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FOREIGN DIRECT INVESTMENT AND EXPORT DYNAMICS IN INDIA: A LONG-RUN AND SHORT-RUN ANALYSIS

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Abstract: The paper analyses the relationship between foreign direct investment and export dynamics in India from 2000 to 2023. Foreign Direct Investment (FDI) is a crucial factor for emerging nations like India, serving as an innovative accelerator to enhance exports and promote economic growth. In order to analyse both long- and short-run adjustments for foreign direct investment and exports, we used time-series data and applied the Augmented Dickey-Fuller test for stationarity. Following this, we employed the Johansen cointegration test as well as the VECM. A substantial correlation exists between FDI inflow and export performance over the long run. FDI corrects short-term deviations from equilibrium to the tune of roughly 29%. The Granger causality test indicates unidirectional causation from exports to foreign direct investment (FDI), suggesting that India's robust export performance draws FDI rather than vice versa. The research indicates that maintaining India's FDI inflow is essential for an export-driven strategy. Future research may focus on sector-specific foreign direct investment export relationships and the influence of global economic changes on these dynamics to enhance understanding of how India may further refine its FDI policies to boost exports and promote long-term economic growth.

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1. INTRODUCTION

Foreign Direct Investment plays a critical role in the economic growth of developing nations by driving capital inflows, technology transfer, and enhancing export performance. It has become a significant factor in shaping the economic landscape of developing countries, with India being a prime example (UNCTAD, 2023). As the most populous country in the world, India has positioned itself as a global hub for FDI, attracting billions of dollars in investments across various sectors. Since its economic liberalisation in 1991, India has witnessed a substantial increase in FDI inflows, which have helped the nation integrate more deeply into the global economy (Chopra & Sachdeva, 2014). Some studies suggest that countries with abundant capital actively seek foreign markets to maximise investment returns (Mijiyawa, 2017). In contrast, nations facing capital shortages often attract FDI to bridge the savings-investment gap, facilitate technology transfer, and stimulate economic development (Fang *et al.*, 2021; Khatun & Ahamad, 2015). FDI can boost a host country's exports directly through the activities of multinational subsidiaries. These subsidiaries may take advantage of the host country's abundant and low-cost resources, reducing production costs and increasing export potential by using the host country as an export hub for the global market (Sahoo & Dash, 2022; Li et at., 2017; Stojcic & Orlic, 2016).

According to the Department for Promotion of Industry and Internal Trade (DPIIT, 2023), India's foreign direct investment (FDI) inflows have increased twentyfold from 2000-01 to 2023-24, with cumulative FDI inflows reaching US dollar 695.04 billion between April 2000 and June 2024, primarily due to government initiatives aimed at improving the ease of doing business and liberalising FDI policies. From April to June 2024, overall foreign direct investment inflows amounted to 22.5 billion US dollars, with equity inflows constituting 16.2 billion US dollars. From 2000 to 2024, the service industry garnered the most significant FDI inflows at 16.33%, amounting to USD 113.49 billion. The computer software and hardware business is followed by over 15.20%, with trading at 6.30%, telecommunications at 5.73%, and the

automobile industry at 5%. In terms of FDI sources, Mauritius was the largest contributor during this time, accounting for 25% of the overall share. Singapore, the USA, the Netherlands, and Japan were next with 24%, 10%, 7%, and 6% of the total share, respectively. The World Investment Report (UNCTAD, 2023) indicates that India holds the third position worldwide for greenfield projects, with over 1,000 project announcements. The nation experienced an increase of 63% in foreign finance project agreements, establishing itself as the second largest beneficiary of such transactions. In 2022, India received 810 industrial investment offers amounting to USD 42.78 billion, while the total value of industrial investment proposals for the year reached USD 298 billion, an increase from USD 169.4 billion the prior year. The Annual Trade Report 2022-23 said that Indian merchandise exports from April to December 2022 were estimated at USD 332.76 billion, an increase from USD 305.04 billion in the corresponding period of 2021. Service exports increased by 27.71%, totalling US dollar 235.81 billion, compared to US dollar 184.65 billion in the prior year. The trade imbalance increased to USD 218.90 billion from USD 136.44 billion over this period. The pharmaceutical industry, in particular, experienced significant FDI inflows, enhancing its outstanding export performance. India, the preeminent global supplier of generic pharmaceuticals, attained pharmaceutical exports amounting to US$ 25.39 billion in the fiscal year 2022-23 (Ministry of Commerce and Industry, 2023).

