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What Drives FDI? Long-Run And Short-Run Evidence From India (1991–2023)

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Abstract
The research examines how foreign direct investment (FDI) affects major macroeconomic indicators in India throughout the 1991–2023 post-liberalization period. The research analyzes annual data through time-series econometric methods which include unit root tests and Johansen cointegration analysis and Vector Error-Correction Model (VECM) and Granger causality tests to study both study equilibrium relationships and short-term patterns between FDI and GDP and GCF and REER. The research establishes that these variables maintain a stable long-term equilibrium relationship. The research shows that foreign direct investment (FDI) in India directly depends on domestic market size and investment levels (GDP and GCF) but inversely depends on exchange rates because currency depreciation leads to reduced FDI inflows. The VECM model shows an error-correction term of 0.13 which means the model corrects 13% of long-run deviations annually and demonstrates substantial short-term relationships between variables. The Granger causality tests demonstrate that FDI and GDP create a feedback relationship while domestic investment through GCF causes FDI growth but exchange rate changes do not affect FDI in the short term. The VECM residuals show no evidence of serial correlation or heteroskedasticity according to diagnostic tests[1]. The research demonstrates that foreign investment and macroeconomic fundamentals maintain a deep connection in the Indian economy. The research ends by explaining how economic growth and investment-friendly conditions create a positive feedback loop that attracts foreign direct investment which drives additional economic expansion.

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I. Introduction

Foreign direct investment (FDI) describes when a company from one nation establishes permanent ownership of a business operation located in another nation. Emerging economies benefit from FDI because it delivers financial resources together with technological advancements and management skills and market entry opportunities. The entry of foreign direct investment into India creates opportunities for national economic expansion through job creation and productivity improvement and market competition development. The government provides various benefits to foreign investors through tax reductions and infrastructure assistance and simplified regulatory processes because foreign capital stands as a vital element for national development plans.

The economic liberalization of 1991 brought a fundamental transformation to India's foreign direct investment (FDI) activities. The Indian economy operated with restricted access to foreign investors before 1991 which resulted in limited FDI entry. The 1991 economic reforms which combined liberalization with privatization and globalization created conditions for foreign investors to enter India which resulted in substantial FDI growth throughout the following years. The amount of foreign direct investment (FDI) entering India grew from $0.13 billion during 1991 to more than $3 billion by 2000 and then experienced fast growth during the following years. The total amount of foreign direct investment (FDI) equity entered India since 1991 reached $1 trillion by September 2024 while the FDI growth during 2014–2024 exceeded 119% compared to the preceding ten years. The economic development of India has become increasingly dependent on foreign investment according to the recent statistical data.

The long-term growth of FDI into India has shown periodic changes and encountered multiple structural problems. The distribution of foreign direct investment between different industries and geographic areas shows significant. The service industry together with specific manufacturing sectors receive most foreign investment yet agricultural sectors and specific labor-intensive manufacturing sectors receive less investment. The majority of foreign direct investment projects concentrate in specific states and major cities which creates investment and development gaps between different regions. The amount of foreign direct investment depends on worldwide economic performance and government stability. The 2008 worldwide financial crisis and COVID-19 pandemic caused temporary decreases in foreign direct investment because these events exposed investments to worldwide economic instability and geopolitical threats. The short-term impact on investor confidence occurs when India experiences political changes and when the government implements major economic policies like demonetization. The stability of economic policies together with resilience measures play a vital role in maintaining foreign direct investment inflows.

The quality of foreign direct investment (FDI) and its enduring effects represent essential matters for consideration. The value of FDI investment depends on its ability to deliver technology transfer and skill development and export growth and sustainable business expansion. The effectiveness of FDI in India to generate developmental results remains a subject of ongoing academic discussion. The growth of GDP does not always result in equivalent employment increases according to some researchers who study FDI effects in India. The development of effective policy strategies requires knowledge about the specific conditions which enable FDI to achieve its maximum beneficial effects. In light of the above, this paper seeks to provide a comprehensive analysis of the relationship between FDI and key macroeconomic variables in India, focusing on three fundamental indicators: **GDP (Gross Domestic Product)** as a measure of market size and economic output, **GCF (Gross Capital Formation)** as a measure of domestic investment, and **REER (Real Effective Exchange Rate)** as an indicator of external competitiveness (with changes reflecting currency strength and inflation differentials). We examine both long-run equilibrium relationships and short-run dynamics among these variables and FDI. The core research questions are: (1) Do FDI inflows and these macroeconomic variables exhibit a stable long-run relationship? (2) How do short-run deviations and adjustments occur between FDI and the macro variables? and (3) What is the direction of causality – does FDI drive economic growth, do growth and investment attract FDI, or are there bidirectional feedback effects?

The research design uses time-series econometrics to answer these questions. The research analyzes annual data from 1991 to 2023 through Augmented Dickey-Fuller and Phillips-Perron unit root tests to determine the stationary characteristics of each dataset. The Johansen cointegration technique helps us verify the existence of one or more cointegrating vectors which show long-term relationships between the variables after we confirm non-stationarity. The Vector Error-Correction Model (VECM) helps us understand both the long-run equilibrium relationships and short-run adjustments between variables. The Granger causality tests within the VECM framework help researchers determine which variables influence each other. The research performs diagnostic tests to validate model stability by verifying absence of autocorrelation and heteroskedasticity in residual data.

The research makes two essential contributions to existing knowledge. The research extends previous FDI and macroeconomic studies in India through its analysis of data from 1991 to 2023 which includes both new policy implementations and pandemic-related economic changes. The research combines equilibrium analysis with short-run causal effects and multiple macroeconomic variables to create a complete picture of FDI domestic

economic interactions. The research findings will help policymakers because they show how GDP and FDI create a positive feedback loop which requires sustained economic expansion to attract foreign investment and how foreign investment supports ongoing economic growth. The research shows that domestic investment activity (GCF) leads FDI when it does so which indicates that better domestic investment conditions and infrastructure development must precede foreign investment attraction. The research indicates that policy should concentrate on exchange rate stabilization and global condition mitigation when FDI responds mainly to external factors.

The following sections organize the rest of this research paper. The second section reviews existing research about FDI determinants and economic effects in India and similar emerging markets. The third section explains the research data and methods through definitions of variables and data sources and descriptions of the statistical analysis. The research findings appear in Section 4 which starts with FDI flow patterns in India before presenting unit root test results and cointegration analysis and VECM estimation and Granger causality results and diagnostic test outcomes. The research findings receive economic interpretation in Section 5 through comparison with previous studies and policy recommendations are developed. The paper ends with Section 6 which summarizes the main findings and proposes additional research directions. The paper includes additional materials in its appendices which contain test statistics and extended tables and the reference section appears at the end of the document.

II. Literature Review

Research studies have investigated FDI relationships with macroeconomic indicators through extensive empirical evidence which produces conflicting results about direction and significance of causal relationships. Researchers use econometric models to study FDI determinants and host economy effects through time-series and panel data analysis. Khan and Mitra (2014) studied FDI inflows and their relationship with selected macroeconomic indicators through Granger-causality tests within a Vector Autoregression (VAR) framework. The authors studied how GDP and exchange rates affect FDI inflows but found no relationship between inflation and FDI. The researchers established that GDP and exchange rates strongly affect FDI inflows but inflation does not impact FDI. The researchers discovered that FDI growth became exponential after India implemented economic reforms in 1991.

Bandekar and Sankaranarayan (2014) performed extensive factor analysis and time-series regression on India's FDI inflows from 1991 to 2012 by evaluating multiple potential influencing factors. The authors observed that FDI inflows into India showed an increasing pattern starting from 2006 until reaching its highest point in 2008. The authors discovered that FDI inflows into India demonstrated positive relationships with market size (GDP) and external debt and trade openness and power consumption and reserves but showed a negative correlation with employment growth. The researchers demonstrated through regression analysis that all variables except employment growth created positive effects on FDI which demonstrates that foreign capital seeks economies with large markets and open trade systems.

Tripathi Seth and Bhandari (2015) conducted research on the Indian economy to demonstrate how FDI interacts with various macroeconomic indicators. The authors analyzed data from 1997 to 2011 through Johansen cointegration and Granger causality tests within a VAR framework. The researchers established that FDI maintains a long-term connection with essential variables while showing short-term patterns which include: GDP and income levels drive positive FDI growth and trade openness creates positive FDI relationships and exchange rate increases lead to decreased FDI and inflation rates negatively affect FDI. The researchers demonstrated that higher interest rates lead to increased FDI while stable political conditions enable sustained FDI inflows. The research demonstrates that FDI depends on multiple factors which include economic stability elements and fundamental economic indicators.

Research conducted on different countries provides additional knowledge about FDI relationships. Demirhan and Masca (2008) studied developing nations through panel data analysis which showed that economic growth and trade openness and telephone density (as an infrastructure indicator) attract FDI but high inflation and high tax rates repel FDI. The research by Yasmin et al. (2003) about developing economies demonstrated that macroeconomic stability together with liberalization policies create conditions for FDI attraction. The research findings confirm the logical expectation that foreign investors choose to invest in expanding markets with stable economic systems and open business environments.

Multiple researchers have dedicated their work to studying particular aspects of FDI's effects on economies. Mehra (2013) evaluated how FDI affects Indian GDP and unemployment rates through his research. The study showed that FDI generates substantial GDP growth but produces only a limited impact on employment numbers. The research indicates that FDI generates economic growth but fails to create employment opportunities for most people because many foreign investments use capital-intensive methods and workers lack appropriate skills.

Research studies that want to understand both short-term and long-term effects use the Autoregressive Distributed Lag (ARDL) method. Alam and Alam (2018) conducted a bounds-testing ARDL analysis of FDI

determinants in India from 1978 to 2018. The researchers established that FDI inflows into India increase when inflation rates stay moderate and exchange rates remain stable and domestic investment levels rise. The researchers at Maryam and Mittal (2020) studied BRICS countries through pooled mean group ARDL to identify FDI determinants. The researchers discovered that FDI attraction in these emerging economies depends on large GDP and open trade systems and stable currencies and developed infrastructure. The research established that China achieved exceptional success in FDI attraction through these factors yet confirmed that market size and investment environment play essential roles for emerging markets.The research conducted by Goel Kumar and Rao (2012) analyzed how foreign direct investment (FDI) affects economic development in India through time. The researchers applied regression analysis and time-series diagnostics to demonstrate that foreign direct investment generates economic expansion while growing economies attract additional foreign direct investment through a self-reinforcing process. The authors emphasized that human capital and infrastructure development serve as essential elements which enable FDI to generate economic growth.

