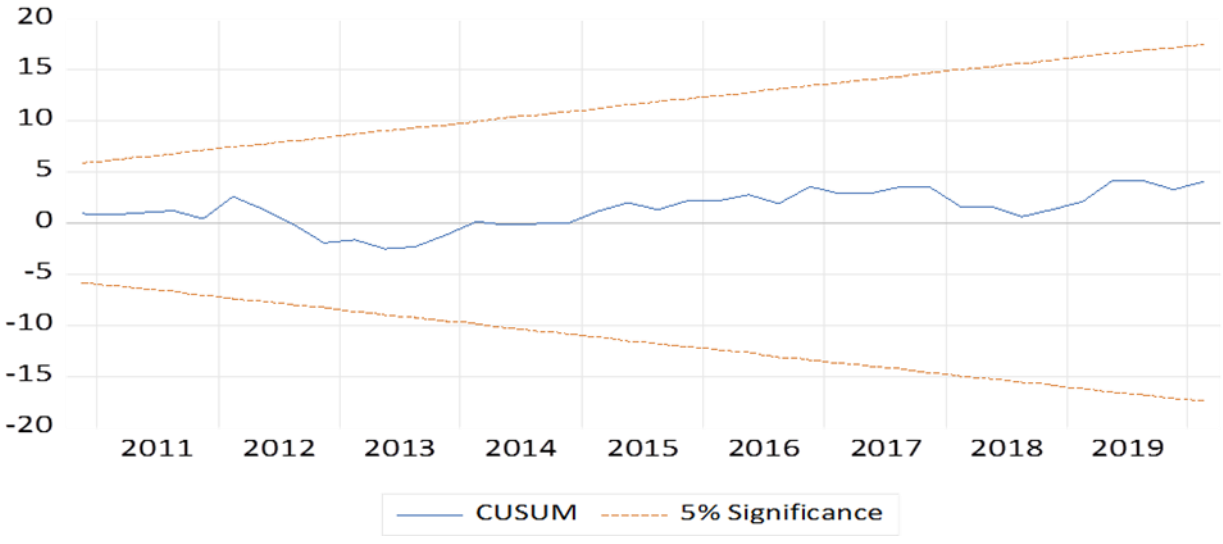


Figure 2. Cumulative Sum of Recursive Residuals plot for FDI_TERY and GVA_TERY
Source: The authors.

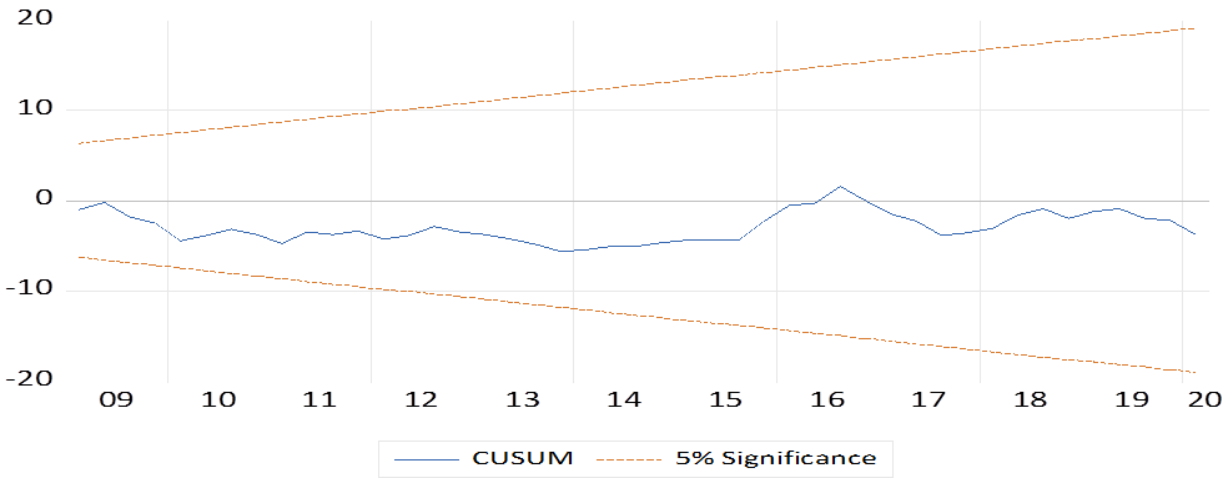


Figure 3. Cumulative Sum of Recursive Residuals plot for FDI_SDRY and GVA_TL
Source: The authors.