1.1. Overview of Foreign Direct Investment Inflow in India

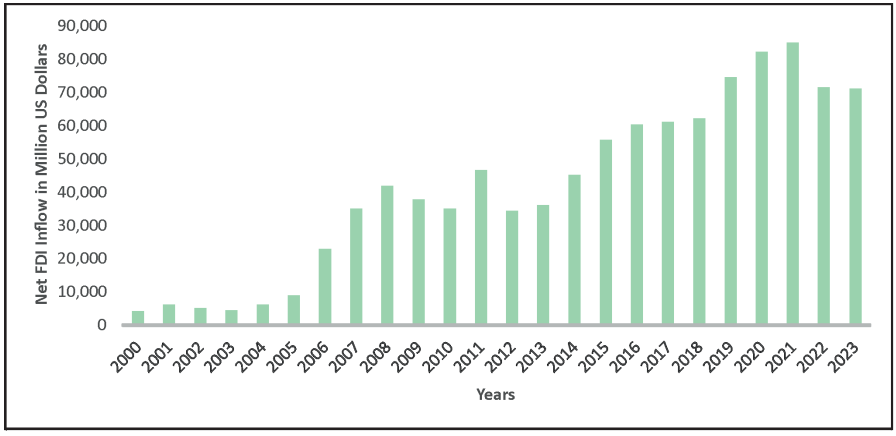

Figure 1: Net FDI inflow in India from 2000 to 2023

Source: DPIIT

The chart shows a clear upward trend in Net FDI inflows into India from 2000 to 2023, measured in millions of US dollars. Between 2000 and 2023, FDI inflows remained relatively low, under 10,000 million USD. However, from 2005 onwards, there was a sharp increase, with inflows rising significantly through 2007. After a brief decline at the time of the global financial crisis in 2008-2009, FDI inflows recovered, continuing a generally upward trajectory. Significant growth has occurred between the period 2015 and 2021, with inflows peaking at around 85,000 million USD in 2021. Although there was a slight decline in 2022 and 2023, the inflows remain substantially higher compared to the early 2000s, reflecting India's growing attractiveness as a destination for foreign investment.

As Foreign Direct Investment (FDI) continues to drive economic growth in India, evaluating its effect on export performance becomes increasingly important. This study investigates two fundamental questions: (i) Does FDI significantly impact the export performance of India in the long run and short run? (ii) Is there a causal relationship between FDI inflows and exports? Employing VECM and Granger causality tests to examine these dynamics provides empirical insights that contribute to the ongoing discourse on FDI-driven export growth.

2. LITERATURE REVIEW

Foreign Direct Investment (FDI) is widely regarded as a catalyst for economic growth in developing countries like India. It is pivotal in enhancing production capacities, fostering technological advancements, and improving infrastructure. Furthermore, FDI significantly influences export performance by integrating domestic industries into global value chains and increasing their competitiveness in international markets. These dynamics underline the importance of FDI in stimulating economic growth while simultaneously driving export-oriented development, making it a critical area of focus in the literature.

2.1. Theoretical Perspectives on the FDI-Export Nexus

The relationship between Foreign Direct Investment (FDI) and exports has been widely examined through various theoretical frameworks, offering insights into how FDI influences export performance. These theories provide a conceptual foundation for understanding the role of FDI in Indian export dynamics.

Vernon's product Life Cycle Theory (1966, 1992) explains how multinational companies from developed nations shift production to developing economies like India as products mature, benefiting from lower production costs. This phenomenon is evident in the Indian manufacturing sector**,** which has evolved into a global production hub, facilitating the export of textiles, electronics, and automotive components. This theory supports the argument that FDI enhances export performance by integrating host economies into global supply chains.

Helpman, Melitz, and Yeaple (2004) extend this perspective by arguing that FDI does not necessarily replace exports but rather enhances a firm's ability to access foreign markets. This is particularly relevant for India, where FDI inflows have helped domestic firms improve their competitiveness and expand export opportunities. Moreover, spillover effects from FDI significantly contribute to export growth. Aitken, Hanson, and Harrison (1997) emphasise that Multinational Corporations (MNCs) bring technological advancements and best practices, fostering productivity improvements in local firms. In India, this effect is evident in the Information Technology (IT) and Business Process Outsourcing (BPO) sectors**,** where FDI has played a crucial role in boosting service exports. Similarly, Chakraborty and Nunnenkamp (2008) highlight that sector-specific, particularly post-liberalisation in the 1990s, has been instrumental in strengthening India's export performance by driving growth in key industries aligned with India's comparative advantages. The Heckscher-Ohlin (H-O) Model (1991) further explains how FDI enhances the export potential of industries that intensively use abundant local resources. This is particularly evident in the Indian textile and pharmaceutical industries**,** where FDI inflows have improved operational efficiency and expanded export capabilities.

The Endogenous Growth Theory (Romer, 1990; Lucas, 1988) supports the notion that FDI fosters long-term economic growth through technological advancements, human capital development, and production efficiency improvements. In India, this is reflected in industries where FDI has led to knowledge transfer, increased innovation, and enhanced manufacturing processes, ultimately strengthening export potential. Finally, Dunning's Eclectic Paradigm (1980, 1988) provides a comprehensive framework for assessing the role of FDI in export-led growth. The OLI framework (Ownership, Location,

and Internalisation advantages) explains why firms engage in FDI and how it influences export-oriented production. In India, FDI inflows have helped firms leverage ownership advantages (technology and brand value), location advantages (low-cost skilled labour), and internalisation benefits (efficient supply chains), contributing to export growth. This theoretical perspective aligns with the observed positive FDI-export nexus, reinforcing the role of FDI as a key driver of India's export expansion.