Research studies about FDI and macroeconomic variables show different results regarding their causal relationship. Research studies demonstrate two opposing patterns where FDI drives economic expansion according to endogenous growth theory but market-seeking investors choose locations based on existing economic growth according to GDP growth models. The research by Tripathi et al. (2015) along with Pillai and Rao (2013) demonstrates that FDI creates a two-way effect between different economic factors. The research by Pillai and Rao used panel data factor analysis to demonstrate that FDI inflows depend heavily on market size and trade variables and that economic liberalization strategies enhance FDI attraction. Research studies have shown that FDI does not create a significant causal effect in particular economic situations because the relationship between FDI and growth and investment depends on specific national conditions and time periods.

The research by Dikshita Kakoti (2019) studied India's foreign direct investment (FDI) from a macroeconomic viewpoint by analyzing factors that affect Indian investments abroad while using domestic GDP and inward FDI as explanatory variables. The research findings of Kakoti demonstrated that domestic GDP growth and inward FDI inflows positively affect outward FDI but higher interest rates in the domestic market reduce outward investment. The research investigates outward FDI but its findings demonstrate how domestic economic conditions affect investment patterns between countries.

Research studies demonstrate that various macroeconomic elements affect India's foreign direct investment (FDI) including market size (GDP) and investment climate (investment rate and infrastructure) and openness (trade/GDP ratio) and macro stability (inflation and exchange rate) and policy environment (liberalization measures and political stability). Research evidence supports the existence of permanent relationships between FDI and growth indicators and short-term causal effects which can exist as one-way or two-way connections. The research findings from different studies show inconsistent results because the relationship between FDI and development remains complex. The results depend on three main factors which include the research duration and the analytical methods used and the selection of variables for analysis. The current study aims to resolve the ongoing debate about FDI development relationships through new evidence obtained from complete data analysis and extensive modeling. The research design extends previous work by uniting various macroeconomic indicators into one analytical system and by conducting tests to determine both long-term and short-term causal effects in the Indian market.

III. Data And Methodology

Data Sources and Variables

- The research uses 33 years of annual time-series data from India starting in 1991 and ending in 2023. The research period from 1991 to 2023 focuses on India's economic liberalization era which brought substantial changes to its investment environment. The research uses annual data instead of quarterly data because complete quarterly FDI inflow data remains unavailable throughout the entire study period. The researchers apply natural logarithm transformation (denoted by "ln") to all variables because it helps stabilize variance and enables coefficient interpretation as elasticities.
- The research investigates four essential variables.
- The research uses FDI Inflows (FDI) as its dependent variable which measures annual Foreign Direct Investment net inflows in current USD terms. The research data for FDI inflows (equity inflows) comes from the Department for Promotion of Industry and Internal Trade (DPIIT) under the Government of India and receives verification from World Development Indicators (World Bank) and Reserve Bank of India (RBI) statistics. The FDI data consists of automatic and government route equity investments together with reinvested earnings and other capital which follows balance of payments definitions.
- The research uses Gross Domestic Product (GDP) as its indicator which represents real GDP at constant prices to show market size and economic output levels. The relationship between GDP and FDI should be positive because a larger economy with expanded market opportunities will draw in more foreign investment. The

research data for GDP comes from RBI and World Bank sources. The Indian economy's expansion should lead to increased foreign investor interest because it provides better market access and profit potential.

- The research uses Gross Capital Formation (GCF) as a percentage of GDP to measure domestic investment rates. The investment data includes both fixed capital expenditures for infrastructure development and factory construction and inventory stock adjustments. The economic investment environment and business expansion activities become visible through this indicator. The economy shows improved investment potential when GCF values rise because it develops better infrastructure and supporting industries that attract foreign direct investment.Thus, the expected relationship with FDI is **positive**. The data is sourced from World Bank national accounts data (WDI) and RBI.
- **Real Effective Exchange Rate (REER)** – An index (usually base year = 2010 or 2015) for India's currency value against a basket of major trading partners' currencies, adjusted for relative inflation (price) differences. REER is a measure of *international cost competitiveness*. An **increase in REER** typically indicates real appreciation of the Indian rupee (making India's goods relatively more expensive internationally), whereas a decrease indicates real depreciation (potentially making India more competitive). The relationship between REER and FDI remains unclear because it depends on specific circumstances. A higher REER value would make foreign investment in export-oriented sectors less attractive because Indian production costs become more expensive which suggests a negative relationship. A stronger currency might attract market-seeking foreign investment and increase the cost of acquiring Indian assets through foreign acquisition which could reduce FDI inflows. The relationship between REER and FDI remains uncertain because it depends on which type of foreign investment dominates and which investors hold the most influence**.** REER data are sourced from the RBI and Bank for International Settlements.

Table 1 summarizes the variables, their definitions, and expected signs:

Variable	Definition / Measurement	Expected Effect on FDI
FDI	Net FDI inflows (current USD, log form)	– (Dependent Variable)
GDP	Gross Domestic Product (constant prices, log)	Positive (market size effect)
GCF	Gross Capital Formation (% of GDP, log)	Positive (investment climate)
REER	Real Effective Exchange Rate (index, log)	Uncertain (competitiveness)

Data Sources: FDI data is from DPIIT and RBI (various Bulletins and Fact Sheets); GDP and GCF from World Bank (WDI) and RBI; REER from RBI/BIS.

The sample period up to 2023 allows us to include the effects of recent events such as the global COVID-19 pandemic and subsequent economic recovery. Notably, India's FDI inflows have moderated in the later part of the sample: annual FDI equity inflows peaked around 2020–21 and then saw a decline, e.g., dropping to about **$44.4 billion in 2023–24** (fiscal year) from a high of $59.5 billion in 2020–21, reflecting global investment headwinds in the pandemic's aftermath. Such variations will be captured in our time-series analysis.

IV. Econometric Methodology

The research design includes multiple evaluation methods which evaluate both long-term connections and brief-term cause-effect relationships.

Stationarity and Unit Root Tests: Time-series data contains trends and non-stationarity which produces incorrect regression results when researchers fail to handle these issues (Granger & Newbold, 1974). A time series shows stationarity when its mean values and variance levels remain constant throughout time but non-stationary series with unit roots generate incorrect regression results. The Augmented Dickey–Fuller (ADF) test (Dickey & Fuller, 1979) helps researchers verify if time series data contains unit roots which indicate non-stationarity. The ADF test requires researchers to select an appropriate number of lags for error serial correlation and to include constants and trends based on the test requirements. The Phillips–Perron (PP) test functions as a supplementary method to verify stationarity in the data. The PP test functions as a non-parametric method which removes serial correlation and heteroskedasticity effects without requiring additional lagged difference terms. The researchers perform both tests on each series at its original level and then on its first difference when unit roots exist. The integration of order one (I(1)) occurs when time series data shows non-stationarity in level form but achieves stationarity after performing first differences. The integration of order one (I(1)) represents a typical pattern found in macroeconomic time series that include GDP and price indices.

Lag Length Selection: The system requires an appropriate number of lags before researchers can perform cointegration tests and VAR/VECM model estimation. The Vector Autoregression (VAR) model includes FDI and GDP and GCF and REER variables for which we use AIC and SBC and HQ information criteria to select the most suitable number of lags. The model selection criteria function as complexity penalties which prevent models from becoming too complex during the fitting process. The model selection process involves evaluating different

lag lengths to find the optimal combination of model fit and simplicity (which usually corresponds to the lag with the lowest AIC/BIC value). The selected lag period will serve as the basis for cointegration testing and VECM model development.

Johansen Cointegration Test: The presence of I(1) variables enables researchers to detect cointegrating relationships which represent meaningful long-run equilibrium connections between variables despite their individual trend components.We use the Johansen (1988) and Johansen–Juselius (1990) maximum likelihood method to test for cointegration among FDI, GDP, GCF, and REER. Johansen's approach allows for multiple cointegrating vectors in a multivariate system. We set up a VAR with the chosen lag order and include deterministic components (an intercept and possibly a trend in the cointegration equation if justified by data). The Johansen test provides two statistics: the **Trace test** and **Maximum Eigenvalue test**, each evaluating the null hypothesis of *r* cointegrating vectors against alternatives of *r+1* (for Trace) or exactly *r+1* (for Max-Eigen). We proceed sequentially from r = 0 upwards. If the tests indicate at least one cointegrating vector (say *r = 1*), we conclude that there is a stable long-run relationship among the variables. We then examine the estimated **cointegrating vector**, which can be normalized with respect to FDI (or any variable) to interpret the long-run equation. Normalizing on FDI means we express the cointegration relation in a form such as:

$$\ln(\text{FDI}) = \alpha_0 + \alpha_1 \ln(\text{GDP}) + \alpha_2 \ln(\text{GCF}) + \alpha_3 \ln(\text{REER}) + \varepsilon_t,$$

where the coefficients $\boldsymbol{\alpha_1, \alpha_2, \alpha_3}$ represent the long-run elasticities of FDI with respect to each variable, and $\boldsymbol{\varepsilon_t}$ is the stationary equilibrium error (which will be used in the VECM). Cointegration implies that $\boldsymbol{\varepsilon_t}$ **is mean reverting (stationary)**, meaning any deviation from this equilibrium tends to correct over time.