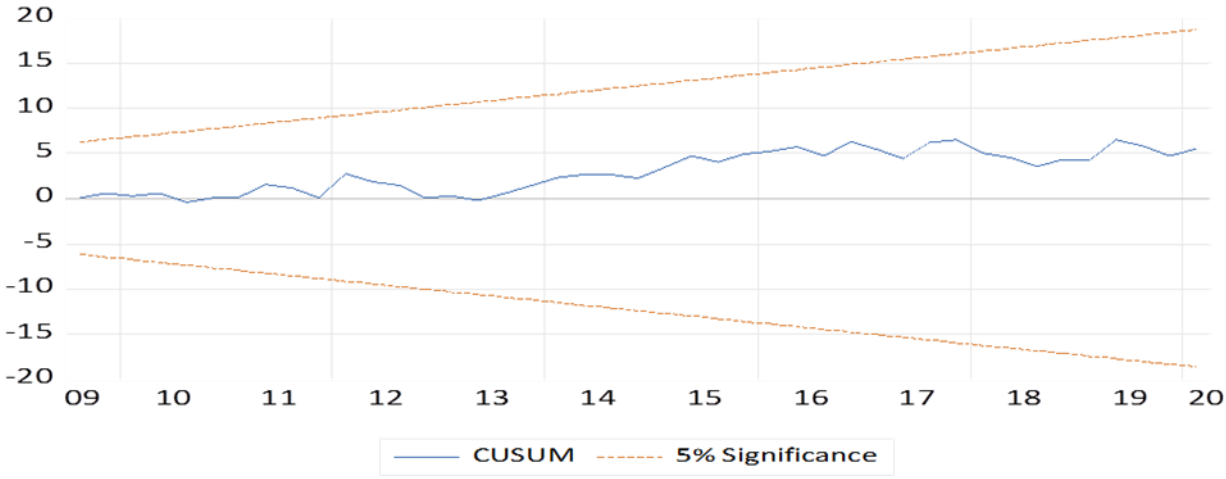


Figure 4. Cumulative Sum of Recursive Residuals plot for FDI_TERY and GVA_TL

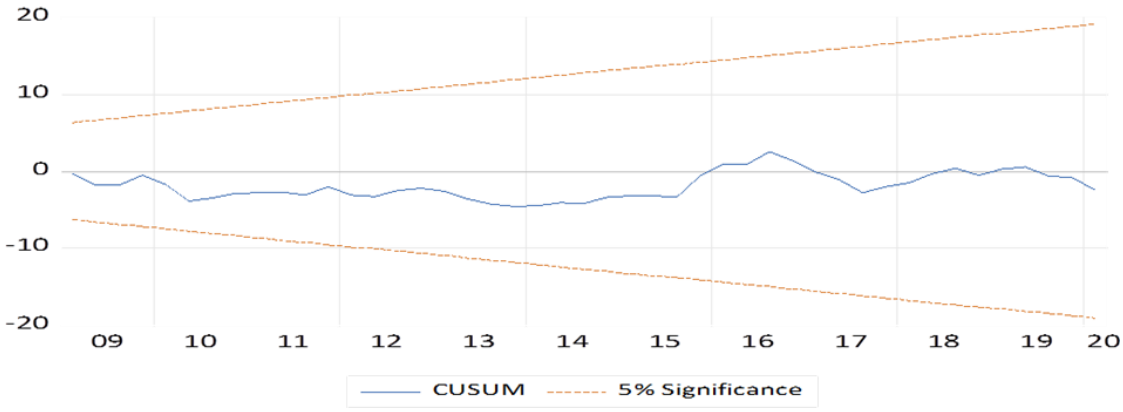


Figure 5. Impulse Responses of FDI_SDRY and GVA_SDRY to One Standard Deviation Shock in the Variables