2.2. Empirical Studies on Foreign Direct Investment and Export Performance

2.2.1. Studies on FDI and Exports in the Indian Context

There is a complex interaction between export performance, foreign direct investment (FDI), and India's economy, as has been shown in the substantial research on this topic. Examining data from 1990 to 2014, Singh and Tandon (2015) conducted a comprehensive investigation on the correlation between foreign direct investment (FDI) and India's export performance. Despite the economic significance of both FDI and exports, their results showed no notable long-term association between the two variables over the time period under consideration.

Paul (2019), on the other hand, emphasised a more positive insight into the effect of FDI on export performance. He found that foreign direct investment (FDI) had a significant beneficial effect on India's export sectors from 2004 to 2017, particularly in technology-driven industries, but also on the country's more conventional export sectors. Liberalised FDI policies were credited with the favourable relationship since they promoted expansion and made a significant contribution to India's GDP growth. In a similar vein, Mohanty and Sethi (2019) investigated the 1980–2017 export-FDI link. The study indicated that foreign investment had a beneficial influence on exports in the short term, but a less noticeable effect in the long run. This underscores the necessity for policies that prioritise export-oriented FDI in order to sustain growth in sectors with high potential.

In addition to this discussion, Barua (2013) looked at the impact of foreign direct investment (FDI) on the growth of exports and GDP in India from 2000 to 2012. He found a positive link and attributed the increase in exports

to technological advances and productivity gains brought about by FDI. A similar long-term equilibrium relationship was found by Sultan (2013) when they examined the FDI-export relationship from 1980 to 2010. Evidence from the Granger causality test shows that FDI inflows are driven by export growth, which suggests that FDI in India is mainly driven by market-seeking incentives rather than export promotion. In a more in-depth analysis of the effect of FDI on India's export performance, Prasanna (2010) found that FDI considerably boosts total manufactured exports as well as exports of high technology. Even if foreign direct investment (FDI) has favourable spillover effects, the study stressed the need to reassess domestic efforts to increase manufacturing exports. Some studies show that exports are very important for getting foreign direct investment. For example, Durairaj (2010) used the Autoregressive Distributed Lag (ARDL) model to examine the relationship between FDI, exports, and economic growth. He found that these variables were positively related in the long run and that exports had a bidirectional causality with economic growth and a unidirectional causation with foreign direct investment. According to Dash and Sharma (2011), there is a two-way relationship between FDI and economic growth, but only a one-way relationship between exports and FDI. This supports the idea that FDI is mostly market-seeking rather than export-oriented. It was also found by Paudel (2014) that liberalisation changes had an impact on India's export performance from 1975 to 2008. Employing the Autoregressive Distributed Lag method of cointegration, the results showed that manufacturing export demand is mainly determined by global demand. At the same time, domestic production, foreign direct investment, and total liberalisation greatly affect manufacturing export supply.

2.2.2. Studies on FDI and Exports in the World Context

The relation between foreign investment inflows and export performance in Asia has been thoroughly examined, with the majority of results suggesting a beneficial effect. Ahmed Mohsin and Hossain (2023) analysed the link between FDI and exports in Bangladesh from 1972 to 2019, concluding that FDI positively influenced export growth, facilitated by structural reforms. Hassan *et al*. (2013) examined the period from 1972 to 2009 in Pakistan and determined that FDI had no significant effect on exports; instead, factors such as GDP and trade openness were crucial drivers, indicating that enhancing

labour skills could augment FDI's role in export growth. Jawaid *et al*. (2016) examined the influence of foreign direct investment (FDI) on Pakistan's export performance from 1974 to 2012, revealing a substantial positive effect in both the short and long term, along with bidirectional causation between FDI and exports. Sultanuzzaman *et al*. (2018) conducted a study analysing the influence of foreign direct investment (FDI) and exports on Sri Lanka's economic growth from 1980 to 2016, employing the ARDL model. The study concludes that foreign direct investment (FDI) positively affects GDP in both the short and long term, while exports exert a negative long-term influence but a positive short-term effect.

Tang (2008) identified a positive link between foreign direct investment (FDI), exports, and economic growth in Malaysia from 1970 to 2006, highlighting a bilateral relationship between FDI and exports. Haseeb *et al*. (2014) corroborated this by demonstrating that both exports and foreign direct investment considerably contributed to Malaysia's GDP from 1971 to 2013. Moreover, Yee *et al*. (2016) discovered that foreign direct investment (FDI) and advantageous exchange rates considerably enhanced Malaysia's export performance from 1975 to 2013, excessive domestic-oriented FDI may impede growth. Etale & Etale (2016) underscored a significant long-term correlation among FDI, exports, and GDP in Malaysia from 1980 to 2013, accentuating the importance of exports in recruiting FDI and promoting economic growth. Nguyen and Do (2020) examined the influence of exchange rate fluctuations and foreign direct investment (FDI) on exports in Vietnam from 1990 to 2018, concluding that FDI exerted a long-term beneficial effect despite short-term difficulties associated with exchange rate instability. Duc Anh Do *et al*. (2022) determined that foreign direct investment (FDI) has a substantial long-term positive impact on export growth in Vietnam from 1985 to 2020. In Indonesia, Febiyansah (2017) noted that foreign direct investment (FDI) significantly contributed to export growth from 2000 to 2012 via technical spillovers, whereas Mahadika Kalayci and Altun (2017) determined that both FDI and exports favourably impacted Indonesia's GDP from 1981 to 2013.