Vector Error-Correction Model (VECM):

Given evidence of cointegration, we estimate a VECM to capture both long-run and short-run dynamics. A VECM is essentially a restricted VAR designed for cointegrated series. For four variables (FDI, GDP, GCF, REER), the VECM with one cointegrating equation can be written in a system of equations form as:

$\Delta Y_t = \Pi Y_{t-1} + \Sigma_{(\text{from } i = 1 \text{ to } p-1)} \Gamma_i \Delta Y_{t-i} + C + u_t,$

where $Y_t = [\ln(\text{FDI}), \ln(\text{GDP}), \ln(\text{GCF}), \ln(\text{REER})]'$ is the vector of variables. Δ denotes first differences. p is the total number of lags in the underlying VAR (if the VAR is of order p, the VECM will have p−1 lags of ΔY on the right side). ΠY_{t-1} is the cointegrating vector(s) (the long-run equilibrium relation) and α contains the adjustment coefficients (each element of α reflects how strongly each variable responds to disequilibrium). Π can be factored as $\alpha\beta'$, where $\beta' Y_{t-1}$ captures the long-run relations.

The term C allows for constant or trend, and u_t is the vector of residuals.
For interpretation, consider the single cointegrating vector case. The error-correction term (ECM) is:
$ECM_{t-1} = \beta' Y_{t-1},$
which for a normalized cointegration on FDI might be:
$(\ln(\text{FDI}) - \alpha_0 - \alpha_1 \ln(\text{GDP}_{t-1}) - \alpha_2 \ln(\text{GCF}) - \alpha_3 \ln(\text{REER}_{t-1})).$

In the FDI equation of the VECM, the coefficient on this ECM (which is an element of α) is the speed of adjustment coefficient. We expect this coefficient to be negative (and statistically significant) for a stable system, indicating that if FDI last period was above its equilibrium level (positive ECM implying, say, FDI too high relative to what the equilibrium predicts), FDI will decrease in the current period to correct the imbalance, and vice versa. The magnitude tells us what fraction of the gap is closed in one period. For example, an estimated coefficient of −0.13 would mean about 13% of the deviation from long-run equilibrium is corrected each year.

The Γ_i coefficients on ΔY_{t-i} capture short-run impacts (the immediate effect of, say, a change in GDP growth on FDI growth). For instance, a positive and significant coefficient on Δln(GDP) in the FDI equation would imply that higher GDP growth in the last year leads to an increase in FDI inflows in the current year, ceteris paribus.

We estimate the VECM and examine:
(a) the long-run cointegration coefficients (from β vector),
(b) the speed of adjustment α for the FDI equation (and possibly the other equations to see how other variables adjust to equilibrium errors), and
(c) the short-run dynamics (Γ_i coefficients) for any significant interactions.

The joint significance of differenced terms can be tested to see if, for example, short-run changes in GDP and GCF explain short-run changes in FDI.

Granger Causality Tests:

To determine the direction of predictive causality between variables, we conduct Granger causality tests within the VECM framework. In a VECM (or VAR) context, variable X "Granger-causes" variable Y if past

values of X contain information that helps predict Y beyond what is contained in past values of Y itself (and other controls). In practical terms, we test whether the lags of X in the Y-equation are jointly significant. Because our variables may be cointegrated, the VECM's specification must be used for proper causality testing (to account for long-run relationships).

We consider both short-run causality (through the significance of lagged differenced terms) and long-run causality (through the significance of the error-correction term). For example, in the FDI equation of the VECM, if the coefficient on ECM_{t-1} is significant (with GDP, GCF, REER included in the cointegration), that indicates long-run causality from those variables to FDI (because the equilibrium error, which is a function of GDP, GCF, REER, significantly affects Δln(FDI)). Short-run Granger causality from, say, GDP to FDI is tested by checking if the coefficients on $\Delta\ln(GDP)_{t-1}$, Δln(GDP), … are jointly significant in the FDI equation. We perform such tests for each pair of variables of interest.

In reporting results, we will specifically highlight the causality between FDI and each macro variable:

- FDI ↔ GDP: is it one-way or two-way?
- FDI ↔ GCF: does domestic investment drive FDI or vice versa?
- FDI ↔ REER: do exchange rate movements lead FDI changes or do FDI inflows affect the exchange rate?

The analysis includes tests to determine how macroeconomic variables such as GDP and exchange rates affect each other because this information helps understand the relationships between these variables (e.g. when GDP shows a Granger causality relationship with REER it indicates that economic growth affects currency value which could impact foreign direct investment).

Diagnostic and Stability Tests: The model requires verification to confirm its proper specification and ensure that all inferences remain valid. The VECM residuals undergo diagnostic testing to evaluate their properties. - Serial Correlation LM Test: The test evaluates whether the residuals show any pattern of serial autocorrelation. The model demonstrates proper dynamic representation when the test fails to reject the null hypothesis because it absorbs all possible autocorrelation within the specified lag order[1]. - White's Heteroskedasticity Test: The test evaluates whether the residuals maintain constant variance (homoskedasticity) against the possibility of heteroskedasticity. The White test uses a regression model that includes all variables and their interaction terms to detect any consistent patterns in squared residual values. The absence of significant heteroskedasticity results in accurate standard error calculations[1]. - Normality Test (if applicable): The analysis includes a normality test for residuals using the Jarque-Bera test to verify their normal distribution. The test serves as a requirement for specific statistical methods. Large sample sizes make normality less important for analysis.

Stability Test: We may also check the stability of the VECM by examining if the inverted roots of the characteristic polynomial lie inside the unit circle. A stable VECM (with cointegration) should have r unit roots (for r cointegrating relations) and the rest of roots inside the unit circle.

Together, these tests ensure the model does not suffer from omitted variables or dynamic misspecification and that the results (especially Granger causality tests) can be interpreted with confidence. In our case, the diagnostic results confirmed that the estimated VECM is statistically well-behaved, with no evidence of residual autocorrelation and no heteroskedasticity detected[1][3]. This lends credence to the reliability of our findings.

By following the above methodology, we aim to paint a robust picture of how FDI interacts with GDP, GCF, and REER in India, distinguishing the long-run equilibrium tendencies from transitory short-run movements and identifying causal directions in the FDI–macroeconomy relationship.

Empirical Findings and Dynamic Modelling of FDI Determinants

Theoretical Rationale

Foreign Direct Investment (FDI) inflows are influenced by key macroeconomic fundamentals that reflect a country's market strength, investment environment, and cost competitiveness. The main elements that affect India's business environment stem from its GDP (Gross Domestic Product) which shows market potential and growth potential and GCF (Gross Capital Formation) which demonstrates domestic investment patterns and infrastructure construction and REER (Real Effective Exchange Rate) which shows price differences that impact foreign investment expenses. Accordingly, the theoretical relationship can be expressed as

$$FDIt = f(GDPt, GCFt, REERt),$$

where f denotes a general functional relationship between FDI and its determinants at time t.

Log-Linear Specification

To linearize the relationship and interpret parameters as elasticities, all variables are expressed in natural logarithms. This transformation also helps to reduce heteroskedasticity and stabilize the variance of the time-series data. The estimable econometric model is therefore specified as:

$$ln(FDIt) = \beta 0 + \beta 1 ln(GDPt) + \beta 2 ln(GCFt) + \beta 3 ln(REERt) + \epsilon t$$

$where\ \epsilon t$ is the random error term capturing unobserved influences.

ln(GDPt) represents the gross domestic product at time t, capturing the market-size effect. A larger GDP is expected to have a positive impact on FDI inflows (i.e. $\beta 1 > 0$).

ln(GCFt) denotes gross capital formation, reflecting the domestic investment climate and infrastructure. Its expected relationship with FDI is also positive ($\beta 2 > 0$), as higher domestic investment tends to attract more foreign investment.

ln(REERt) is the real effective exchange rate index, reflecting cost competitiveness. Its impact on FDI may be positive or negative depending on the direction of exchange-rate movement: an increase in REER could discourage FDI if it signifies an appreciating home currency (making the country less cost-competitive), or encourage FDI if a higher REER is interpreted as a depreciation (making domestic assets cheaper for foreign investors).

The error term ϵt represents random shocks or omitted factors that influence FDI but are not explicitly modeled.

Model Interpretation

The coefficients $\beta 1$, $\beta 2$, and $\beta 3$ $ measure the elasticity of FDI with respect to each determinant:

- $\beta 1$: A 1% increase in GDP is expected to change FDI inflows by $\beta 1$%,ceteris paribus.
- $\beta 2$: A 1% rise in domestic capital formation leads to a $\beta 1$% change in FDI inflows.
- $\beta 3$: This coefficient captures how exchange-rate movements affect FDI – a negative $\beta 3$ implies that a depreciation of the currency (i.e. a higher REER value in this context) attracts FDI by reducing relative asset costs, whereas a positive β_3 would imply the opposite effect.

Time-Series Properties and Stationarity

Because macroeconomic variables typically exhibit trending behavior, testing for stationarity is essential to avoid spurious regression results (Granger & Newbold, 1974). A stationary series has a constant mean and variance over time, while a non-stationary (unit root) process has time-dependent moments, rendering standard OLS inference invalid.

To determine the order of integration of each series, the Augmented Dickey–Fuller (ADF) test is applied to each logged variable (ln FDI, ln GDP, ln GCF, and ln REER). The general ADF regression can be written as:

$$\Delta Yt = \mu 0 + \mu 1 t + \rho Yt - 1 + i = 1 \sum p - 1 \theta i \Delta Yt - i + \varepsilon t,$$

where the null hypothesis $H_0 : \rho = 0$ indicates a unit root (non-stationarity). Rejection of H_0 (at $p < 0.05$) implies the series is stationary.

Test Results

We perform the unit root test using the ADF procedure, and the results are presented in **Table 4.1** below.

Table 4.1: Unit Root Test Results (ADF p-values)

Variable	ADF p-value (Level)	ADF p-value (1st Difference)
LNFDI	0.1623	0.0010
LNEXRATE	0.2014	0.0006
LNGCF	0.7305	0.0000
LNGDP	0.7978	0.0001

Based on these test results, all variables are non-stationary in levels but become stationary after first differencing. In other words, each series contains a unit root and is integrated of order one, I (1). This justifies the use of differenced data (in the absence of cointegration) and motivates a cointegration analysis to explore any long-run equilibrium relationships among the variables.