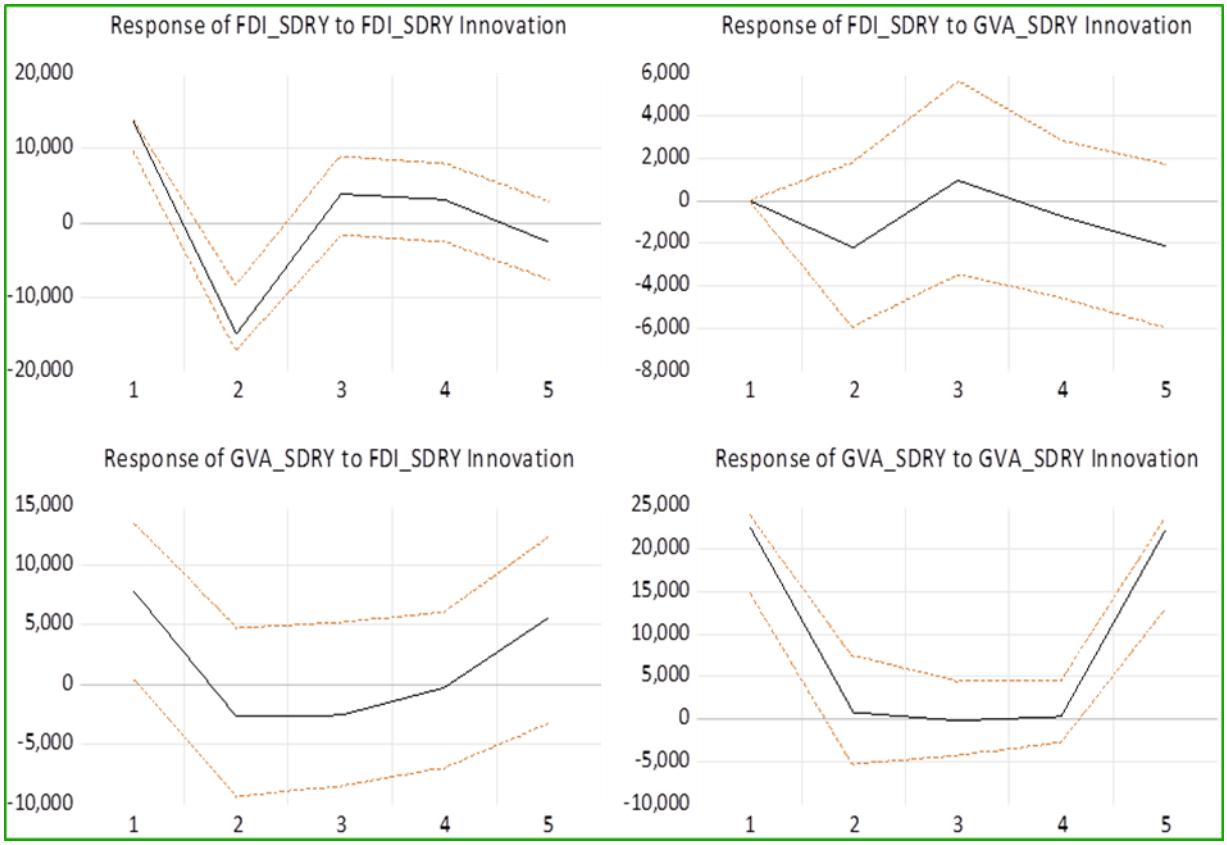


Figure 6. Impulse Responses of FDI_TERY and GVA_TERY to One Standard Deviation Shock in the Variables