Majeed and Ahmad (2007) conducted an analysis of 49 emerging nations, including several Asian countries, from 1970 to 2004. A mutually beneficial link was identified between foreign direct investment (FDI) and exports, with FDI significantly enhancing export capability. Davaakhuu *et al*. (2015)

examined the influence of foreign direct investment (FDI) on Mongolia's export development from 1995 to 2012, concluding that FDI significantly enhanced export supply, especially within the mining industry, which was vital for Mongolia's export growth. Mekuriaw (2021) analysed the influence of foreign direct investment (FDI) on Ethiopia's export development from 1991 to 2016, concluding that FDI substantially improved exports.

Radulescu and Serbanescu (2012) looked at how FDI affected the competitiveness of exports in Central and Eastern Europe from 1990 to 2010. The study concluded that FDI in trade-related areas was necessary to increase exports and make local businesses more competitive. But they warned that FDI in areas that do not produce goods could cause trade deficits, stressing how important it is to focus on investments that will help exports. Vural and Zortuk (2011) examined how FDI affected Turkey's exports from 1982 to 2009. Their research showed a positive link between FDI and export growth. This link was strengthened by the falling value of the Turkish Lira, which increased demand for exports. In the same way, AbuAl-Foul and Soliman (2008) looked at FDI and export success in Egypt, Morocco, Tunisia, and Turkey from 1975 to 2003. They found that FDI had a positive effect on both manufactured and non-manufactured exports, but not so much on high-value goods. In the African setting, Aigheyisi (2015) looked at how well Nigeria did with its non-oil exports from 1981 to 2012. The study discovered that FDI inflows do not have a big effect on exports, but import penetration did have a short-term positive effect on exports. This shows that policies are needed to encourage FDI in sectors other than oil. In Macedonia, Jovanka Damoska Sekuloska (2017) found that foreign direct investment (FDI) greatly increased export growth in the car sector from 2005 to 2015. FDI was responsible for 86% of the increase in exports and made the country's economy much more competitive.

Sultanuzzaman *et al*. (2018) looked at how FDI and exports affected Sri Lanka's economic growth from 1980 to 2016. They found that FDI had a good effect on GDP and suggested that exports should be more diverse to keep growth going. Iwamoto and Nabeshima (2012) looked at FDI and export diversification in 175 countries from 1980 to 2007. They found that FDI greatly encourages export diversity and sophistication, especially in developing countries. Le *et al*. (2015) looked at the relationship between

BRIC FDI and export success in SADC countries from 2003 to 2011. They found a strong positive link that made the region's export potential higher. Gamariel and Hove (2019) looked at how FDI affected the competitiveness of exports in Sub-Saharan Africa from 1995 to 2015. They found that FDI increases productivity and the growth of human capital, which improves export performance.

In China, Tang and Zhang (2015) and Zhang (2015) stressed how important absorptive capacity is for getting the most out of FDI for industrial exports. Their research showed that foreign direct investment (FDI) greatly increases the ability and sophistication of exports, especially when strong human capital and facilities are in place to support it. In 2015, Ahmad Draz and Yang looked at the connections between foreign direct investment (FDI), exports, and economic growth in the ASEAN-5 countries from 1981 to 2013. They found that FDI had a one-way effect on exports but a two-way effect on economic growth. Popovici (2018) looked at how foreign direct investment (FDI) affected exports in EU member states from 1999 to 2012 and found that FDI had a good effect on exports, especially in newer EU member states. A study by Lakshani *et al.* (2023) looked at the relationship between foreign direct investment (FDI) and net exports (NE) in 110 countries from 2002 to 2020. They found strong two-way links, which suggests that FDI increases the ability to export goods and helps the economy grow.

3. DATA AND METHODOLOGY

3.1. Data

The study examines annual time series data from 2000 to 2023. Time series analysis is essential for analysing historical data to predict future trends and investigate relationships among variables. This approach facilitates the identification of substantial patterns within the data, offering insights into the relationship between FDI inflows and exports. Data on Foreign Direct Investment (FDI) inflows was derived from the "Department for Promotion of Industry and Internal Trade (DPIIT)", whilst Export (Ex) data was collected from the "World Bank". Both variables were transformed into natural logarithms, including LnFDI and LnEx, to mitigate heteroscedasticity problems.

3.2. Model Specification

3.2.1. The Augmented Dickey-Fuller Test

To assess the long-term relationship among variables, it is essential to test the stationarity of the series. This study employed the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979, 1981) for unit root analysis. Initially, all variables were tested for stationarity at level I(0). If any variable was identified as non-stationary at its level, it was further tested at the first difference I(1), and, if required, at the second difference I(2). The model is represented as:

$$\Delta Yt = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 t + \Sigma_{j=2}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t \quad (1)$$

Where, ΔYt: First difference of the time series Yt, which helps in testing for stationarity.

ΔYt = Yt – Yt-1

α_0: The intercept term is also referred to as a drift term.