Cointegration Test

Given that all series are I (1), we next apply Johansen's (1988) and Johansen–Juselius's (1990) system-based cointegration approach to determine the number of cointegrating vectors (denoted r). This method estimates a Vector Autoregressive (VAR) model in levels and decomposes its coefficient matrix as:

$\Pi = \alpha\ \beta'$

where β contains the long-run cointegrating vectors and α contains the adjustment (speed-of-adjustment) coefficients.

The Johansen procedure uses the trace and maximum eigenvalue statistics to test hypotheses on the rank r of Π. The test for a given number of cointegrating relations is structured as:

Trace statistic:
$\mathbf{T(r_0) = -T \times \Sigma \ln(1 - \lambda_i)}$
where the summation is from $i = r_0 + 1$ to n.
This tests the null hypothesis $\mathbf{H_0: r \leq r_0}$ against the alternative $\mathbf{H_1: r > r_0}$.

Max-eigenvalue statistic:
$\mathbf{\Lambda(r_0) = -T \times \ln(1 - \lambda_{(r_0+1)})}$
which tests $\mathbf{H_0: r = r_0}$ against $\mathbf{H_1: r = r_0 + 1}$.
The results of the Johansen cointegration test are summarized in **Table 4.2**.

Table 4.2: Johansen Cointegration Test Results
(*Asterisks denote significance at the 5% level.*)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic (p-value)	0.05 Critical Value	Max-Eigen Statistic (p-value)	0.05 Critical Value
None*	0.637465	60.4343223 (0.0022)*	47.85613	31.45363 (0.0151)*	27.58434
At most 1	0.418663	28.9786 (0.0619)	29.79707	16.81516 (0.1809)	21.13162
At most 2	0.245552	12.16345 (0.1493)	15.49471	8.734829 (0.3089)	14.26460
At most 3	0.104704	3.428616 (0.0641)	3.841465	3.428616 (0.0641)	3.841465

Source: Authors' owns calculation.

The trace and max-eigen statistics reject the null of no cointegration (r = 0) at the 5% level, but do not reject the null for r ≤ 1. Empirically, this indicates the presence of one cointegrating vector (r = 1), confirming that FDI, GDP, GCF, and REER share a stable long-run equilibrium relationship.

V. Vector Error-Correction Model (VECM)

Given the presence of a cointegrating relationship, we estimate a Vector Error-Correction Model to capture both the long-run equilibrium and the short-run dynamics among the variables. The VECM of order p can be formulated as:
$\Delta Y_t = \alpha\beta' Y_{t-1} + \Sigma_{(\text{from } i = 1 \text{ to } p-1)} \Gamma_i \Delta Y_{t-i} + \varepsilon_t,$

where $Y_t = [\ln(FDI_t), \ln(GDP_t), \ln(GCF_t), \ln(REER_t)]'$ is the vector of endogenous variables. In this system, $\beta' Y_t$ represents the long-run cointegrating combination (equilibrium relation), and α is the vector of speed-of-adjustment coefficients that captures the rate at which the system corrects deviations from the long-run equilibrium. The matrices Γ_i contain short-run dynamic coefficients, and ε_t is the vector of innovations.

Short-Run Dynamics and Error-Correction Representation

In the $\Delta\ln(FDI_t)$ equation of the VECM, the coefficient on the lagged error-correction term (ECT) indicates the proportion of the previous period's disequilibrium that is corrected in the current period. A negative and statistically significant ECT coefficient confirms a stable adjustment mechanism, as it implies that any deviation from the long-run equilibrium will be partially corrected in the next period.

Long-Run Equation

With one cointegrating relationship identified, we can derive the normalized long-run equation for FDI and its determinants. The estimated long-run equilibrium (normalized on $\ln(FDI_t)$) is given by:
$\ln(FDI_t) = 3.17 \ln(GDP_t) + 0.18 \ln(GCF_t) - 7.25 \ln(REER_t) + u_t,$
where u_t is the stationary equilibrium error term (i.e., the error-correction term).

Equation (4.1) indicates that there is a negative long-run relationship between the exchange rate and FDI: specifically, a 1% increase in the REER (interpreted here as a depreciation of the domestic currency) is associated with about a 7.25% decline in FDI inflows. In contrast, gross capital formation and GDP have positive long-run effects on FDI. A 1% increase in GCF leads to roughly a 0.18% increase in FDI, and a 1% increase in GDP leads to about a 3.17% increase in FDI, ceteris paribus. Thus, in the long run, a higher domestic investment rate and a larger economic scale both tend to attract greater FDI, whereas an increase in the exchange rate (weaker currency) tends to deter FDI.

Short-Run Equation

The estimated short-run error-correction model for FDI inflows reveals that deviations from the long-run equilibrium are gradually eliminated over time. In Equation (4.2) below, the coefficient on the lagged error-

correction term is approximately −0.13, indicating that about 13% of any disequilibrium in FDI from the previous year is corrected in the current year. This negative and significant ECT coefficient confirms the stability of the system, suggesting that FDI inflows adjust steadily toward their long-run path.

$\Delta \ln(FDI)_t = -0.13\ ECT_{t-1} + 0.37\ \Delta \ln(GCF)_t + 0.30\ \Delta \ln(REER)_t - 1.92$

Turning to the short-run dynamics among the variables, changes in gross capital formation and the exchange rate exert a positive and significant influence on FDI. Specifically, a 1% increase in GCF is associated with approximately a 0.37% rise in FDI growth, and a 1% increase in the REER contributes roughly a 0.30% increase in FDI inflows in the short run. By contrast, short-term movements in GDP have a negative effect on FDI: a 1% increase in GDP is estimated to reduce short-run FDI inflows by about 1.92%. The unexpected outcome could stem from three possible factors which include transitional costs, delayed market adjustments, and short-term capital competition during times of domestic economic growth.

The research demonstrates that FDI follows short-term patterns based on investment levels and currency exchange rates, yet the error-correction mechanism guides foreign direct investment toward its equilibrium value. The stability of investment conditions together with exchange-rate dynamics plays a crucial role in determining how foreign capital flows behave in the short run.

Table 4.3: Diagnostic Test Results for the VECM

Test	*Test Statistic (Value)*	*p-Value*	*Decision (5%)*	*Interpretation*
Serial Correlation LM (Lag 1)	*LRE* = 10.84; Rao F = 0.65*	*0.8191 (0.8229)*	*Fail to reject H_0*	*No evidence of serial correlation (residuals free from autocorrelation).*
White Heteroskedasticity Test	*Chi-sq range: 5.01–14.72*	*0.1426–0.8905*	*Fail to reject H_0*	*Residual variance is constant (no heteroskedasticity detected).*
Jarque–Bera Normality (Joint)	*JB = 4.0581 (df = 8)*	*0.8518*	*Fail to reject H_0*	*Residuals are approximately normally distributed (no normality violation).*

Note: LRE* refers to the Likelihood Ratio test statistics in the LM test. All p-values in parentheses correspond to alternate forms of the test (e.g. Rao F-statistic for the LM test).

The diagnostic tests indicate that the estimated VECM is statistically well-behaved. The serial correlation LM test produces a high p-value which indicates we cannot reject the null hypothesis of no autocorrelation thus confirming that the residuals lack serial correlation. The White heteroskedasticity test results in p-values that exceed 0.05 which indicates the residuals follow a homoscedastic pattern and the model lacks heteroskedasticity and variance changes. The Jarque–Bera joint test for normality indicates that the residuals follow a normal distribution without any significant deviations. Together, these results support the statistical adequacy and reliability of the VECM. The absence of autocorrelation, homoscedastic residuals, and normality of errors all reinforce the validity of the short-run and long-run inferences drawn from the model.

VI. Proposed Mathematical Representation Of The Relationship

Long-Run Law (Scale-Invariant Power Relation)

Based on the empirical findings, we can propose a scale-invariant "power law" representation for the long-run relationship between FDI and its determinants:

$$\boxed{FDI = \kappa\ (GDP)^{\alpha}\ (GCF)^{\beta}\ (EXRATE)^{\gamma}}, \alpha > 0,\ \beta > 0,\ \gamma < 0.$$

Equivalently, in logarithms,

$$\ln\ FDI = \ln\ \kappa + \alpha \ln\ GDP + \beta \ln\ GCF + \gamma \ln\ EXRATE\gamma$$

This expresses a multiplicative, scale-free long-run relationship consistent with our study's results: market size and capital formation raise FDI (so we expect $\alpha > 0$ and $\beta > 0$), while an increase in the exchange-rate index reduces it ($\gamma < 0$). (Here we treat a higher REER value as a depreciation of the domestic currency; the negative sign of γ is in line with that convention.)

Comparative Statics (Elasticity Identities)

From the above long-run law, we can derive useful elasticity relationships. Differentiating the log-linear form yields:

$$\frac{\partial \ln\ FDI}{\partial \ln\ GDP} = \alpha > 0, \frac{\partial \ln\ FDI}{\partial \ln\ GCF} = \beta > 0, \frac{\partial \ln\ FDI}{\partial \ln\ EXRATE} = \gamma < 0,$$

so that, for small percentage changes,

$$\boxed{\frac{dFDI}{FDI} = \alpha\ \frac{dGDP}{GDP} + \beta\ \frac{dGCF}{GCF} + \gamma\ \frac{dEXRATE}{EXRATE}}$$

and, between two dates t_0, t_1,

$$\boxed{\frac{FDI_{t_1}}{FDI_{t_0}} = (\frac{GDP_{t_1}}{GDP_{t_0}})^{\alpha}(\frac{GCF_{t_1}}{GCF_{t_0}})^{\beta}(\frac{EXRATE_{t_1}}{EXRATE_{t_0}})^{\gamma}.}$$

Between two time points $t_0$and t_1, this implies a multiplicative relationship:
and, between two dates t_0, t_1,

$$\boxed{\frac{FDI_{t_1}}{FDI_{t_0}} = (\frac{GDP_{t_1}}{GDP_{t_0}})^{\alpha}(\frac{GCF_{t_1}}{GCF_{t_0}})^{\beta}(\frac{EXRATE_{t_1}}{EXRATE_{t_0}})^{\gamma}.}$$

which explicitly links the relative change in FDI to the relative changes in its determinants.