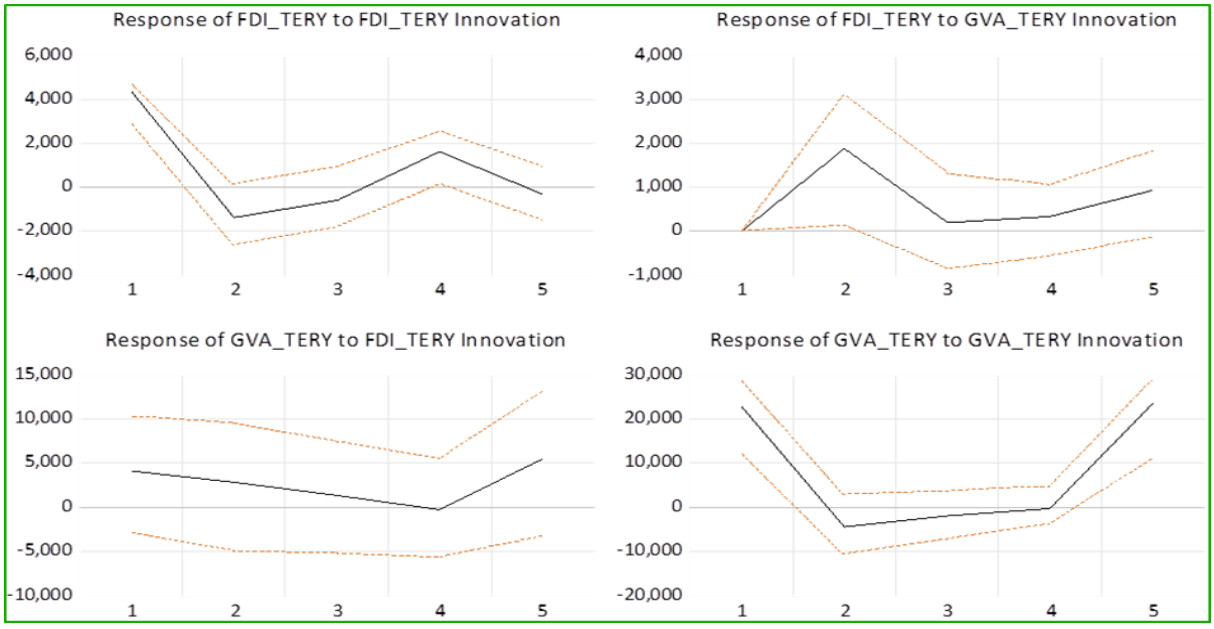
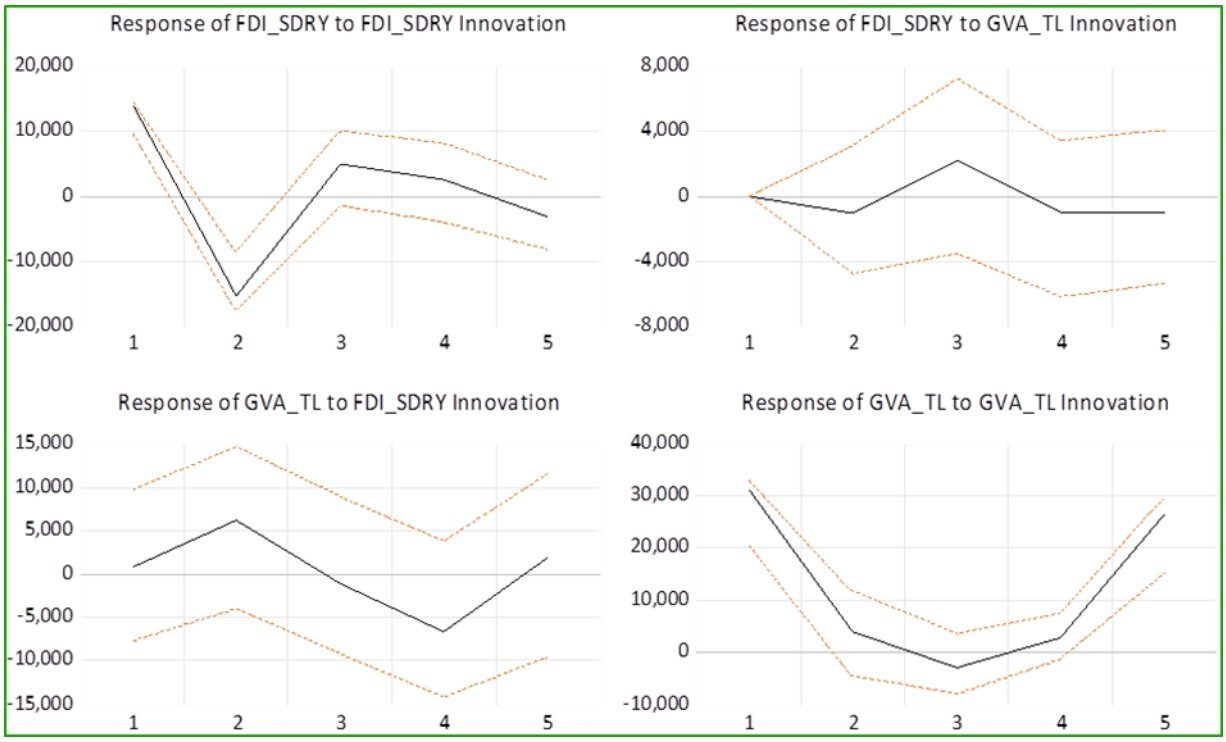


Figure 7. Impulse Responses of FDI_SDRY and GVA_TL to One Standard Deviation Shock in the Variables



5. Discussions and Conclusion

The current study attempts to analyse and explore the pattern of quarterly FDI inflow and its implication for sectoral and overall growth and vice versa. The results of this exercise bring forth some striking observations on this issue. One of the most important findings is the fact that both secondary and tertiary sector GVA are cointegrated with their respective FDI inflows, indicating a stable equilibrium relationship in the long run. However, the short-run dynamics analysis show that (i) there is no significant short-run relationship exists between FDI and GVA in either sector, (ii) Both FDI and GVA in each sector are heavily influenced by their own past values and (iii) there exists strong error correction mechanisms in all models we have explored, suggesting rapid adjustments towards long-run equilibrium following any deviations.

The causality analysis has shown that there exists unidirectional short and long run causality from GVA to FDI inflow in both the sectors. The main implication of this finding is the fact that changes in sectoral GVA influences FDI inflow into the same sector in the long-run, if not in the short-run. Furthermore, the study has also shown that the tertiary sector has less potential to attract FDI as compared to the secondary sector.

The findings presented above help us to shed some light on some potential policy implications. Policies should prioritize enhancing GVA within sectors, as this ultimately attracts FDI in the long run. Also it can be argued that tailored policies for each sector should be framed considering their unique dynamics and potential for FDI inflows. Investment in infrastructure development across all sectors can go a long way in creating a strong foundation for sustainable economic growth and attract long-term FDI.

This study sheds light on the complex relationship between FDI and GVA in India's secondary and tertiary sectors. By highlighting the long-run cointegration, short-run dynamics, and causality structures, the findings offer valuable insights for policymakers to formulate effective strategies for attracting and leveraging FDI for sustainable economic development. By prioritizing GVA growth,

fostering conducive investment environments, and addressing sector-specific needs, India can maximize the benefits of FDI inflows and achieve its desired economic goals.

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