α_1Yt-1: The lagged value of the series.

α_2t: The deterministic time trend component.

$\Sigma_{J=2}^{P}\ \gamma j \Delta Yt - j$: The sum of the lag first differenced values of the series.

ε_t: Error term with a random component ε_t.

3.2.2. Johansen Cointegration Test

The Johansen Cointegration Test was employed in this study to identify long-run equilibrium relationships among variables integrated at order one, I(1). The appropriate lag length was determined using the Akaike Information Criterion (AIC), and the test applied the trace and maximum eigenvalue likelihood ratio tests to evaluate canonical correlations (Johansen, 1988; Johansen & Juselius, 1990). This method is widely used in empirical research, with Yussuf (2021) examining long-term economic linkages in the East African Community and Kurita and Shintani (2023) enhancing its applicability by incorporating Fourier-type nonlinear trends. These studies reinforce the robustness of the Johansen approach in modern econometric analyses.

The Trace Test is given as:

$$Jtrace = -N\Sigma_{k=r+1}^{n} \log(1 - \lambda k) \quad (2)$$

The maximum eigenvalue test is given as:

$$J\ max = N \log(1 - \lambda r+1) \quad (3)$$

Where:

Jtrace: This is the test statistic for the trace test.

N: This denotes the sample size

$\Sigma_{k=r+1}^{n}$: Summation from k=r+1 to n, where 'r' represents the number of co-integrating vectors under the null hypothesis, and n is the total number of tested variables.

λk: kth largest eigenvalue obtained from the estimated matrix of the system. The eigenvalue λk measures the strength of the co-integrating relationships.

log(1–λk): This is the natural logarithm of 1 –λk.

λr+1: represents the Eigenvalue corresponding to the (r+1) co-integrating relationship.

3.2.3. Vector error correction model (VECM)

The Vector Error Correction Model (VECM) is widely used in econometric analysis to examine both short-run dynamics and long-run relationships in time series data. Johansen (1991) developed a robust approach for assessing cointegration, emphasising VECM's ability to capture short-term fluctuations and long-term equilibrium adjustments. Engle and Granger (1987) laid the foundation for this approach, which introduced cointegration and error correction methods, later refined by Lutkepohl (2005) to handle both short-run volatility and long-term causation. Given that FDI and exports are often non-stationary and cointegrated, VECM is the appropriate technique for analysing their dynamic interdependencies. Studies such as Tsaurai (2015) on FDI, exports, and GDP in Zambia, Kari and Saddam (2014) on FDI, economic growth, and oil exports in GCC countries, and Popovici (2016) on economic growth, FDI, and exports in Romania have successfully applied VECM to explore similar relationships. This study employed VECM to analyse how FDI influences export performance in India, ensuring methodological rigour and alignment with existing literature.

The dynamic link between foreign direct investment (FDI) inflows and exports (lnFDI and lnEx, respectively) was investigated using the VECM model. In addition to capturing short-term adaptation, the model also captures long-term equilibrium interactions.

For exports (lnEx), the equation is:

$$\Delta \ln Ex_t = \alpha_1(\ln Ex_{t-1} - \beta \ln FDI_{t-1} - \mu) + \sum_{i=1}^{p} \gamma_{1i} \Delta \ln Ex_{t-i} + \sum_{j=1}^{q} \delta 1 j \Delta \ln FDI_{t-j} + \varepsilon_{1t} \quad (4)$$

For FDI inflows (lnFDI), the equation is:

$$\Delta \ln FDI_t = \alpha_2(\ln Ex_{t-1} - \beta \ln FDI_{t-1} - \mu) + \sum_{i=1}^{p} \gamma_{2i} \Delta \ln Ex_{t-i} + \sum_{j=1}^{q} \delta 2 j \Delta \ln FDI_{t-j} + \varepsilon_{2t} \quad (5)$$

Where:

Δ: denotes the first difference.

$lnEx_t$ and $lnFDI_t$: are the natural logarithms of exports and FDI inflows at time t.

$lnEx_{t-1}$ and $lnFDI_{t-1}$: lagged values of lnExports and lnFDIinflow.

α_1 and α_2: the error correction coefficients, indicating how quickly deviations from long run equilibrium are corrected.

β: is the parameter representing the long-term relationship between lnEx and lnFDI (note that I used a single β to represent the relationship instead of separate β1 and β2.

μ: is a constant term (intercept).

$\Sigma^{p}_{i=1}\ \gamma_{1i}\ \Delta lnEx_{t-i}$: short-term dynamics or the lagged effects of changes in Exports on FDI inflows

$\Sigma^{q}_{i=1}\ \delta_{2j}\ \Delta lnFDI_{t-j}$: short-term effects of lagged changes in FDI inflows on itself.

γ1 and γ2: capture short-run dynamics for lnEx and lnFDI

ε_{1t} and ε_{2t}: Error terms for each equation.