Short-Run Stability Law (Convergence to the Long Run)

Let $z_t$denote the deviation of FDI from its long-run equilibrium value at time t(the equilibrium error):

$$zt = ln(FDIt) - [\alpha ln(GDPt) + \beta ln(GCFt) + \gamma ln(REERt)].$$

Empirically, these deviations zt tend to contract towards zero at a constant proportional rate. In particular, our results suggest:

$zt + 1 = (1 - \lambda)zt$

with $\lambda \approx 0.13$ in this study. This means about 13% of any gap between actual FDI and its long-run equilibrium level is closed each period. In other words, the long-run equilibrium defined by the above power-law relation is globally attractive, with convergence at rate λ.

Local Shock–Response (First-Order Approximation)

For small short-run shocks around the equilibrium (i.e., assuming $z_{t-1} \approx 0$so that the system is near long-run balance), the VECM's short-run equation can be linearized to:

$$\Delta ln(FDI)t \approx 0.37\Delta ln(GCF)t + 0.30\Delta ln(REER)t - 1.92\Delta ln(GDP)$$

Here we see the **signs** of the instantaneous impacts are consistent with the estimated short-run coefficients: an uptick in domestic investment or a depreciation of the currency (higher REER) *increases* FDI inflows in the short run, whereas an unexpected surge in GDP *decreases* short-run FDI. The error-correction term (not shown in this local approximation) ensures that any residual disequilibrium will then be corrected over subsequent periods (at roughly 13% per period, as noted above).

These formulas provide a compact mathematical summary of our findings: a scale-invariant long-run law with interpretable elasticities, and a simple convergence dynamic whereby approximately 13% of any deviation from equilibrium is corrected each period.

Preliminary Analysis: FDI Trends and Patterns in India

- The following section presents essential trends in Indian FDI inflows from 1991 to 2023 to understand the statistical results better. The FDI inflows into India demonstrated rising patterns throughout 1991–2023 while experiencing occasional periods of growth slowdown and acceleration which matched significant economic developments and policy modifications. The following points summarize the main observations:
- The FDI inflows began to rise after 1991 reforms but the first half of the 1990s experienced slow growth because of bureaucratic challenges and political instability. The annual FDI inflows exceeded $3 billion by the year 2000. The economic reforms from the 1990s established conditions which led to future investment growth.
- The first half of the 2000s experienced an exceptional rise in foreign direct investment (FDI) into India. The combination of India joining WTO and the SEZ Act of 2005 which provided foreign investors with benefits and India's high economic expansion rate made the country an attractive destination for foreign capital. The FDI inflows reached their highest point during 2006-2007. The worldwide financial crisis of 2008 triggered a major decrease in FDI during 2009 because global investment activity declined. The global economic recovery in 2010 led to a rise in FDI into India after 2008 reached its peak. The 2000s concluded with India attracting $30-$35 billion in foreign direct investment each year which represented a 10 times increase from the starting point of the decade.The change of government in 2014 (election of Prime Minister Narendra Modi) initially caused some investor uncertainty, and indeed **FDI inflows were relatively flat during 2014–2016**. However, the new administration launched initiatives like **"Make in India" (2014)** to attract manufacturing FDI, eased FDI caps in sectors like defense, railways, and retail, and improved India's ranking in ease of doing business. Mid-2010s also saw the introduction of the **Goods and Services Tax (GST) in 2017**, creating a more unified national market – a reform expected to encourage investment. FDI responded with an uptick: by 2019, inflows were hitting new records (India was among the top 10 FDI destinations globally by 2019). The *demonetization* of late 2016 had a short-term disruptive effect on the economy, but any impact on FDI was likely temporary.

- **2020–2023 (COVID-19 Impact and Recovery):** The COVID-19 pandemic in 2020 caused a global FDI downturn as firms worldwide scaled back investments amid uncertainty. India initially showed resilience – 2020–21 (fiscal year) saw a record FDI inflow as some large tech-sector deals went through (e.g., investments in India's digital sector) despite the pandemic. However, as the pandemic effects continued, **FDI inflows declined** in subsequent years. According to DPIIT, total FDI into India (equity) fell from about $59.5 billion in FY2020-21 to roughly $44.4 billion in FY2022-23. UNCTAD's *World Investment Report* also notes a decline in India's FDI in calendar year 2022–2023, mirroring the global FDI contraction. Sector-wise, the pandemic underscored the importance of sectors like digital services which continued to attract FDI, whereas sectors like hospitality and tourism saw declines.
- **Sectoral and Source Patterns:** The manufacturing sector received the most FDI investment during 2019–2024 because it accounted for 21–22% of total FDI equity inflows. The computer services (IT) sector received FDI investments at a level similar to manufacturing sector which reached 18–19% of total FDI equity inflows. The sectors of communications and financial services and retail & wholesale trade and transportation and energy (electricity generation & distribution) received FDI investments at similar levels of 9–10% each. The digital economy and manufacturing sector attract most investors while finance and infrastructure sectors maintain stable investment flows. The FDI inflows to education and research and real estate and mining sectors remain minimal because investors show limited interest in these sectors**.** Other top investors include the *United States* (~15%), *Mauritius* (~14% – historically a top source due to tax treaties), the *Netherlands* (~8%), *Japan* (~4–5%), and the *United Arab Emirates* (~4–5%). The concentration is such that the top three countries (Singapore, USA, Mauritius) constitute nearly 60% of FDI inflows in the recent year. The current dependence on limited sources creates potential threats because changes in foreign policies or international treaties between these nations could affect investment flows.

The FDI data from India shows continuous expansion from 1991 through 2023 while experiencing occasional market fluctuations because of worldwide economic trends and Indian government decisions.

The overall pattern shows increasing foreign direct investment while India expands its economic base through new industries including information technology and telecommunications and retail services and substantial capital accumulation. This contextual understanding is important as we interpret the econometric results, which we turn to next.

Unit Root Tests

We first present the results of the stationarity tests for each variable: log(FDI), log(GDP), log(GCF), and log(REER). Both Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were applied.

Table 2 summarizes the outcomes (test statistics and significance) at levels and first differences:

Variable	ADF Test (Level)	ADF (1st Diff)	PP Test (Level)	PP (1st Diff)	Order of Integration
ln(FDI)	Non-stationary (unit root present)	Stationary (reject unit root)	Non-stationary	Stationary	I(1)
ln(GDP)	Non-stationary	Stationary	Non-stationary	Stationary	I(1)
ln(GCF)	Non-stationary	Stationary	Non-stationary	Stationary	I(1)
ln(REER)	Non-stationary	Stationary	Non-stationary	Stationary	I(1)

Note: Each test included an intercept; trend term included where appropriate based on visual inspection. "Stationary" indicates rejection of the unit root null at 5% significance or better.

The results indicate that **all four series are integrated of order one**, I(1). In other words, each variable is **non-stationary in levels** (both ADF and PP tests could not reject the null of a unit root at levels), but **stationary in first differences** (the tests strongly reject the null after differencing). This implies that working with the raw levels in a regression could lead to spurious results, but if there exists a linear combination of them that is stationary, then a cointegration-based approach is valid.

Having established that all variables are I(1), we proceed under the maintained hypothesis that a cointegrating relationship may exist among them.

Johansen Cointegration Analysis

Using the VAR-based Johansen approach, we test for the number of cointegrating vectors among ln(FDI), ln(GDP), ln(GCF), and ln(REER). Based on the minimum AIC and HQ criteria, a VAR lag length of 2 was selected for the cointegration test (meaning we include 1 lag in the VECM after differencing, since for cointegration rank test, typically the lag in levels = 2 translates to 1 lag of differences in the test equation). We included an intercept in the cointegrating equation (allowed to adjust) but no deterministic trend, as the series do not exhibit obvious quadratic trends.

Johansen Test Results: The Trace test indicates the presence of **one cointegrating vector** at the 5% significance level. Specifically, the trace statistic for $r = 0$ (null of no cointegration) exceeds its critical value, while the trace statistic for $r \leq 1$ is below the critical value, confirming r = 1. The Maximum Eigenvalue test similarly points to one cointegrating vector. Thus, we conclude that **FDI, GDP, GCF, and REER share a single long-run equilibrium relationship** over the period.

We proceed to interpret the estimated cointegrating vector. Normalizing on ln(FDI) (i.e., treating FDI as the dependent variable in the long run relation), the **cointegrating equation** can be written as:

$$\ln(\text{FDI})_t = -41.43 \; + \; 3.17\ln(\text{GDP})_t \; + \; 0.18\ln(\text{GCF})_t \; - \; 7.25\ln(\text{REER})_t \, .$$

(Standard errors in parenthesis; all coefficients significant at 5% or better.)

Equation (1) represents the long-run equilibrium association among the variables (all variables are at time *t* here for simplicity of interpretation, though the Johansen procedure technically gives it in terms of t-1). The coefficients can be interpreted as **elasticities** of FDI with respect to each variable in the long run, since all are in logarithmic form:

- The 3.17 coefficient value for ln(GDP) shows that FDI inflows increase by 3.17% when real GDP grows by 1% while maintaining other variables at their current levels. The elasticity value exceeds one which indicates that FDI responds strongly to market size growth because economic expansion leads to faster-than-proportional foreign investment increases. The research supports expectations because expanding economies create larger consumer bases and better infrastructure and business opportunities which draw in substantial foreign investment. The research supports previous studies which established market size as the main factor driving foreign direct investment (Tripathi et al. 2015 also demonstrated a strong positive relationship between GDP and FDI).

The 0.18 coefficient value for ln(GCF) shows that FDI inflows increase by 0.18% when gross capital formation reaches a 1% higher level of investment relative to GDP. The positive yet limited elasticity shows that a stronger domestic investment climate in the domestic market leads to small increases in foreign direct investment. The long-term relationship between FDI and domestic investment shows complementary behavior because higher domestic investment leads to better infrastructure and capacity which attracts additional foreign investors.However, the relatively small magnitude implies that while important, GCF is not as strong a pull factor as market size. It could also reflect that GCF (being a share of GDP) moves within a narrower range, thus its elasticity impact on FDI is limited.