3.2.4. Granger Causality Test

The Granger Causality Test (Granger, 1969) is a statistical method used to determine whether one time series can predict another. For two variables, as

FDI and exports, the test assesses whether the past values of Foreign Direct Investment contain information that helps forecast export, indicating a potential causal relationship. However, this test does not establish true causality but instead checks whether changes in Foreign Direct Investment occur before changes in exports (Hamilton, 1994). Studies such as Bouchrika and Bardi (2025) and Nupehewa *et al*. (2022) have applied this test to analyse the causal nexus between FDI and economic growth, highlighting unidirectional and bidirectional relationships across different economies. These findings reinforce the test's relevance in examining FDI's impact on exports in this study.

Granger Causality Model:

Unrestricted Model (Including Lagged Values Xt): (6)

$$Y_t = \alpha_0 + \sum_{k=1}^{q} \alpha_k \ Y_{t-k} + \sum_{k=1}^{p} \beta_k X_{t-k} + \varepsilon_t$$

Restricted Model (Excluding Lagged Values of Xt): (7)

$$Y_t = \alpha_0 + \sum_{k=1}^{q} \alpha_k Y_{t-k} + \varepsilon_t$$

Where:

Y_t: denotes dependent variable at time t

X_{t-k}: denotes lag values of the independent variable

α_0: is intercept term

α_k and β_k: are coefficients for lagged values of Yt and Xt

q: is optimal lag length

ε_t: Is the error term.

Wald Test: The Wald Test is essential in the Granger causality test to assess whether past values of one variable (X_t) improve the prediction of another (Y_t). If the null hypothesis that all β_i coefficients are jointly zero is rejected, X_t Granger-causes Y_t. Studies like Gujarati and Porter (2009) highlight its econometric significance, while Toda and Yamamoto (1995) extended it for non-stationary variables. Dumitrescu and Hurlin (2012) refined it for heterogeneous panel data, reinforcing its relevance in economic time series analysis.

4. RESULTS AND DISCUSSION

Table 1: Dickey-Fuller Test Results of Unit Root (At Level and First Difference)

Variables	ADF Test		Order of Integration	
	t-statistics	p-Value	At level	At First Difference
LnEX	-2.246	0.1900	Non-Stationary	-
LnFDI	-1.94	0.3135	Non-Stationary	-
d_lnEX	-4.108	0.0009	-	Stationary
d_FDI	-3.936	0.0018	-	Stationary

lnEx: Natural log of export, lnFDI: Natural log of FDI, d_lnEx: First difference of the natural logarithm of exports, d_lnFDI: First difference of the natural logarithm of Foreign Direct Investment

Source: Computed by the author using the software Stata

The ADF test results in Table 1 show that both variables, lnEx and lnFDI, are non-stationary at each of their levels. The test statistics for lnEx and lnFDI are -2.246 and -1.940, respectively. These values exceed the critical values at the 1%, 5%, and 10% significance levels, with MacKinnon's approximate p-values of 0.1900 and 0.3135, respectively. This suggests that neither variable shows stationarity at its level forms. However, both variables become stationary after their first differencing. The first difference of lnEx (d_lnEx) produces a test statistic value of -4.108 and a p-value of 0.0009, whereas the first difference of lnFDI (d_lnFDI) produces a test statistic value of -3.936 and a p-value of 0.0018. These findings verified that both variables are integrated at order one, I(1), and require differencing to attain stationarity. This aligns with Ahmed and Haque (2022), Bouri *et al*. (2023), and Zhang and Li (2024), who emphasised the necessity of stationarity verification through the ADF test to ensure valid cointegration and VECM analysis.

Table 2: Lag Order Selection

Lag	*LL*	*LR Statistic*	*(df)*	*P -value*	*FPE*	*AIC*	*HQIC*	*SBIC*
0	-17.4846				0.024062	1.94846	1.9679	2.04803
1	22.3129	79.595*	4	0.000	0.000674*	-1.63129	-1.57297*	-1.33257*
2	26.4805	8.3352	4	0.080	0.000674	-1.64805*	-1.55086	-1.15018
3	29.7925	6.6241	4	0.157	0.000752	-1.57925	-1.44319	-0.882239
4	31.570	3.5549	4	0.470	0.001014	-1.357	-1.18206	-0.460839

*Optimum lag

"Likelihood Ratio (LR), Log-Likelihood (LL), Degrees of Freedom (df), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC) and Schwartz Bayesian Information (SBIC)"

Source: Computed by the author using the software Stata

The lag order selection criteria indicate that the ideal lag length for the Vector Error Correction Model (VECM) is one lag. This result is substantiated by several measures, with the 'Akaike Information Criterion (AIC)' attaining its minimal value of -1.64805 at lag 2, indicating that this latency offers a better fit. The final prediction error (FPE) is minimised at lag 1 (0.000674). The likelihood ratio (LR) test produces a significant statistic of 79.595 at lag 1, accompanied by a p-value of 0.000, indicating that lag 1 is highly suitable for exploring the dynamics between FDI inflow and exports in India. Results for higher lags indicate a decreasing return, with lag 3 exhibiting an AIC of -1.44319 and lag 4 at -1.18206, suggesting that the increase in complexity does not significantly improve the model fit. Consequently, choosing lag 1 provides an ideal balance between model fit and complexity while accurately representing the associations among the variables.