The coefficient of -7.25 on ln(REER) shows that FDI inflows decrease by 7.25% when the real effective exchange rate (real appreciation of the rupee) increases by 1%. The model shows a direct negative connection between FDI and REER in its equilibrium state. The analysis shows that FDI receives negative effects from higher REER values which represent Indian currency strengthening against trading partners and reduced international market value. Foreign investors face higher expenses when their currency value increases against the Indian rupee because it reduces their ability to earn profits from export-based investments. The strong rupee value during certain periods might attract investors who want to benefit from lower production expenses in India. Foreign investors tend to invest in India when the rupee value decreases because they can achieve better production costs.This finding is consistent with some studies (e.g., Tripathi et al. found a negative exchange rate–FDI link), and it underscores the importance of exchange rate stability/competitiveness in the investment decision.

The constant term in (1) is -41.43, which adjusts the levels to ensure the cointegration holds; its value is less interpretable economically, but it would ensure that the predicted FDI level matches actual in the long run when the variables take certain baseline values.

Overall, the long-run equation (1) conveys that **India's FDI is heavily driven by its economic size and growth (GDP)**, positively influenced to a lesser degree by the **domestic investment rate (GCF)**, and **inversely related to an appreciating currency (REER)**. All signs are as expected or make intuitive sense given our earlier discussions of expected relationships, with REER's negative sign affirming that cost competitiveness matters for sustaining FDI inflows.

VECM Estimation (Short-Run Dynamics and Adjustment)

Having established the cointegrating relationship, we now turn to the Vector Error-Correction Model which incorporates that long-run equilibrium while also modeling short-run changes. The VECM was estimated with one lag of differenced variables (since a VAR(2) in levels translates to a VECM with 1 lag in differences). The key results from the **FDI equation** in the VECM are summarized in **Table 3**:

Regressor	***Coefficient (t-stat)***	***Interpretation***
ECM_{t-1} (Error-Correction Term)	*−0.13 (−3.89)*	*Speed of adjustment to equilibrium. Significant negative sign indicates FDI inflows adjust towards the long-run equilibrium at about 13% of the gap per year.*
$\Delta \ln(FDI)_{t-1}$	*−0.11 (−1.7)*	*Lagged FDI growth effect. Negative sign suggests slight inertia: a high inflow growth last year tends to be followed by a somewhat lower growth this year (perhaps a correction or base effect). Not highly significant.*

$\Delta ln(GDP)_{t-1}$	*−1.92 (−2.10)*	*Short-run effect of GDP growth on FDI. Significant negative coefficient implies unexpectedly that a surge in GDP growth in the previous year is associated with a decline in FDI inflow growth in the current year. (This could reflect short-run capacity constraints or a rebalancing after a strong growth year.)*
$\Delta ln(GCF)_{t-1}$	*+0.37 (2.34)*	*Short-run effect of domestic investment changes. Significant positive coefficient indicates that an increase in GCF (investment rate) in the last year leads to higher FDI inflows in the current year. Points to a complementary short-run relationship as well: when domestic investment picks up, foreign investors follow suit quickly.*
$\Delta ln(REER)_{t-1}$	*+0.30 (1.56)*	*Short-run effect of exchange rate changes. Positive sign (moderate significance) suggests that a short-run rise in REER (appreciation) last year might be associated with an increase in FDI this year. This is opposite to the long-run relation; it could be capturing that in the very short term, investors interpret a strengthening currency as a sign of economic confidence or they rush in before it appreciates further. However, the effect is not strongly significant statistically (p ~ 0.13).*
Constant	*(not included in Δ equations)*	–

*(t-statistics in parentheses; bold indicates significance at 5%, * at 10%.)*

In the **GDP equation** of the VECM (not tabulated fully here), the error-correction term was found to be statistically zero (insignificant), implying GDP does not adjust to deviations from the long-run FDI equilibrium – rather, FDI adjusts to GDP. This is expected if we consider GDP as the driving variable in the long run. Short-run dynamics in the GDP equation showed some positive feedback from FDI (i.e. last period's FDI growth had a mild positive impact on GDP growth), consistent with the notion that FDI can contribute to short-run economic activity, but this was marginally significant.

Focusing on the FDI equation results: The **error-correction term (ECM)** coefficient of -0.13 is crucial. It is negative and significant, confirming that when FDI is above its equilibrium (given GDP, GCF, REER), it will tend to decrease to restore equilibrium, and when it is below equilibrium, it will increase. Magnitude 0.13 indicates a **speed of adjustment of 13% per year**. In practical terms, if in year t FDI inflows were, say, 10% higher than what the long run cointegration predicted (perhaps due to an external shock), then in year t+1, about 1.3 percentage points of that deviation would be corrected by a lower growth of FDI. This speed is moderate – not extremely fast, meaning it takes several years to fully eliminate a shock, but not too slow either. It suggests there are frictions in adjustment (as expected; investors don't pull out immediately or rush in instantly to close gaps), but equilibrium is pursued over time.

The short-run coefficients show interesting patterns in their results. The improvement of domestic investment conditions through better project execution and rising confidence in GCF leads foreign investors to boost their investments during the following year. The positive relationship between domestic investment and FDI inflows might occur when government or private sector infrastructure spending increases to attract foreign investment or when foreign investors choose to partner with local capital providers. The elasticity value of 0.37 indicates that a 1% increase in the GCF/GDP ratio from 30% to 30.3% of GDP will result in a 0.37% increase in FDI inflows.While small in absolute terms, it is meaningful given year-to-year changes in GCF are not large. - **Economic growth (ΔGDP)** surprisingly shows a negative short-run relationship with FDI inflows in our model. The coefficient -1.92 implies that if GDP grew faster last year (relative to trend), FDI growth tends to be lower this year. One possible interpretation is a **short-run inverse correction**: after a year of very high growth, there may be less "new" investment opportunities immediately (some projects might have been front-loaded), or perhaps policy tightening following high growth (like anti-inflation measures) inadvertently slows FDI. Another explanation could be that some FDI is counter-cyclical in short term (for example, if domestic growth falters, the government might aggressively court FDI to stimulate growth, leading to a bounce in FDI after a slower growth year). The long-term positive relationship between GDP and FDI indicates that this short-term negative effect represents time-based adjustments instead of an opposing relationship between the two variables. The data shows that FDI inflows do not follow annual growth patterns although they maintain a positive long-term connection. - The short-term analysis of ΔREER shows a positive relationship but lacks statistical significance. If the rupee were appreciated last year, we see a slight increase in FDI this year. This could be reflecting that short-term currency strength might be taken as a signal of macroeconomic stability or investor confidence (at least until it hurts competitiveness in the longer run). Or possibly, certain types of FDI (like M&A deals) might surge when the rupee is stronger, as domestic asset prices abroad look cheaper in foreign currency terms during the initial period of appreciation. However, since this coefficient isn't robustly significant, we should not overstate it. The long-run effect was clearly negative, so perhaps the sign reversal here is an anomaly or due to correlated effects (e.g., GDP growth tends to cause both REER appreciation and FDI increase with a lag, which might confound the separate effect in short run).

In summary, the VECM results suggest that **FDI inflows adjust to maintain a long-run equilibrium with India's macroeconomic fundamentals**: when out of equilibrium, there's a correction mechanism at work.

In the short run, **domestic investment activity acts as a leading indicator for FDI**, and **FDI does not immediately surge in tandem with every GDP growth uptick** (some lags/frictions are present, sometimes even an inverse short-run relation possibly due to cyclical factors). Exchange rate movements do not seem to be Granger-cause short-run FDI changes in a significant way (as confirmed by causality tests below).

Diagnostic Checks

Before interpreting causality and policy implications, we verify that the VECM model we have estimated is sound:

- **No Serial Correlation:** The LM test for residual autocorrelation up to lag 1 and 2 yielded p-values well above 0.1, indicating we cannot reject the null of no autocorrelation. Thus, the model's residuals are not systematically correlated over time[1].
- **Heteroskedasticity:** White's test for heteroskedasticity (with no cross-term or with cross-terms) did not find significant evidence of heteroskedasticity in residuals (p-value > 0.05). Residuals appear to have constant variance over the sample[1].
- **Normality:** A Jarque-Bera test on the residuals indicated approximate normality (though one component's residual was slightly skewed, the joint test for the system was within acceptable range). Even if normality were off, with 33 observations the asymptotic results are still reliable.
- **Stability: The VECM stability condition was satisfied. The model contains one cointegrating vector which leads to a single unit root in the companion matrix that represents cointegration while all other roots exist outside the unit circle. The model demonstrated dynamic stability because all roots were located inside the unit circle.**These diagnostics suggest that our inference (t-tests, etc.) is valid and that the model does not suffer from misspecification. The absence of serial correlation is particularly important for the validity of Granger causality tests.

Granger Causality Results

With the VECM in hand, we conduct **Granger causality tests** to address the directional relationships among the variables. We focus on pairwise causality relevant to our hypotheses:

1. **GDP and FDI:** We test whether past values of GDP help predict FDI (beyond past FDI) and vice versa.
2. **GCF and FDI:** Does domestic investment lead FDI or follow it?
3. **REER and FDI:** Does exchange rate movement lead changes in FDI or do FDI inflows affect the exchange rate?
4. We also comment on GDP and REER causality, as it emerged significantly in our analysis, to complete the picture of macro linkages.

The tests are conducted in the VECM context, meaning the error-correction term is included and lagged differences as per the model. We report the **F-statistics** for joint significance of lagged terms and the inference.

GDP ↔ FDI: We find **bidirectional causality** between GDP and FDI. The null hypothesis "GDP does not Granger-cause FDI" is rejected at the 5% level ($F \approx 5.16$) when considering lag 1 in the VECM. Likewise, "FDI does not Granger-cause GDP" is rejected (significant at around 10% in our single-lag test, $F \approx 3.2$). The research shows that GDP growth leads to increased FDI inflows and FDI inflows result in GDP growth. The research confirms a feedback mechanism because Indian economic growth strength attracts more foreign direct investment from investors who want to access expanding markets and foreign direct investment leads to future economic expansion through capital accumulation and productivity improvements. The study confirms previous research which demonstrates that FDI and economic growth create a reciprocal relationship particularly in developing nations because foreign investment drives economic expansion and economic expansion attracts foreign investment. It reinforces the idea of a **virtuous cycle** – policies that promote GDP growth can indirectly pull in more FDI, and policies that attract FDI can, in turn, fuel further growth. Our findings mirror those of several studies: for example, Khan and Mitra (2014) also noted GDP ↦ FDI causality, and others have argued for FDI's role in growth (though not always immediate). The economic relationship between FDI and output in India demonstrates a two-way influence according to the research findings.

The Granger tests demonstrate that Gross Capital Formation creates a one-way causal effect on Foreign Direct Investment. The test of "GCF does not Granger-cause FDI" produced a statistically significant result ($F \approx 8.45$, $p < 0.01$). The F-statistic for testing "FDI does not Granger-cause GCF" remained small and failed to achieve statistical significance. The data shows that domestic investment changes trigger FDI fluctuations but FDI does not affect domestic investment patterns in the short term. The increase in domestic investment activities from government and private sector entities creates conditions which attract foreign investors to enter the market.However, an increase in FDI inflows by itself does not significantly predict changes in the overall domestic investment rate – likely because FDI is a relatively small fraction of total investment in India (FDI might be, say, 2-3% of GDP, whereas GCF is 30% of GDP; so even large swings in FDI are a small share of GCF). In other words, **FDI is the tail, not the dog, in terms of driving aggregate investment** in the short run; domestic investment efforts appear to set the pace. This result aligns with the notion of *complementarity*: FDI often comes

in to supplement domestic projects rather than initiate them independently. For policy, it suggests strengthening domestic investment conditions (infrastructure, ease of doing business for domestic firms, financial conditions) could indirectly boost FDI. The significant causality GCF→FDI is consistent with our VECM short-run coefficient for ΔGCF which was positive and significant in the FDI equation, as discussed earlier.

REER and FDI: The causality tests did **not find any significant Granger causality between exchange rate (REER) and FDI in either direction**. We could not reject "REER does not Granger-cause FDI" – the FDI equation's lagged REER term wasn't jointly significant (consistent with the weak coefficient we saw) – and similarly "FDI does not Granger-cause REER" showed no significance. This suggests that, in the short run, **currency movements are not a predictor of FDI flows**, nor do FDI inflows have an immediate measurable impact on the real exchange rate. The latter is understandable because, while large capital inflows can put pressure on a currency to appreciate, FDI is typically smaller and more steady compared to other flows like portfolio investment, and often sterilized by central bank interventions if needed. Additionally, India's REER is influenced by trade dynamics and monetary policy, not just capital flows.

GDP → REER: An interesting finding in our analysis is a **unidirectional causality from GDP to REER**. The tests show that GDP growth Granger-causes changes in the REER (F statistic significant at 5%), whereas REER does not Granger-cause GDP (no surprise, as exchange rate alone might not drive growth in short run). This implies that when India's economy grows faster, it tends to lead to an appreciation of the real exchange rate. This makes sense: higher growth often comes with capital inflows and possibly higher inflation relative to trading partners, both of which can elevate the REER. We mention this because it ties into the interplay: GDP growth → stronger REER, and we know stronger REER (if sustained) in the long run tends to reduce FDI. So there is a nuanced chain: rapid growth could initially attract FDI (directly) and strengthen currency, but if the currency strengthens too much, it could later deter some FDI – a balancing act for policymakers between maintaining competitiveness and reaping growth benefits.

Summarizing the causality structure:

- **GCF → FDI:** Unidirectional. Domestic capital formation leads foreign capital inflow (no reverse effect detected).
- **GDP ↔ FDI:** Bidirectional. They reinforce each other; a feedback loop exists.
- **REER – FDI:** No short-run causality either way (long-run relation exists though, as cointegration showed).
- **GDP → REER:** Unidirectional (growth influences currency value).

These relationships are concisely depicted in a causal diagram below for clarity:

- GCF ⟶ FDI
- GDP ⟶ FDI and FDI ⟶ GDP (two-headed arrow)
- GDP ⟶ REER
- (No arrow between REER and FDI in short run)

The observed pattern follows theoretical predictions because macroeconomic elements determine FDI through market size and investment environment factors which drive foreign investment. The research findings show that FDI creates growth opportunities after it enters a market. The research supports this finding because FDI decisions require extended planning periods and investors base their choices on factors which extend beyond currency market fluctuations.

The Granger causality results support cointegration findings by showing how domestic factors create conditions for foreign investment which subsequently drives economic expansion. The research shows that FDI does not create immediate changes in domestic investment or exchange rates but instead operates through complex economic relationships.

VII. Discussion

The research findings about FDI relationships with the Indian macroeconomy provide valuable insights which need evaluation through economic theory and previous research and policy implications.

The cointegrating relationship between FDI inflows and GDP and GCF and REER shows that these variables maintain a stable long-run equilibrium. Foreign investors base their long-term investment decisions on fundamental economic indicators which show consistent patterns in India. The research shows that market size (GDP) stands as the main factor which attracts foreign direct investment because investors seek large and expanding markets. The research shows that FDI responds more than proportionally to GDP changes because the estimated elasticity value exceeds 1. The results could indicate two possible scenarios: investors benefit from growing returns and clustering effects that occur when India's economy reaches specific thresholds which attract additional foreign investment. The results show that GDP growth leads to better institutional development and human capital improvements which attract more foreign direct investment. The research supports previous studies by Tripathi et al. (2015) and others which demonstrated that market size stands as the primary factor for FDI

attraction. The research supports Demirhan & Masca (2008) who studied multiple countries and discovered that GDP serves as a leading factor which determines FDI attraction.

The research findings about REER show negative long-term connections which matter for India because the country needs to draw foreign investment while protecting its trade competitiveness. The research shows that foreign investors will lose interest in India when the real value of its currency strengthens because of capital inflows and productivity gaps and inflation differences. The research supports export-oriented FDI because investors who want to establish export operations will choose locations with weaker currency values.It may be less intuitive for market-oriented FDI (which might not directly depend on export cost competitiveness), but even they could be concerned that an overvalued currency might precede a future correction or indicate macro instability. Our finding is consistent with the negative exchange rate effect reported in some India-focused studies, and also resonates with broader evidence that *exchange rate stability* and competitiveness matter (for example, other emerging markets have found excessive appreciation can reduce inward FDI). Policymakers thus should be mindful that macroeconomic policies leading to sharp real appreciation (e.g., high inflation without depreciation, or surges of hot money inflows not managed well) might indirectly hurt FDI prospects.

The role of **gross capital formation (GCF)** in the long run, while positive, is smaller in magnitude. This suggests that *ceteris paribus*, a higher domestic investment rate signals a healthy investment climate to foreign investors, but it's not a game-changer by itself. It could also be that GDP already captures much of the effect (since GCF is part of GDP composition); the remaining effect of GCF could be interpreted as *beyond GDP, does the composition tilt towards investment attract FDI?* – apparently yes, but modestly. Nevertheless, the direction confirms complementarity: foreign investors are not crowded out by high domestic investment; rather, they are slightly attracted by it. This finding aligns with Bandekar & Sankaranarayan (2014) who found positive correlations between infrastructure/power consumption (proxies related to investment) and FDI. In policy terms, continuing to boost domestic investment – through public infrastructure projects, incentivizing private capital formation – likely creates an environment that is welcoming for FDI to come in and co-invest or build on that foundation.

Short-Run Dynamics and Causality Discussion: The bidirectional short-run causality between **FDI and GDP** supports the hypothesis of a mutually reinforcing relationship. From a theoretical standpoint, this is consistent with endogenous growth models where FDI contributes to growth via technology transfer and capital deepening, and with the notion that foreign investors are attracted to robust economic performance. This interplay can create a positive feedback loop or *investment-growth spiral*: success breeds success. However, it's important to note that the feedback in our findings was asymmetric in strength – GDP's effect on FDI (as seen in F-statistics and elasticity in cointegration) seems stronger than FDI's effect on GDP in the immediate short runThe GDP effects of FDI might emerge through extended time periods or through the accumulation of multiple factors (which our one-year lagged causality tests could fail to detect). The existence of a minimal short-term relationship between FDI and GDP holds significance because it indicates foreign investment delivers operational efficiency and knowledge that leads to additional economic expansion. This aligns with Mehra (2013) who found FDI boosts GDP significantly, though our results caution that the effect on employment might not be equally impressive (jobless growth concern noted by Mehra is relevant – our study didn't include employment, but if GDP growth from FDI doesn't create enough jobs, that's a policy concern beyond GDP itself).

The unidirectional **GCF→FDI causality** underlines an important point often discussed in development economics: FDI tends to *follow* domestic investment trends rather than initiate them. This could reflect the fact that foreign investors prefer to piggyback on local entrepreneurs' insights – if domestic firms are investing in an industry, foreigners interpret it as a good sign and join in (or provide capital via joint ventures, etc.). The research indicates that FDI policy liberalization will not produce results when the domestic economy lacks vitality and investment potential. The Indian government needs to create domestic investment-friendly conditions through credit availability growth and interest rate reduction and policy stability maintenance to attract foreign direct investment. The study finds no evidence that FDI creates GCF because this relationship does not exist. The study presents an unexpected finding because FDI should increase total investment according to standard accounting principles. However, Granger causality here is about predictability; since FDI is a relatively small fraction of total GCF, fluctuations in FDI don't move the needle enough to forecast changes in the broad GCF measure. It doesn't negate that FDI is part of investment – just that domestic factors dominate GCF movements.

On the **exchange rate and FDI**, our finding of no short-run causality suggests that investors do not make quick in-and-out FDI decisions based on currency fluctuations. Unlike portfolio flows, FDI decisions typically involve long lead times, regulatory approvals, and are driven by strategic considerations. A multinational is unlikely to significantly alter its investment plan for India because the rupee moved 5% this year. What matters more are expectations of long-run stability and trend. This explains why REER shows up in cointegration (long-run) but not in short-run causality. It's an important nuance: policymakers sometimes worry that currency volatility will scare off FDI; our results imply minor short-term volatility might not matter much, but a sustained

trend (appreciation or depreciation) will matter. So, maintaining a competitive but relatively stable currency regime over the long term can be beneficial for attracting FDI – abrupt large appreciations could hurt, but small oscillations around equilibrium likely won't deter long-term investors.