Table 3: Johansen Cointegration Test

Rank	*LL*	*Eigenvalue*	*Trace Statistic*	*Critical Value (5%)*	*Conclusion*
0	13.031497		12.2441*	15.41	No cointegration at rank 0
1	17.148498	0.30093	4.0101	3.76	1 cointegrating equation

* Indicates statistical significance at the 5% level.
Log-Likelihood (LL)
Source: Computed by the author using the software Stata

The Johansen Cointegration Test reveals one cointegrating equation between lnEx and lnFDI, indicating a long-term equilibrium connection between both variables. At rank 0, the trace statistic is 12.2441, which is below the critical value of 15.41, indicating the absence of cointegration at this level. This indicates that lnEx and lnFDI lack a long-term link without additional integration. The eigenvalue at rank 1 is 0.30093, while the trace statistic is 4.0101, exceeding the critical value of 3.76. This notable result indicates the existence of only one cointegrating relationship among the variables. This cointegration indicates that while lnEx and lnFDI may exhibit short-term variations, they are anticipated to converge over time, reaching a long-term equilibrium.

3. VECTOR ERROR CORRECTION MODEL (VECM)

Table 4.1: Statistical performance measures for the two equations in the VECM model

Equation	*Parameters*	*RMSE*	*R^2*	*Chi-Square*	*p-value*
ΔExports (Exports)	2	0.128494	0.4728	18.831	0.0001
ΔFDI (FDI Inflow)	2	0.237011	0.3993	13.96	0.0009

Table 4.2: Long - run and short-run dynamics between variables
(*Coefficients and significance levels for the error correction terms in both equations)*

Dependent Variable	*Error Correction Term (ce1 L1)*	*Std. Err.*	*z-score*	*p-value*	*Significance*
ΔExports(Exports)	0.0755314	0.0570767	1.32	0.186	Not Significant
Constant	0.0732843	0.0389673	1.88	0.060	Marginally Significant
ΔFDI(FDI Inflow)	0.2900761	0.1052801	2.76	0.006	Significant
Constant	-0.0190821	0.0718765	-0.27	0.791	Not Significant

Table 4.3: Cointegrating Equations

Equation	Chi-Square	p-value
_ce1	54.093	0.000

_ce1: First cointegrating equation

Table 4.4: Johansen Normalisation Restriction Imposed

Variable	*Coefficient*	*Std. Err.*	*z-score*	*p-value*
LnEx	1	-	-	-
lnFDI	-1.1329	0.154	-7.35	0.000
Constant	-14.2804	-	-	-

Source: Computed by the author using the software Stata.

Note: "The coefficients indicate both short-run dynamics and long-run relationships between the variables. A p-value < 0.05 signifies statistical significance. The model incorporates error correction terms to adjust for deviations from long-run equilibrium, reflecting meaningful impacts between the variables. To ensure robustness, all models were assessed for stability, autocorrelation, and heteroskedasticity."

The VECM model provides a significant insight into the correlation between FDI inflows and export success in India. In the long term, the cointegrating equation's coefficient of -1.1329 (p-value: 0.000) indicates a negative correlation between FDI inflow and export. This indicates that for each 1-unit variation from the equilibrium in FDI inflows, exports adjust by 1.13 units, signifying a robust long-term corrective mechanism. In the short term, the error correction term for FDI inflows is considerable, with a coefficient of

0.2900761 (p-value: 0.006), indicating that almost 29% of deviations from equilibrium are rectified in subsequent periods. Exports exhibit a negligible short-run adjustment (p-value: 0.186), indicating they are less reactive to short-term variations. The model has satisfactory results, evidenced by an R-squared value of 0.4728 for ΔExports and 0.3993 for ΔFDI, considerably influencing the overall dynamics. This demonstrates that FDI inflows significantly impact export performance in the long term, whereas short-run adjustments are mostly shown in FDI inflows. Similarly, Aziz and Mishra (2022) found a long-run negative FDI-export relationship, supporting this study's -1.1329 coefficient. Shah *et al*. (2023) emphasised a 30% disequilibrium correction, aligning with the 0.2901 coefficient. Chaudhry and Khan (2024) confirmed minimal short-run FDI impact on exports, consistent with the p-value of 0.186. These findings validate the VECM model's robustness in analysing FDI-export dynamics.

Table 5: Granger Causality Wald Test

Excluded Variable	*chi-square*	*degrees of freedom (df)*	*p-Value*
lnFDI	0.0681	1	0.794
lnEx	4.2539	1	0.039

Source: Computed by the author using Stata

The Granger causality Wald test findings indicate that lnFDI does not Granger-cause lnEx, evidenced by a chi-squared value of 0.0681 and a p-value of 0.794. This asserts that historical values of lnFDI do not provide substantial information for forecasting future values of lnEx. Conversely, lnEx Granger causes lnFDI, as evidenced by a chi-squared statistic of 4.2539 and a p-value of 0.039. This demonstrates that previous values of lnEx exert a statistically significant influence on subsequent values of lnFDI. Ultimately, the outcome underscores a unidirectional link in which exports affect FDI inflows, but not the other way around.

Diagnostics Tests

Table 6: Lagrange Multiplier (LM) Test, ARCH LM Test, Jarque-Bera Normality Test, Skewness Test, Kurtosis Test

Test Name	*Lags*	*t-Statistic*	*p-Value*	*Results*
Lagrange Multiplier (LM) Test	1	7.47	0.11304	No autocorrelation
	2	1.922	0.075014	No autocorrelation

Test Name	*Lags*	*t-Statistic*	*p-Value*	*Results*
ARCH LM Test	-	0.01	0.8960	No heteroscedasticity
Jarque-Bera Normality Test	-	4.368	0.35848	Residuals normally Distributed
Skewness Test	-	2.546	0.27999	No significant skewness
Kurtosis Test	-	1.822	0.40213	No excess kurtosis

Source: Computed by the author using Stata

The diagnostic test results in Table 6 for the VECM model indicate that the model is well-described and robust. The Lagrange Multiplier (LM) test findings demonstrate the absence of autocorrelation at lags 1 and 2, with p-values of 0.11304 and 0.75014, indicating that the residuals are uncorrelated at these intervals. The ARCH LM test shows no indication of heteroskedasticity in the residuals, as evidenced by a p-value of 0.8960, which further supports the model's reliability. The Jarque-Bera test findings affirm the normality of the residuals, with p-values of 0.35848. The skewness and kurtosis tests substantiate this finding, indicating that the residuals display symmetry and conform to a normal distribution. The skewness test shows no significant skewness, and the kurtosis test shows no excess kurtosis with corresponding p-values of 0.2799 and 0.40213, respectively. Similarly, Asteriou and Hall (2021) highlight LM and ARCH LM tests for robustness, while Haque *et al*. (2022) confirm their relevance in FDI-trade analysis. Bouri *et al*. (2023) stress the Jarque-Bera test's role in ensuring normality in econometric models. These diagnostic assessments confirm that the VECM model accurately represents the intrinsic relationship among these variables.

CONCLUSION

The research indicates a substantial long-term relationship between foreign direct investment and export performance in India. The Johansen cointegration test validates a stable long-term equilibrium between these two variables, emphasising the important role of FDI inflows in enhancing India's export capacity over time. The VECM model indicates that around 29% of deviations from equilibrium are corrected in the short run through changes in FDI inflows. However, export performance seems to be less responsive to short-run variations. The Granger causality test shows a unidirectional causal relationship between exports and FDI, suggesting that export expansion in India plays a major role in drawing FDI rather than the other way around.

The results highlight the crucial role of export success in drawing foreign investments, especially in industries such as manufacturing, IT, and pharmacy in India. Contrary to prevalent perceptions, foreign direct investment (FDI) does not immediately stimulate export growth in the short run, highlighting the necessity for export-oriented strategies to maintain FDI inflows. The research offers compelling evidence that robust export performance is essential for sustaining and increasing foreign investment inflows, therefore facilitating India's long-term economic growth and development.

RECOMMENDATIONS

Policy Focus on Export-Oriented FDI: To sustain the long-term benefits of FDI on export performance, policymakers should focus on attracting FDI to export-driven sectors like manufacturing, pharmaceuticals, and IT. This can be achieved by maintaining a strong emphasis on easing the business environment, particularly for foreign investors targeting these sectors (Arora & Siddiqui, 2020; Rastogi & Sawhney, 2014; Narayanan & Bhat, 2011). Such policies will help boost FDI inflows and ensure continued growth in exports.

Enhance Export Competitiveness: Since exports have been found to Granger-cause FDI, enhancing export infrastructure and addressing logistical challenges are crucial to improve India's competitiveness on the global stage. Investments in digital infrastructure, port facilities, and supply chain improvements will be essential to attract FDI, particularly in areas where India enjoys a comparative advantage (Manthri & Bhokray, 2015; Sahoo *et al.*, 2022; Kumar *et al.*, 2022).

Strengthen Technological Spillovers: FDI also contributes to technological advancements and knowledge transfer, which can significantly improve productivity and export performance. Encouraging domestic industries to adopt these innovations will be crucial. Promoting partnerships between foreign firms and local companies can help facilitate the flow of knowledge and technology (Morita & Nguyen, 2021; Feng, 2020). Strengthening such collaborations can enhance India's technological edge and export capabilities (Keller, 2021).

Diversification of FDI Sources: While India has traditionally attracted FDI from major sources like Mauritius, Singapore, and the USA, efforts should be made to diversify FDI inflows from other regions, including emerging markets

and Europe, to reduce reliance on a few key investors (Jolo & Koc, 2022; Irfan & Ojha, 2023).

Supportive Trade Agreements: Finally, engaging in strategic trade agreements with key markets can help foster both FDI and export growth. These agreements can enhance access to international markets for Indian goods and services while creating an attractive environment for foreign investors. For example, the TRIPS Agreement encouraged Indian pharmaceutical firms to boost R&D investments and integrate into the global value chain, driving technological upgrades and post-TRIPS growth (Kamiike, 2020).

LIMITATIONS

The study focuses on only two variables, FDI inflow and exports, and overlooks key factors such as GDP, exchange rates, and sector-specific impacts. Also, the reliance on time series data from 2000 to 2023 may not fully capture the effects of recent policy shifts.

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