Comparison with Previous Studies: Our results confirm and expand upon prior research: - The positive GDP-FDI link and potential two-way causality is well documented (e.g., Wang (2009) for developing countries, and specifically for India by Kumar & Pradhan (2002) and others). - The role of **trade openness** was emphasized in some literature (Demirhan & Masca, Tripathi et al.), but we did not explicitly include a trade variable. Some of its effect might be captured indirectly via GDP or REER. India's trade to GDP ratio has increased post-liberalization; including a trade variable could be an extension, but likely it would correlate with GDP growth (as India grew, it opened more). - We focused on exchange rate and found a negative impact, which matches Tripathi et al. (2015)'s findings. Interestingly, some studies like Khan & Mitra (2014) found exchange rate Granger-caused FDI. Our causality tests did not find that in the short run, possibly due to different variable definitions or sample. Khan & Mitra's sample ended 2012; post-2014, India's FDI surged even with varying exchange rates, perhaps weakening a short-run pattern. Also, they included inflation which we did not – if inflation and exchange rate both affect FDI, excluding inflation might concentrate the effect in exchange rate in their study. - The positive effect of domestic investment climate (captured by GCF or infrastructure proxies) aligns with findings like Alam & Alam (2018) who noted domestic investment's long-run positive coefficient, and Maryam & Mittal (2020) highlighting infrastructure availability. - One discrepancy: We found a short-run *negative* effect of GDP growth on FDI growth (though long-run is positive). Some literature might not observe this if using different methods; it could be an artifact of including REER and GCF in the system. It's possible that when GDP jumps, REER also moves (appreciates) and that deters some FDI, or high growth saturates capacity short-term. This finding might be context-specific (e.g., after 2008 crisis, India had high GDP growth due to stimulus but FDI lagged until reforms caught up).

Policy Implications: The findings have several policy implications for India and similar economies: - **Maintain Growth Momentum:** Since economic growth is both a driver and beneficiary of FDI, policies that sustain high GDP growth (sound fiscal management, monetary stability, structural reforms to improve productivity) will indirectly keep India attractive for FDI. The implementation of proactive measures to enhance growth will simultaneously attract foreign investors back into the market during economic downturns. - The domestic investment environment directly influences foreign investor decisions because they base their decisions on local market conditions. The improvement of local investment conditions through better infrastructure and reduced business regulations and stable taxation and streamlined bureaucratic processes will lead to increased foreign direct investment. The government has started to improve business conditions through Make in India and infrastructure modernization and Ease of Doing Business ranking initiatives. The research findings validate these initiatives because domestic investment creates conditions that attract foreign direct investment. - Exchange Rate Management: A competitive exchange rate should be maintained throughout the long-term period. The Indian government has maintained a managed float system but it should prevent excessive currency appreciation to attract efficiency-seeking foreign direct investment. The government should implement reserve accumulation as a policy tool to fight against rupee appreciation when fast capital entries and other market factors drive the currency value too high. The main objective should focus on preventing long-term exchange rate imbalances instead of attempting to control short-term market fluctuations. - Targeted FDI policies: The Indian government should direct its FDI attraction efforts toward industries which match domestic operational strengths. The government should create joint venture opportunities to attract foreign investment into renewable energy because domestic investment in this sector remains high. The Indian government can support FDI technology acquisition through sector-specific incentives because this approach will generate economic growth which will create additional investment opportunities. - Harnessing the FDI-Growth Cycle: The evidence shows FDI and GDP create a feedback loop so India should pursue growth-oriented policies and FDI market access expansion simultaneously. The two elements require each other because FDI entry without economic growth will not attract investors who need markets to operate and economic expansion without foreign investment will reach its capacity limits. The government needs to develop balanced strategies for its investment policies. - No complacency on FDI: The research shows FDI does not drive GCF so investors should not rely on foreign direct investment to boost their total investment and GDP levels. The government should treat FDI as an addition to domestic investment instead of using it as a replacement for local business development. The government should avoid depending too heavily on foreign direct investment because this approach creates risks for domestic entrepreneurship development. The external account stability depends on other capital flows and current account performance because FDI does not create immediate exchange rate stability in the short term.

Limitations and Further Research: The research covers all aspects but it contains specific boundaries. The study uses annual data because of availability restrictions which results in a limited sample size of 33 observations. This limits degrees of freedom and could obscure very short-term dynamics that quarterly data might capture. Future research could attempt to use higher-frequency data or extend the time span as new data become available.

We considered three key macro variables, but there are other factors that could be relevant: **inflation rate**, **interest rates**, **trade openness** (exports/imports), **human capital**, or **political risk indices**The addition of extra variables becomes feasible but it leads to increased complexity and reduced available degrees of freedom. The analysis can detect indirect effects of interest rates on GCF and inflation on REER but a detailed examination would reveal their specific impacts.

The research could benefit from sectoral and source-based FDI analysis to determine if different types of investment follow distinct patterns. The relationship between GDP growth and FDI attraction shows different patterns for market-seeking investments versus resource-seeking investments. Or do exchange rate changes affect manufacturing FDI differently than services FDI? Such analysis might require sector-specific FDI data and perhaps different model setups (possibly panel data across sectors).

Structural breaks were qualitatively discussed (like 1991 reforms, 2008 crisis). A more formal approach (e.g., a Chow test or dummy variables for post-1991, post-2008) could be integrated to see if the long-run relationship changed after those events. Khan & Mitra (2014) identified 1991 as a break for FDI series. Our sample inherently is post-1991, so that's accounted, but the 2008 crisis might have impacted the intercept or slopes temporarily. Visual inspection suggests cointegration holds overall, but one could check for cointegration allowing regime shifts.

Finally, while our focus was on *inward* FDI, the interplay of *outward* FDI (Indian firms investing abroad) and macro variables could be another dimension. Outward FDI has grown for India in the 2010s and could have implications (like outward FDI might relieve pressure on exchange rate or respond to domestic conditions in another way). Kakoti (2019) touched on outward FDI; a complete picture of India's integration with global capital flows would consider both directions.

VIII. Conclusion

This paper examined the causal relationships between Foreign Direct Investment and key macroeconomic variables – GDP, Gross Capital Formation, and the Real Effective Exchange Rate – in India over the period 1991–2023. Using a range of econometric tools on annual data, we established several important results:

- There exists a **stable long-run equilibrium** linking FDI with macroeconomic fundamentals. In this equilibrium, FDI inflows increase with a larger economic size and higher domestic investment, but decrease with an appreciating (less competitive) real exchange rate. Quantitatively, the long-run elasticities imply that India's market size is a primary magnet for FDI (a 1% rise in GDP associated with ~3.2% rise in FDI), whereas a stronger rupee significantly deters FDI in the long run (1% REER appreciation linked to ~7.3% drop in FDI).
- Short-run deviations from this equilibrium are corrected over time. The Vector Error-Correction Model showed that FDI inflows adjust at a rate of 13% annually which indicates it takes 4–5 years to fully resolve equilibrium disruptions. The model shows that investors make slow adjustments to their investment decisions when they detect economic imbalances.
- The Granger causality analysis showed that GDP and FDI create a feedback loop through their mutual influence on each other. The results validate endogenous growth theory because FDI inflows create future economic expansion while GDP growth attracts foreign direct investment.**Domestic investment (GCF) was found to causally lead FDI inflows**, highlighting that an improved domestic investment climate can pull in foreign investment, while the reverse (FDI causing higher domestic investment rate) was not evident in the short term. Meanwhile, **no short-run causality was detected between exchange rate changes and FDI** – exchange rate matters for the long-term level of FDI but does not seem to play a role in year-to-year FDI fluctuations, and FDI inflows don't significantly drive short-run currency movements under a managed float regime.
- The diagnostic tests validated our model's strength which supported our research findings [1]. The model produces reliable coefficient estimates and test statistics because the residuals show no serial correlation and heteroskedasticity. The cointegration and VECM specification thus appears appropriate for capturing the data-generating process of FDI and its macroeconomic covariates in India.

The research demonstrates that a strong domestic economy serves as the fundamental requirement for attracting foreign direct investment (FDI). Foreign investment inflows will increase when countries implement structural reforms and build infrastructure and develop their human capital resources. The long-term maintenance of investor confidence depends on achieving macroeconomic stability through proper management of currency value and inflation rates. The relationship between FDI and domestic investment shows that policies which support domestic business growth through business facilitation and financial support and investment rewards will

attract more foreign direct investment. The performance of FDI tracks domestic economic growth because it seeks out strong economic expansion and high investment levels and affordable production costs.

The discovery of bidirectional relationships between FDI and economic growth indicates that foreign direct investment serves as an active force which drives national development. The implementation of FDI-friendly policies which include sectoral cap liberalization and investor protection and performance-based incentives becomes justified because these measures generate economic growth and operational efficiency improvements.However, policymakers should also be mindful of the composition of FDI to maximize benefits: for instance, our results do not directly address employment, but if much of FDI goes into capital-intensive sectors, the growth might not translate into jobs ("jobless growth" as some studies warned). The government should promote foreign direct investment (FDI) in sectors which generate beneficial external effects through technology transfer and employment generation and infrastructure development.

The relationship between foreign direct investment (FDI) and macroeconomic indicators in India shows how foreign capital supports national economic expansion while domestic economic performance determines FDI inflows and there are no simple solutions to achieve these effects. The economy depends on foreign direct investment because it expands when domestic conditions are strong and foreign capital helps build economic stability. The period from 1991 to 2023 demonstrated how India achieved its transition from being a small FDI market to becoming a leading foreign investment hub through economic reforms and sustained economic expansion. India will achieve its development targets through maintaining economic stability and welcoming foreign investment by sustaining this partnership between sound economic governance and open investment policies.

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